

## Scikit Discovery

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## Chapter 4

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## Chapter 5

# Namespace Documentation

### 5.1 skdiscovery Namespace Reference

#### Namespaces

- [data\\_structure](#)
- [utilities](#)
- [visualization](#)

### 5.2 skdiscovery.data\_structure Namespace Reference

#### Namespaces

- [framework](#)
- [generic](#)
- [image](#)
- [series](#)
- [table](#)

### 5.3 skdiscovery.data\_structure.framework Namespace Reference

#### Namespaces

- [base](#)
- [config](#)
- [discoverypipeline](#)
- [stagecontainers](#)

## 5.4 skdiscovery.data\_structure.framework.base Namespace Reference

### Classes

- class [PipelineItem](#)  
*The general class used to create pipeline items.*
- class [TablePipelineItem](#)  
*Pipeline item for Table data.*

## 5.5 skdiscovery.data\_structure.framework.config Namespace Reference

### Functions

- def [getConfig](#) ()  
*Retrieve skdiscovery configuration.*
- def [writeConfigValue](#) (section, key, value)  
*Write config to disk.*
- def [getConfigValue](#) (section, key)  
*Retrieve a value from the config file.*
- def [getDispyPassword](#) ()  
*Get dispy password.*
- def [getHostName](#) ()  
*Get Host name for displaying link to dispy status.*

### 5.5.1 Function Documentation

#### 5.5.1.1 getConfig()

```
def skdiscovery.data_structure.framework.config.getConfig ( )
```

Retrieve skdiscovery configuration.

#### Returns

skdiscovery configparser

#### 5.5.1.2 getConfigValue()

```
def skdiscovery.data_structure.framework.config.getConfigValue (
    section,
    key )
```

Retrieve a value from the config file.

**Parameters**

<i>section</i>	Section of the configuration file that contains the value
<i>key</i>	Key of the value

**Returns**

value in the specified section associated with given key

**5.5.1.3 getDispyPassword()**

```
def skdiscovery.data_structure.framework.config.getDispyPassword ( )
```

Get dispy password.

**Returns**

dispy password

**5.5.1.4 getHostName()**

```
def skdiscovery.data_structure.framework.config.getHostName ( )
```

Get Host name for displaying link to dispy status.

**Returns**

Hostname

**5.5.1.5 writeConfigValue()**

```
def skdiscovery.data_structure.framework.config.writeConfigValue (
    section,
    key,
    value )
```

Write config to disk.

## Parameters

<i>section</i>	Name of section
<i>key</i>	Name of key
<i>value</i>	Value to write

## 5.6 skdiscovery.data\_structure.framework.discoverypipeline Namespace Reference

## Classes

- class [DiscoveryPipeline](#)  
*Pipeline for running the analysis.*

## 5.7 skdiscovery.data\_structure.framework.stagecontainers Namespace Reference

## Classes

- class [StageContainer](#)  
*Container to hold a stage for the DiscoveryPipeline.*
- class [StageContainerAlternative](#)  
*Stage Container that holds a list of stage containers and randomly chooses one to use.*
- class [StageContainerIncrementalAdd](#)  
*In each perturb call, it incrementally adds one of the filters specified in the constructor.*

## 5.8 skdiscovery.data\_structure.generic Namespace Reference

## Namespaces

- [accumulators](#)

## 5.9 skdiscovery.data\_structure.generic.accumulators Namespace Reference

## Namespaces

- [data](#)
- [gpshplotter](#)
- [hcluster](#)

## 5.10 skdiscovery.data\_structure.generic.accumulators.data Namespace Reference

### Classes

- class [DataAccumulator](#)  
*Stores a copy of the data in its current state in the pipeline.*

## 5.11 skdiscovery.data\_structure.generic.accumulators.gpshplotter Namespace Reference

### Classes

- class [GPSHPlotter](#)  
*Plots results from General\_Component\_Analysis, for the GPS horizontal or vertical components.*

## 5.12 skdiscovery.data\_structure.generic.accumulators.hcluster Namespace Reference

### Classes

- class [HCluster](#)  
*Hierarchical Clustering function that produces a cluster map of the distance matrix.*

## 5.13 skdiscovery.data\_structure.image Namespace Reference

### Namespaces

- [accumulators](#)
- [analysis](#)
- [filters](#)
- [generate](#)

## 5.14 skdiscovery.data\_structure.image.accumulators Namespace Reference

### Namespaces

- [saver](#)

## 5.15 skdiscovery.data\_structure.image.accumulators.saver Namespace Reference

### Classes

- class [Saver](#)  
*Write images out to a hdf5 file.*

## 5.16 skdiscovery.data\_structure.image.analysis Namespace Reference

### Namespaces

- [squares\\_from\\_poly](#)

## 5.17 skdiscovery.data\_structure.image.analysis.squares\_from\_poly Namespace Reference

### Classes

- class [SquaresFromPoly](#)  
*Generate shapely squares that intersect with a shapely polygon.*

## 5.18 skdiscovery.data\_structure.image.filters Namespace Reference

### Namespaces

- [select\\_channel](#)

## 5.19 skdiscovery.data\_structure.image.filters.select\_channel Namespace Reference

### Classes

- class [SelectChannel](#)  
*Select a specific channel out of a 3 dimensional image.*

## 5.20 skdiscovery.data\_structure.image.generate Namespace Reference

### Namespaces

- [rotate\\_image](#)
- [tile\\_image](#)

## 5.21 skdiscovery.data\_structure.image.generate.rotate\_image Namespace Reference

### Classes

- class [RotateImage](#)  
*Create new images by rotating 90, 180, and 270 degrees.*

## 5.22 skdiscovery.data\_structure.image.generate.tile\_image Namespace Reference

### Classes

- class [TileImage](#)  
*Create several smaller images from a larger image.*

## 5.23 skdiscovery.data\_structure.series Namespace Reference

### Namespaces

- [accumulators](#)
- [analysis](#)
- [filters](#)

## 5.24 skdiscovery.data\_structure.series.accumulators Namespace Reference

### Namespaces

- [plotter](#)

## 5.25 skdiscovery.data\_structure.series.accumulators.plotter Namespace Reference

### Classes

- class [Plotter](#)  
*Make a plot of series data.*

## 5.26 skdiscovery.data\_structure.series.analysis Namespace Reference

### Namespaces

- [correlate](#)
- [gca](#)
- [mogi](#)

## 5.27 skdiscovery.data\_structure.series.analysis.correlate Namespace Reference

### Classes

- class [Correlate](#)  
*Computes the correlation for series data.*

## 5.28 skdiscovery.data\_structure.series.analysis.gca Namespace Reference

### Classes

- class [General\\_Component\\_Analysis](#)  
*Performs either ICA or PCA analysis on series data.*

## 5.29 skdiscovery.data\_structure.series.analysis.mogi Namespace Reference

### Classes

- class [Mogi\\_Inversion](#)  
*Perform a Mogi source inversion on a set of gps series data.*

## 5.30 skdiscovery.data\_structure.series.filters Namespace Reference

### Namespaces

- [dataremoiver](#)
- [hyperbolictan](#)
- [interpolate](#)
- [kalman](#)
- [lowpass](#)
- [median](#)
- [offset\\_detrend](#)
- [trend](#)

## 5.31 skdiscovery.data\_structure.series.filters.dataremoiver Namespace Reference

### Classes

- class [DataRemover](#)  
*Sets specified series data to NaN.*



## 5.32 `skdiscovery.data_structure.series.filters.hyperbolictan` Namespace Reference

### Classes

- class [HTanFilter](#)  
*Filter to subtract arctan fit from data.*

## 5.33 `skdiscovery.data_structure.series.filters.interpolate` Namespace Reference

### Classes

- class [InterpolateFilter](#)  
*Interpolate missing values on series data.*

## 5.34 `skdiscovery.data_structure.series.filters.kalman` Namespace Reference

### Classes

- class [KalmanFilter](#)  
*Runs a forward and backward Kalman Smoother with a FOGM state on series data.*

## 5.35 `skdiscovery.data_structure.series.filters.lowpass` Namespace Reference

### Classes

- class [LowPassFilter](#)  
*A FIR Remez (Parks-McLellan) designed low pass filter for series data.*

## 5.36 `skdiscovery.data_structure.series.filters.median` Namespace Reference

### Classes

- class [MedianFilter](#)  
*A Median filter for series data.*

## 5.37 `skdiscovery.data_structure.series.filters.offset_detrend` Namespace Reference

### Classes

- class [OffsetDetrend](#)  
*Trend filter that fits a stepwise function to linearly detrended series data.*

## 5.38 skdiscovery.data\_structure.series.filters.trend Namespace Reference

### Classes

- class [TrendFilter](#)

*Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.*

## 5.39 skdiscovery.data\_structure.table Namespace Reference

### Namespaces

- [accumulators](#)
- [analysis](#)
- [filters](#)
- [fusion](#)
- [generators](#)

## 5.40 skdiscovery.data\_structure.table.accumulators Namespace Reference

### Namespaces

- [plotter](#)

## 5.41 skdiscovery.data\_structure.table.accumulators.plotter Namespace Reference

### Classes

- class [Plotter](#)

*Make a plot of table data.*

## 5.42 skdiscovery.data\_structure.table.analysis Namespace Reference

### Namespaces

- [correlate](#)
- [dbscan](#)
- [gca](#)
- [midas](#)
- [mogi](#)
- [outlier](#)
- [rotate\\_pca](#)
- [skew](#)

## 5.43 skdiscovery.data\_structure.table.analysis.correlate Namespace Reference

### Classes

- class [Correlate](#)  
*Computes the correlation for table data and stores the result as a matrix.*

## 5.44 skdiscovery.data\_structure.table.analysis.dbscan Namespace Reference

### Classes

- class [DBScan](#)  
*Runs [DBScan](#) on table data.*

## 5.45 skdiscovery.data\_structure.table.analysis.gca Namespace Reference

### Classes

- class [General\\_Component\\_Analysis](#)  
*Performs a general component analysis on table data.*

## 5.46 skdiscovery.data\_structure.table.analysis.midas Namespace Reference

### Classes

- class [MIDAS](#)  
*In Development A basic [MIDAS](#) trend estimator*

## 5.47 skdiscovery.data\_structure.table.analysis.mogi Namespace Reference

### Classes

- class [Mogi\\_Inversion](#)  
*Perform a mogi source inversion on a set of gps table data.*

## 5.48 skdiscovery.data\_structure.table.analysis.outlier Namespace Reference

### Classes

- class [Outlier](#)  
*Computes  $(data / mad(data))$  for outlier detection.*

## 5.49 skdiscovery.data\_structure.table.analysis.rotate\_pca Namespace Reference

### Classes

- class [RotatePCA](#)  
*\*\*\* In Development \*\*\* Class for rotating PCA to seperate superimposed signals*

## 5.50 skdiscovery.data\_structure.table.analysis.skew Namespace Reference

### Classes

- class [Skew](#)  
*Calculates the skew of table data.*

## 5.51 skdiscovery.data\_structure.table.filters Namespace Reference

### Namespaces

- [antenna\\_offset](#)
- [calibrate\\_grace](#)
- [calibrate\\_mascon](#)
- [combine\\_columns](#)
- [dataremoval](#)
- [geolocation](#)
- [hyperbolictan](#)
- [interpolate](#)
- [kalman](#)
- [lowpass](#)
- [median](#)
- [normalize](#)
- [offset\\_detrend](#)
- [propagate\\_nans](#)
- [resample](#)
- [snow\\_removal](#)
- [stabilization](#)
- [table\\_filter](#)
- [trend](#)
- [weighted\\_average](#)

## 5.52 skdiscovery.data\_structure.table.filters.antenna\_offset Namespace Reference

### Classes

- class [AntennaOffset](#)  
*Applies corrections to fix offsets in PBO GPS data induced by antenna changes.*

## 5.53 skdiscovery.data\_structure.table.filters.calibrate\_grace Namespace Reference

### Classes

- class [CalibrateGRACE](#)  
*Calibrate Grace Data.*

## 5.54 skdiscovery.data\_structure.table.filters.calibrate\_mascon Namespace Reference

### Classes

- class [CalibrateGRACEMascon](#)  
*Calibrate Grace Data.*

## 5.55 skdiscovery.data\_structure.table.filters.combine\_columns Namespace Reference

### Classes

- class [CombineColumns](#)  
*Create a new column by selecting data from a column.*

## 5.56 skdiscovery.data\_structure.table.filters.dataremover Namespace Reference

### Classes

- class [DataRemover](#)  
*Sets specified table data to NaN.*

## 5.57 skdiscovery.data\_structure.table.filters.geolocation Namespace Reference

### Classes

- class [GeoLocationFilter](#)  
*Removes objects not located in a specified region.*

## 5.58 skdiscovery.data\_structure.table.filters.hyperbolictan Namespace Reference

### Classes

- class [HTanFilter](#)  
*Filter to subtract an arctan fit from data.*

## 5.59 skdiscovery.data\_structure.table.filters.interpolate Namespace Reference

### Classes

- class [InterpolateFilter](#)  
*Interpolate missing values on table data.*

## 5.60 skdiscovery.data\_structure.table.filters.kalman Namespace Reference

### Classes

- class [KalmanFilter](#)  
*Runs a forward and backward Kalman Smoother with a FOGM state on table data.*

## 5.61 skdiscovery.data\_structure.table.filters.lowpass Namespace Reference

### Classes

- class [LowPassFilter](#)  
*A remez low pass filter for table data.*

## 5.62 skdiscovery.data\_structure.table.filters.median Namespace Reference

### Classes

- class [MedianFilter](#)  
*A Median filter for table data.*

## 5.63 skdiscovery.data\_structure.table.filters.normalize Namespace Reference

### Classes

- class [NormalizeFilter](#)  
*Normalize data using median filter.*

## 5.64 skdiscovery.data\_structure.table.filters.offset\_detrend Namespace Reference

### Classes

- class [OffsetDetrend](#)  
*Trend filter that fits a stepwise function to linearly detrended table data.*

## 5.65 skdiscovery.data\_structure.table.filters.propagate\_nans Namespace Reference

### Classes

- class [PropagateNaNs](#)  
*Propagates NaN's from one column to other columns.*

## 5.66 skdiscovery.data\_structure.table.filters.resample Namespace Reference

### Classes

- class [Resample](#)  
*Resample data.*

## 5.67 skdiscovery.data\_structure.table.filters.snow\_remover Namespace Reference

### Classes

- class [SnowRemover](#)  
*Removes data with snow errors.*

## 5.68 skdiscovery.data\_structure.table.filters.stabilization Namespace Reference

### Classes

- class [StabilizationFilter](#)  
*This filter transforms GPS stations in a region to a local reference frame.*

## 5.69 skdiscovery.data\_structure.table.filters.table\_filter Namespace Reference

### Classes

- class [TableFilter](#)  
*This class removes tables based on their label.*

## 5.70 skdiscovery.data\_structure.table.filters.trend Namespace Reference

### Classes

- class [TrendFilter](#)  
*Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.*

## 5.71 skdiscovery.data\_structure.table.filters.weighted\_average Namespace Reference

### Classes

- class [WeightedAverage](#)

*This filter performs a rolling weighted average using standard deviations as weight.*

## 5.72 skdiscovery.data\_structure.table.fusion Namespace Reference

### Namespaces

- [grace](#)
- [snow](#)

## 5.73 skdiscovery.data\_structure.table.fusion.grace Namespace Reference

### Classes

- class [GraceFusion](#)

*Fuses GRACE equivalent water depth time series.*

## 5.74 skdiscovery.data\_structure.table.fusion.snow Namespace Reference

### Classes

- class [SnowFusion](#)

*Adds snow time series data to table based on geographic coordinates.*

## 5.75 skdiscovery.data\_structure.table.generators Namespace Reference

### Namespaces

- [catalog\\_generator](#)
- [data\\_generator](#)

## 5.76 skdiscovery.data\_structure.table.generators.catalog\_generator Namespace Reference

### Classes

- class [CatalogGenerator](#)

*In Development Generates galaxy catalogs for use in DiscoveryPipeline*



## 5.77 skdiscovery.data\_structure.table.generators.data\_generator Namespace Reference

### Classes

- class [DataGenerator](#)  
*In Class for generating random data.*

## 5.78 skdiscovery.utilities Namespace Reference

### Namespaces

- [cloud](#)
- [patterns](#)
- [planetary](#)

## 5.79 skdiscovery.utilities.cloud Namespace Reference

### Namespaces

- [amazon\\_control](#)
- [amazon\\_gui](#)
- [ssh\\_reverse](#)

## 5.80 skdiscovery.utilities.cloud.amazon\_control Namespace Reference

### Functions

- def [init](#) (in\_aws\_access\_key, in\_aws\_secret, in\_aws\_region, in\_aws\_security\_group, in\_aws\_key\_name, in\_↵ pem\_file)  
*The underlying functionality for the Amazon GUI, the user should not need to directly interface with this function.*
- def [closeDispyScheduler](#) ()  
*Close the Dispy Scheduler.*
- def [startDispyScheduler](#) ()  
*Start the Dispy Scheduler.*
- def [generateInfo](#) (instance)  
*Read metadata from an Amazon instance.*
- def [updateStatus](#) ()  
*Update status information in amazon\_list.*
- def [setNumInstances](#) (new\_total\_instances, instance\_type, image\_id)  
*Change the number of running instances.*
- def [updateIPAddress](#) (instance\_info)  
*Update ip address of instance info.*

- def `goodConnection` (instance, port)  
*Check if an amazon instance has a port open.*
- def `createTunnels` ()  
*Create reverse ssh tunnels to all instances.*
- def `startDispyNode` ()  
*Start dispy on each Amazon instance.*
- def `resetInstances` ()  
*Reboot Amazon instances.*
- def `reset` ()  
*Close and clear Amazon List.*
- def `close` ()  
*Shutdown all instances, close dispy scheduler and clear Amazon list.*
- def `clearAmazonList` ()  
*Shutdown connection tunnels to Amazon instances and clear amazon list.*

## Variables

- `aws_access_key` = None
- `aws_secret` = None
- `aws_region` = None
- `aws_security_group` = None
- `aws_key_name` = None
- `pem_file` = None
- `ec2_res` = None
- `ec2_client` = None
- list `amazon_list` = []
- `scheduler` = None
- `popen` = None

## 5.80.1 Function Documentation

### 5.80.1.1 `clearAmazonList()`

```
def skdiscovery.utilities.cloud.amazon_control.clearAmazonList ( )
```

Shutdown connection tunnels to Amazon instances and clear amazon list.

### 5.80.1.2 `close()`

```
def skdiscovery.utilities.cloud.amazon_control.close ( )
```

Shutdown all instances, close dispy scheduler and clear Amazon list.

#### 5.80.1.3 closeDispyScheduler()

```
def skdiscovery.utilities.cloud.amazon_control.closeDispyScheduler ( )
```

Close the Dispy Scheduler.

#### 5.80.1.4 createTunnels()

```
def skdiscovery.utilities.cloud.amazon_control.createTunnels ( )
```

Create reverse ssh tunnels to all instances.

#### 5.80.1.5 generateInfo()

```
def skdiscovery.utilities.cloud.amazon_control.generateInfo (
    instance )
```

Read metadata from an Amazon instance.

##### Returns

metadata for Amazon instance

#### 5.80.1.6 goodConnection()

```
def skdiscovery.utilities.cloud.amazon_control.goodConnection (
    instance,
    port )
```

Check if an amazon instance has a port open.

##### Parameters

<i>instance</i>	Amazon instance information
<i>port</i>	Port to check

##### Returns

Boolean indicating if a port is open

#### 5.80.1.7 init()

```
def skdiscovery.utilities.cloud.amazon_control.init (
    in_aws_access_key,
    in_aws_secret,
    in_aws_region,
    in_aws_security_group,
    in_aws_key_name,
    in_pem_file )
```

The underlying functionality for the Amazon GUI, the user should not need to directly interface with this function.

##### Parameters

<i>in_aws_access_key</i>	AWS access key
<i>in_aws_secret</i>	AWS Secret Access Key
<i>in_aws_region</i>	AWS region (e.g. us-west-2)
<i>in_aws_security_group</i>	Security Group Name
<i>in_aws_key_name</i>	Name of Key Pair
<i>in_pem_file</i>	Filename of ssh key

#### 5.80.1.8 reset()

```
def skdiscovery.utilities.cloud.amazon_control.reset ( )
```

Close and clear Amazon List.

#### 5.80.1.9 resetInstances()

```
def skdiscovery.utilities.cloud.amazon_control.resetInstances ( )
```

Reboot Amazon instances.

#### 5.80.1.10 setNumInstances()

```
def skdiscovery.utilities.cloud.amazon_control.setNumInstances (
    new_total_instances,
    instance_type,
    image_id )
```

Change the number of running instances.

## Parameters

<i>new_total_instances</i>	New number of instances
<i>instance_type</i>	Instance type for new instances
<i>image_id</i>	ID of image (ami-xxxxxxx)

## 5.80.1.11 startDispyNode()

```
def skdiscovery.utilities.cloud.amazon_control.startDispyNode ( )
```

Start dispy on each Amazon instance.

## 5.80.1.12 startDispyScheduler()

```
def skdiscovery.utilities.cloud.amazon_control.startDispyScheduler ( )
```

Start the Dispy Scheduler.

## 5.80.1.13 updateIPAddress()

```
def skdiscovery.utilities.cloud.amazon_control.updateIPAddress (
    instance_info )
```

Update ip address of instance info.

## Parameters

<i>instance_info</i>	Information about amazon instance
----------------------	-----------------------------------

## 5.80.1.14 updateStatus()

```
def skdiscovery.utilities.cloud.amazon_control.updateStatus ( )
```

Update status information in amazon\_list.

## 5.80.2 Variable Documentation

### 5.80.2.1 amazon\_list

```
list skdiscovery.utilities.cloud.amazon_control.amazon_list = []
```

### 5.80.2.2 aws\_access\_key

```
skdiscovery.utilities.cloud.amazon_control.aws_access_key = None
```

### 5.80.2.3 aws\_key\_name

```
skdiscovery.utilities.cloud.amazon_control.aws_key_name = None
```

### 5.80.2.4 aws\_region

```
skdiscovery.utilities.cloud.amazon_control.aws_region = None
```

### 5.80.2.5 aws\_secret

```
skdiscovery.utilities.cloud.amazon_control.aws_secret = None
```

### 5.80.2.6 aws\_security\_group

```
skdiscovery.utilities.cloud.amazon_control.aws_security_group = None
```

#### 5.80.2.7 ec2\_client

```
skdiscovery.utilities.cloud.amazon_control.ec2_client = None
```

#### 5.80.2.8 ec2\_res

```
skdiscovery.utilities.cloud.amazon_control.ec2_res = None
```

#### 5.80.2.9 pem\_file

```
skdiscovery.utilities.cloud.amazon_control.pem_file = None
```

#### 5.80.2.10 popen

```
skdiscovery.utilities.cloud.amazon_control.popen = None
```

#### 5.80.2.11 scheduler

```
skdiscovery.utilities.cloud.amazon_control.scheduler = None
```

## 5.81 skdiscovery.utilities.cloud.amazon\_gui Namespace Reference

### Functions

- def [init](#) ()  
*Initialize GUI for controlling Amazon instances.*
- def [drawGUI](#) ()  
*Draw the GUI on the screen.*
- def [changeButtonState](#) (enabled=True)  
*Enable or disable the buttons and slider in the GUI.*
- def [checkValidValues](#) ()  
*Check if Amazon information is valid.*

## Variables

- `widget_dict` = `OrderedDict()`
- list `disable_list` = `['initialize_button', 'cache_button', 'restore_button']`
- list `initialized_disabled_list` = `['new_num_instances_widget', 'execute_instances_button']`
- list `key_value_list`
- bool `initialized` = `False`

## 5.81.1 Function Documentation

### 5.81.1.1 `changeButtonState()`

```
def skdiscovery.utilities.cloud.amazon_gui.changeButtonState (
    enabled = True )
```

Enable or disable the buttons and slider in the GUI.

#### Parameters

<i>enabled</i>	State to change the buttons to.
----------------	---------------------------------

### 5.81.1.2 `checkValidValues()`

```
def skdiscovery.utilities.cloud.amazon_gui.checkValidValues ( )
```

Check if Amazon information is valid.

#### Returns

True if all AWS text fields have data in them, false otherwise

### 5.81.1.3 `drawGUI()`

```
def skdiscovery.utilities.cloud.amazon_gui.drawGUI ( )
```

Draw the GUI on the screen.



#### 5.81.1.4 init()

```
def skdiscovery.utilities.cloud.amazon_gui.init ( )
```

Initialize GUI for controlling Amazon instances.

### 5.81.2 Variable Documentation

#### 5.81.2.1 disable\_list

```
list skdiscovery.utilities.cloud.amazon_gui.disable_list = ['initialize_button', 'cache_button',  
'restore_button']
```

#### 5.81.2.2 initialized

```
bool skdiscovery.utilities.cloud.amazon_gui.initialized = False
```

#### 5.81.2.3 initialized\_disabled\_list

```
list skdiscovery.utilities.cloud.amazon_gui.initialized_disabled_list = ['new_num_instances_↔  
widget', 'execute_instances_button']
```

#### 5.81.2.4 key\_value\_list

```
list skdiscovery.utilities.cloud.amazon_gui.key_value_list
```

**Initial value:**

```
1 = ['aws_id_widget', 'aws_secret_widget', 'aws_region_widget', 'aws_security_widget',  
2     'aws_keyname_widget', 'aws_pem_widget', 'aws_image_id', 'instance_type_widget']
```

### 5.81.2.5 widget\_dict

```
skdiscovery.utilities.cloud.amazon_gui.widget_dict = OrderedDict()
```

## 5.82 skdiscovery.utilities.cloud.ssh\_reverse Namespace Reference

### Classes

- class [ReverseTunnel](#)  
*Create a reverse ssh tunnel.*

### Functions

- def [print\\_verbose](#) (s, verbose=False)  
*Print statement if verbose is True.*
- def [handler](#) (chan, host, port, verbose=False)  
*Handler is responsible for sending and receiving data through ssh tunnel.*
- def [reverse\\_forward\\_tunnel](#) (server\_port, remote\_host, remote\_port, transport, check=30, verbose=False)  
*Creates a reverse ssh tunnel.*

### 5.82.1 Function Documentation

#### 5.82.1.1 handler()

```
def skdiscovery.utilities.cloud.ssh_reverse.handler (  
    chan,  
    host,  
    port,  
    verbose = False )
```

Handler is responsible for sending and receiving data through ssh tunnel.

#### Parameters

<i>chan</i>	SSH Channel for transferring data
<i>host</i>	Address of remote host
<i>port</i>	Port to forward
<i>verbose</i>	Print status information

## 5.82.1.2 print\_verbose()

```
def skdiscovery.utilities.cloud.ssh_reverse.print_verbose (
    s,
    verbose = False )
```

Print statement if verbose is True.

## Parameters

<i>s</i>	Statement to print
<i>verbose</i>	Print only if verbose is True

## 5.82.1.3 reverse\_forward\_tunnel()

```
def skdiscovery.utilities.cloud.ssh_reverse.reverse_forward_tunnel (
    server_port,
    remote_host,
    remote_port,
    transport,
    check = 30,
    verbose = False )
```

Creates a reverse ssh tunnel.

## Parameters

<i>server_port</i>	Port on local host
<i>remote_host</i>	Address of remote host
<i>remote_port</i>	Port of remote host
<i>transport</i>	SSH Transport
<i>check</i>	Amount of time to wait in seconds when opening up a channel
<i>verbose</i>	Print status information

## Returns

Thread running reverse ssh tunnel, event used to close ssh tunnel, list of child threads started by main thread

## 5.83 skdiscovery.utilities.patterns Namespace Reference

## Namespaces

- [astro\\_tools](#)

- [atec\\_tools](#)
- [general\\_tools](#)
- [image\\_tools](#)
- [kalman\\_smoother](#)
- [pbo\\_tools](#)
- [polygon\\_utils](#)
- [random\\_walks](#)
- [trend\\_tools](#)

## 5.84 skdiscovery.utilities.patterns.astro\_tools Namespace Reference

### Functions

- def [z\\_to\\_v](#) (z)  
*Convert redshift to km/s assuming shift is due to velocity using special relativity.*
- def [v\\_to\\_z](#) (v)  
*Convert km/s to redshift assuming all are using special relativity.*
- def [angular\\_separation](#) (ra1, dec1, ra2, dec2)  
*Angular separation between two objects via the haversine formula.*
- def [move\\_point](#) (ra, dec, ang\_dist, bearing)  
*Move a point along a great circle at a particular bearing.*
- def [abs\\_mag](#) (app\_mag, z)  
*Get the absolute magnitude from apparent magnitude.*
- def [app\\_mag](#) (abs\_mag, z)  
*Get the apparent magnitude from absolute magnitude.*
- def [nfw](#) (R, norm\_constant, Rs, Rcore)  
*2D Navarro-Frenk-White surface radial profile probability density*
- def [lf](#) (x, A, mstar, alpha)  
*Schechter function.*
- def [dlf](#) (x, A, m1, a1, m2, a2)  
*double Schechter function.*
- def [cdf\\_dlf](#) (x, A, m1, a1, m2, a2, start=-26)  
*Cumulative Schechter function.*
- def [inv\\_cdf\\_dlf](#) (p, A, m1, a1, m2, a2, start=-26, end=-15)  
*Inverse Cumulative Schechter function.*

### 5.84.1 Function Documentation

#### 5.84.1.1 [abs\\_mag\(\)](#)

```
def skdiscovery.utilities.patterns.astro_tools.abs_mag (
    app_mag,
    z )
```

Get the absolute magnitude from apparent magnitude.

Assumes concordance cosmology. No kcorrection is applied.

## Parameters

<i>app_mag</i>	Apparent magnitude
<i>z</i>	Redshift

## Returns

absolute magnitude of object at *z*

## 5.84.1.2 angular\_separation()

```
def skdiscovery.utilities.patterns.astro_tools.angular_separation (
    ra1,
    dec1,
    ra2,
    dec2 )
```

Angular separation between two objects via the haversine formula.

All inputs are in degrees.

Formula obtained from <http://www.movable-type.co.uk/scripts/gis-faq-5.1.html>

Formula originally presented in R.W. Sinnott, "Virtues of the Haversine", Sky and Telescope, vol. 68, no. 2, 1984, p. 159

## Parameters

<i>ra1</i>	Right Ascension of first object (degrees)
<i>dec1</i>	Declination of first object (degrees)
<i>ra2</i>	Right Ascension of second object (degrees)
<i>dec2</i>	Declination of second object (degrees)

## Returns

angular separation between two objects

## 5.84.1.3 app\_mag()

```
def skdiscovery.utilities.patterns.astro_tools.app_mag (
    abs_mag,
    z )
```

Get the apparent magnitude from absolute magnitude.

Assumes concordance cosmology. No kcorrection is assumed.

**Parameters**

<i>abs_mag</i>	Absolute magnitude
<i>z</i>	Redshift

**Returns**

apparent magnitude of object at *z*

**5.84.1.4 cdf\_dlf()**

```
def skdiscovery.utilities.patterns.astro_tools.cdf_dlf (
    x,
    A,
    m1,
    a1,
    m2,
    a2,
    start = -26 )
```

Cumulative Schechter function.

Second LF is set to be 2\*A of first LF.

**Parameters**

<i>x</i>	magnitude
<i>A</i>	Scale factor
<i>m1</i>	Knee of distribution 1
<i>a1</i>	Faint-end turnover of first lf
<i>m2</i>	Knee of distribution 2
<i>a2</i>	Faint-end turnover of second lf
<i>start</i>	Brightest magnitude

**Returns**

Probability that galaxy has a magnitude greater than *x*

**5.84.1.5 dlf()**

```
def skdiscovery.utilities.patterns.astro_tools.dlf (
    x,
```

```

    A,
    m1,
    a1,
    m2,
    a2 )

```

double Schechter function.

Second LF is set to be 2\*A of first LF.

#### Parameters

<i>x</i>	magnitude
<i>A</i>	Scale factor
<i>m1</i>	Knee of distribution 1
<i>a1</i>	Faint-end turnover of first lf
<i>m2</i>	Knee of distribution 2
<i>a2</i>	Faint-end turnover of second lf

#### Returns

float: Double Schechter function at magnitude x

#### 5.84.1.6 inv\_cdf\_dlf()

```

def skdiscovery.utilities.patterns.astro_tools.inv_cdf_dlf (
    p,
    A,
    m1,
    a1,
    m2,
    a2,
    start = -26,
    end = -15 )

```

Inverse Cumulative Schechter function.

Second LF is set to be 2\*A of first LF.

#### Parameters

<i>p</i>	probability
<i>A</i>	Scale factor
<i>m1</i>	Knee of distribution 1
<i>a1</i>	Faint-end turnover of first lf
<i>m2</i>	Knee of distribution 2
<i>a2</i>	Faint-end turnover of second lf
<i>start</i>	Brightest magnitude
<i>end</i>	Faintest possible magnitude

**Returns**

Magnitude associated with cdf probability p

**5.84.1.7 lf()**

```
def skdiscovery.utilities.patterns.astro_tools.lf (
    x,
    A,
    mstar,
    alpha )
```

Schechter function.

**Parameters**

<i>x</i>	magnitude
<i>A</i>	Scale factor
<i>mstar</i>	Knee of distribution
<i>alpha</i>	Faint-end turnover

**Returns**

float: Schechter function at magnitude x

**5.84.1.8 move\_point()**

```
def skdiscovery.utilities.patterns.astro_tools.move_point (
    ra,
    dec,
    ang_dist,
    bearing )
```

Move a point along a great circle at a particular bearing.

All inputs are in degrees The formula was obtained from <http://www.movable-type.co.uk/scripts/latlong.html>

**Parameters**

<i>ra</i>	Starting right ascension
<i>dec</i>	Starting declination
<i>ang_dist</i>	Angular distance to travel
<i>bearing</i>	Direction to travel (0 is north, 90 is positive RA)



**Returns**

tuple containing updated ra and dec

**5.84.1.9 nfw()**

```
def skdiscovery.utilities.patterns.astro_tools.nfw (
    R,
    norm_constant,
    Rs,
    Rcore )
```

2D Navarro-Frenk-White surface radial profile probability density

**See**

Navarro, J. F., Frenk, C. S., & White, S. D. M. 1996, ApJ, 462, 563 Bartelmann, M., A&A, 1996, 313, 697 Rykoff, E.S., et al., ApJ, 746, 178

**Parameters**

<i>R</i>	Radius
<i>norm_constant</i>	Normalization constant
<i>Rs</i>	Scale radius
<i>Rcore</i>	Since NFW profile diverges at R=0, the value at the center is held fixed starting at Rcore

**Returns**

probability density of profile at R

**5.84.1.10 v\_to\_z()**

```
def skdiscovery.utilities.patterns.astro_tools.v_to_z (
    v )
```

Convert km/s to redshift assuming all are using special relativity.

**Parameters**

<i>v</i>	velocity in km/s
----------	------------------

**Returns**

Redshift of object with speed in km/s

**5.84.1.11 `z_to_v()`**

```
def skdiscovery.utilities.patterns.astro_tools.z_to_v (
    z )
```

Convert redshift to km/s assuming shift is due to velocity using special relativity.

**Parameters**

<code>z</code>	Redshift
----------------	----------

**Returns**

speed in km/s assuming shift is due to motion using special relativity

**5.85 `skdiscovery.utilities.patterns.atec_tools` Namespace Reference****Functions**

- def [geocalc](#) (lat1, lon1, lat2, lon2)
- def [get\\_lp\\_tec](#) (tvec, vtec\_est, window\_length=481, polyorder=3)  
*get\_lp\_tec returns a low pass version of the vertical tec at the same time spacing as vtec\_est (that is, at the times given by tvec).*
- def [getRawStitch](#) (DOYs, llat, ulat, llon, rlon, year=2016)
- def [fixTECOffset](#) (siteprnTEC, doyN, dchk=3, dcut=.25, mjump=1)
- def [findTECEvents](#) (rawdata, dayNum, hrEvent, pwin=200, nstd=10, thrstd=.75, verbose=False, fixOffset=False)
- def [plotTECres](#) (pidx, resbuf, hrEvent, pwin=200)
- def [makeMap](#) (lat\_0, lon\_0, dbuffer=5, projection='gnom', resolution='i')
- def [findPRNs](#) (raw\_tec, eventHr, doyN, lat\_0, lon\_0, latWin=5, lonWin=5, nThreshold=1000)
- def [genDTecs](#) (aprn, raw\_tec, doyN)
- def [plotPRNd](#) (raw\_tec, dtecDat, eventHr, doyN, lat\_0, lon\_0, m, fsize=(10, 10), clim=.1, ms=5)
- def [plotTracks](#) (prns, asite, raw\_tec, eventHr, doyN, lat\_0, lon\_0, m, fsize=(10, 10), ms=[15])
- def [genHodochron](#) (raw\_data, aprn, doyN, lat\_0, lon\_0)
- def [plotHodochron](#) (genRes, eventTime, propTime=None, ylim=[-1500, clim=.1, figsize=(12, 5), ms=5, nDir=True, fntsize=10)

**5.85.1 Function Documentation**

#### 5.85.1.1 findPRNs()

```
def skdiscovery.utilities.patterns.atec_tools.findPRNs (
    raw_tec,
    eventHr,
    doyN,
    lat_0,
    lon_0,
    latWin = 5,
    lonWin = 5,
    nThreshold = 1000 )
```

#### 5.85.1.2 findTECevents()

```
def skdiscovery.utilities.patterns.atec_tools.findTECevents (
    rawdata,
    dayNum,
    hrEvent,
    pwin = 200,
    nstd = 10,
    thrstd = .75,
    verbose = False,
    fixOffset = False )
```

#### 5.85.1.3 fixTECOffset()

```
def skdiscovery.utilities.patterns.atec_tools.fixTECOffset (
    siteprnTEC,
    doyN,
    dchk = 3,
    dcut = .25,
    mjump = 1 )
```

#### 5.85.1.4 genDTecs()

```
def skdiscovery.utilities.patterns.atec_tools.genDTecs (
    aprn,
    raw_tec,
    doyN )
```

#### 5.85.1.5 genHodochron()

```
def skdiscovery.utilities.patterns.atec_tools.genHodochron (
    raw_data,
    aprn,
    doyN,
    lat_0,
    lon_0 )
```

#### 5.85.1.6 geocalc()

```
def skdiscovery.utilities.patterns.atec_tools.geocalc (
    lat1,
    lon1,
    lat2,
    lon2 )
```

#### 5.85.1.7 get\_lp\_tec()

```
def skdiscovery.utilities.patterns.atec_tools.get_lp_tec (
    tvec,
    vtec_est,
    window_length = 481,
    polyorder = 3 )
```

get\_lp\_tec returns a low pass version of the vertical tec at the same time spacing as vtec\_est (that is, at the times given by tvec).

If problem, returns None. Where data cannot be low pass filtered, returns numpy.nan values

#### Inputs

tvec input time array in float days vtec\_est input vertical tec arr, len = len(tvec) window\_length number of 15 second intervals to window over. Default is 481 (2 hours) Must be odd polyorder order of polynomial fit to window. Default is 3.

#### 5.85.1.8 getRawStitch()

```
def skdiscovery.utilities.patterns.atec_tools.getRawStitch (
    DOYs,
    llat,
    ulat,
    llon,
    rlon,
    year = 2016 )
```

#### 5.85.1.9 makeMap()

```
def skdiscovery.utilities.patterns.atec_tools.makeMap (
    lat_0,
    lon_0,
    dbuffer = 5,
    projection = 'gnom',
    resolution = 'i' )
```

#### 5.85.1.10 plotHodochron()

```
def skdiscovery.utilities.patterns.atec_tools.plotHodochron (
    genRes,
    eventTime,
    propTime = None,
    ylim = [-1500,
    clim = .1,
    figsize = (12,5),
    ms = 5,
    nDir = True,
    fntsize = 10 )
```

#### 5.85.1.11 plotPRNd()

```
def skdiscovery.utilities.patterns.atec_tools.plotPRNd (
    raw_tec,
    dtecDat,
    eventHr,
    doyN,
    lat_0,
    lon_0,
    m,
    fsize = (10,10),
    clim = .1,
    ms = 5 )
```

#### 5.85.1.12 plotTECres()

```
def skdiscovery.utilities.patterns.atec_tools.plotTECres (
    pidx,
    resbuf,
    hrEvent,
    pwin = 200 )
```

### 5.85.1.13 plotTracks()

```
def skdiscovery.utilities.patterns.attec_tools.plotTracks (
    prns,
    asite,
    raw_tec,
    eventHr,
    doyN,
    lat_0,
    lon_0,
    m,
    fsize = (10,10),
    ms = [15 ]
```

## 5.86 skdiscovery.utilities.patterns.general\_tools Namespace Reference

### Functions

- def [getPCAComponents](#) (pca\_results)  
*Retrieve PCA components from PCA results.*
- def [rotate](#) (col\_vectors, az, ay, ax)  
*Rotate col vectors in three dimensions.*
- def [translate](#) (col\_vectors, delta\_x, delta\_y, delta\_z)  
*Translate col vectors by x, y, and z.*
- def [formatColorbarLabels](#) (colorbar, pad=29)  
*Adjust the labels on a colorbar so they are right aligned.*

### 5.86.1 Function Documentation

#### 5.86.1.1 formatColorbarLabels()

```
def skdiscovery.utilities.patterns.general_tools.formatColorbarLabels (
    colorbar,
    pad = 29 )
```

Adjust the labels on a colorbar so they are right aligned.

#### Parameters

<i>colorbar</i>	Input matplotlib colorbar
<i>pad</i>	Amount of padding to use

### 5.86.1.2 getPCAComponents()

```
def skdiscovery.utilities.patterns.general_tools.getPCAComponents (
    pca_results )
```

Retrieve PCA components from PCA results.

#### Parameters

<i>pca_results</i>	PCA results from a pipeline run
--------------------	---------------------------------

#### Returns

Pandas DataFrame containing the pca components

### 5.86.1.3 rotate()

```
def skdiscovery.utilities.patterns.general_tools.rotate (
    col_vectors,
    az,
    ay,
    ax )
```

Rotate col vectors in three dimensions.

$R_x * R_y * R_z * \text{row\_vectors}$

#### Parameters

<i>col_vectors</i>	Three dimensional Column vectors
<i>az</i>	Z angle
<i>ay</i>	Y angle
<i>ax</i>	X angle

#### Returns

rotated col vectors

#### 5.86.1.4 `translate()`

```
def skdiscovery.utilities.patterns.general_tools.translate (
    col_vectors,
    delta_x,
    delta_y,
    delta_z )
```

Translate col vectors by x, y, and z.

##### Parameters

<i>col_vectors</i>	Row vectors of positions
<i>delta_x</i>	Amount to translate in the x direction
<i>delta_y</i>	Amount to translate in the y direction
<i>delta_z</i>	Amount to translate in the z direction

## 5.87 `skdiscovery.utilities.patterns.image_tools` Namespace Reference

### Functions

- def [buildMatchedPoints](#) (in\_matches, query\_kp, train\_kp)  
*Get postions of matched points.*
- def [scaleImage](#) (input\_data, vmin=None, vmax=None)  
*Scale image values to be within 0 and 255.*
- def [divideIntoSquares](#) (image, size, stride)  
*Create many patches from an image.*
- def [generateSquaresAroundPoly](#) (poly, size=100, stride=20)  
*Generate that may touch a shapely polygon.*

#### 5.87.1 Function Documentation

##### 5.87.1.1 `buildMatchedPoints()`

```
def skdiscovery.utilities.patterns.image_tools.buildMatchedPoints (
    in_matches,
    query_kp,
    train_kp )
```

Get postions of matched points.



## Parameters

<i>in_matches</i>	Input matches
<i>query_kp</i>	Query key points
<i>train_kp</i>	Training key points

## Returns

Tuple containing the matched query and training positions

## 5.87.1.2 divideIntoSquares()

```
def skdiscovery.utilities.patterns.image_tools.divideIntoSquares (
    image,
    size,
    stride )
```

Create many patches from an image.

Will drop any patches that contain NaN's

## Parameters

<i>image</i>	Source image
<i>size</i>	Size of one side of the square patch
<i>stride</i>	Spacing between patches (must be an integer greater than 0)

## Returns

Array containing the extent [x\_start, x\_end, y\_start, y\_end] of each patch and an array of the patches

## 5.87.1.3 generateSquaresAroundPoly()

```
def skdiscovery.utilities.patterns.image_tools.generateSquaresAroundPoly (
    poly,
    size = 100,
    stride = 20 )
```

Generate that may touch a shapely polygon.

**Parameters**

<i>poly</i>	Shapely polygon
<i>size</i>	Size of boxes to create
<i>stride</i>	Distance between squares

**Returns**

list of Shapely squares that may touch input polygon

**5.87.1.4 scaleImage()**

```
def skdiscovery.utilities.patterns.image_tools.scaleImage (
    input_data,
    vmin = None,
    vmax = None )
```

Scale image values to be within 0 and 255.

**Parameters**

<i>input_data</i>	Input data
<i>vmin</i>	Minimum value for scaled data, where smaller values are clipped, defaults to Median - stddev as determined by mad
<i>vmax</i>	Maximum value for scaled data, where larger values are clipped, defaults to Median + stddev as determined by mad

**Returns**

input\_data scaled to be within 0 and 255 as an 8 bit integer

**5.88 skdiscovery.utilities.patterns.kalman\_smoother Namespace Reference****Functions**

- def [KalmanFilter](#) (in\_data, t, sigma\_sq, R, Pinit, x0=0, invert=False, clipping=5)  
*Runs the kalman filter on data.*
- def [FitFOGMParameters](#) (data, Pinit=100, R=1, method='brute', x0=0, clipping=5)  
*Find best FOGM parameters for a given data set.*
- def [IterativeGridSearch](#) (f, args, intervals, max\_iter=50, tol=0.1, bounds=None, prev\_minimum=None, verbose=False)  
*Find the minimum of f using an iterative grid search with 3 points per dimension.*

- def [KalmanSmoother](#) (in\_data, Pinit=1e6, Restimate=1, clipping=5, method='simple', t=None, sigma\_sq=None, R=1, verbose=False, max\_clip\_iter=10)  
*Smoother based on a forward and a backward kalman filter.*
- def [FOGM](#) (size, t, sigma\_sq, R)  
*Generates data from a First Order Gaussian-Markov process.*

### 5.88.1 Function Documentation

#### 5.88.1.1 FitFOGMPParameters()

```
def skdiscovery.utilities.patterns.kalman_smoother.FitFOGMPParameters (
    data,
    Pinit = 100,
    R = 1,
    method = 'brute',
    x0 = 0,
    clipping = 5 )
```

Find best FOGM parameters for a given data set.

##### Parameters

<i>data</i>	input data
<i>Pinit</i>	Initial updated covariance
<i>R</i>	Noise Variance
<i>method</i>	Method used to fit FOGM parameters. Use "simple", "brute", or "igrid".
<i>x0</i>	Initial value of x0 to use in the kalman filter
<i>clipping</i>	Clipping factor used when computing cost functions

##### Returns

best fit correlation time  
FOGM variance  
Noise variance  
correlation time from L  
FOGM variance from Chat

#### 5.88.1.2 FOGM()

```
def skdiscovery.utilities.patterns.kalman_smoother.FOGM (
    size,
```

```

    t,
    sigma_sq,
    R )

```

Generates data from a First Order Gaussian-Markov process.

#### Parameters

<i>size</i>	Number of data points
<i>t</i>	Correlation time
<i>sigma_sq</i>	FOGM variance
<i>R</i>	Measurement variance

#### Returns

Data generated from a FOGM

#### 5.88.1.3 IterativeGridSearch()

```

def skdiscovery.utilities.patterns.kalman_smoother.IterativeGridSearch (
    f,
    args,
    intervals,
    max_iter = 50,
    tol = 0.1,
    bounds = None,
    prev_minimum = None,
    verbose = False )

```

Find the minimum of *f* using an iterative grid search with 3 points per dimension.

#### Parameters

<i>f</i>	Function to be minimized. The function must accept a tuple with coordinates for the first input.
<i>args</i>	additional arguments to pass on to the function.
<i>intervals</i>	Space that contains the minimum. Must be a list of tuples, even if only 1 dimension.
<i>max_iter</i>	Maximum number of iterations before stopping search.
<i>tol</i>	Error tolerance on result.
<i>bounds</i>	Additional set of bounds for ending search.
<i>prev_minimum</i>	Previous minimum of function. If the current minimum is close to the previous minimum the search will stop
<i>verbose</i>	Output debugging information.

**Returns**

A tuple containing a numpy array with the location of the minimum; and the minimum value of the function.

**5.88.1.4 KalmanFilter()**

```
def skdiscovery.utilities.patterns.kalman_smoother.KalmanFilter (
    in_data,
    t,
    sigma_sq,
    R,
    Pinit,
    x0 = 0,
    invert = False,
    clipping = 5 )
```

Runs the kalman filter on data.

**Parameters**

<i>in_data</i>	Input data
<i>t</i>	Correlation time
<i>sigma_sq</i>	FOGM variance
<i>R</i>	Noise variance
<i>Pinit</i>	Initial variance
<i>x0</i>	Intial updated state (default: 0)
<i>invert</i>	Run the filter backwards (boolean flag)
<i>clipping</i>	Clipping factor to use when computing cost functions

**Returns**

the predicted state  
the predicted covariance  
the updated state  
the updated covariance  
C\_hat, the sample innovation variance  
L, a different log variance cost function

**5.88.1.5 KalmanSmoother()**

```
def skdiscovery.utilities.patterns.kalman_smoother.KalmanSmoother (
    in_data,
    Pinit = 1e6,
```

```

Restimate = 1,
clipping = 5,
method = 'simple',
t = None,
sigma_sq = None,
R = 1,
verbose = False,
max_clip_iter = 10 )

```

Smoother based on a forward and a backward kalman filter.

#### Parameters

<i>in_data</i>	Data to be smoothed (must be in a Pandas DataFrame)
<i>Pinit</i>	Initial updated covariance
<i>Restimate</i>	Initial estimate for noise variance
<i>clipping</i>	Iteratively remove points beyond clipping * MSE.
<i>method</i>	Method used to fit FOGM parameters. Use either "simple", "brute", or "igrid".
<i>t</i>	Fixed correlation time to use. Both sigma_sq and R must also be specified.
<i>sigma_sq</i>	Fixed sigma squared to use. Both t and R must also be specified.
<i>R</i>	Fixed measurement error to use Both t and sigma_sq must also be specified.
<i>verbose</i>	Output additional information.
<i>max_clip_iter</i>	Maximum number of clip iterations.

#### Returns

values smoothed by the kalman smoother  
 associated variance of smoothed result  
 t, same as input, might have been altered by fitting parameters  
 sigma\_sq, same as input, might have been altered by fitting parameters  
 R, same as input, might have been altered by fitting parameters

## 5.89 skdiscovery.utilities.patterns.pbo\_tools Namespace Reference

### Classes

- class [SourceWrapper](#)  
*Wrapper for using old interface with updated source interfaces.*

### Functions

- def [getLength](#) (position\_y, position\_x)  
*Get the length of the input position y and position x data.*
- def [compute\\_distances](#) (position\_y, position\_x, source\_y, source\_x, latlon=True)  
*Compute the y and x distance between the observation location and the source location.*
- def [mogi](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, latlon=True)

- Compute the surface deformation due to changes in a mogi source.*
- def [finite\\_sphere](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, alpha\_rad, latlon=True)
- Compute the surface deformation due to changes in a finite sphere source.*
- def [closed\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)
- Compute the surface deformation due to changes in a closed pipe source.*
- def [constant\\_open\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)
- Compute the surface deformation due to changes in a constant width open pipe source.*
- def [rising\\_open\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)
- Compute the surface deformation due to changes in a rising width amplitude open pipe source.*
- def [sill](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, latlon=True)
- Compute the surface deformation due to changes in a sill-like source.*
- def [dirEigenvectors](#) (coord\_list, pca\_comps, pdir='H')
- Takes eigenvectors (north and east) and forces them to point "outward".*
- def [datetimeToNumber](#) (in\_time)
- Converts input pandas Timestamp or pandas DatetimeIndex to unix time.*
- def [MogiVectors](#) (mogi\_res, station\_lat\_list, station\_lon\_list, flag3D=False)
- Creates a set of Mogi vectors for plotting.*

## 5.89.1 Function Documentation

### 5.89.1.1 closed\_pipe()

```
def skdiscovery.utilities.patterns.pbo_tools.closed_pipe (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    pipe_delta,
    latlon = True )
```

Compute the surface deformation due to changes in a closed pipe source.

For reference, see "Volcano Deformation", Dzurisin 2006, pg 292 (<http://link.springer.com/book/10.1007/978-3-540-49302-0>)

#### Parameters

<i>position_y</i>	Observation positions in the y coordinate
<i>position_x</i>	Observation positions in the x coordinate
<i>source_y</i>	Position of the source in the y coordinate
<i>source_x</i>	Position of the source in the x coordinate
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>pipe_delta</i>	Pipe delta from source depth to top/bottom
<i>latlon</i>	If true, then position_y, position_x, source_y, and source_x are given in latitude and longitude coordinates

**Returns**

Array containing the x, y, and z deformations

**5.89.1.2 compute\_distances()**

```
def skdiscovery.utilities.patterns.pbo_tools.compute_distances (
    position_y,
    position_x,
    source_y,
    source_x,
    latlon = True )
```

Compute the y and x distance between the observation location and the source location.

**Parameters**

<i>position</i> ↔ _y	Obsevation y position
<i>position</i> ↔ _x	Observation x position
<i>source</i> ↔ _y	Source y position
<i>source</i> ↔ _x	Source x position
<i>latlon</i>	Interpret positions as latitudes and longitudes

**Returns**

The y and x distance between observation location and source locaiton

**5.89.1.3 constant\_open\_pipe()**

```
def skdiscovery.utilities.patterns.pbo_tools.constant_open_pipe (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    pipe_delta,
    latlon = True )
```

Compute the surface deformation due to changes in a constant width open pipe source.

For reference, see "Volcano Deformation", Dzurisin 2006, pg 295 (<http://link.springer.com/book/10.1007/978-3-540-49302-0>)



## Parameters

<i>position_y</i>	Observation positions in the y coordinate
<i>position_x</i>	Observation positions in the x coordinate
<i>source_y</i>	Position of the source in the y coordinate
<i>source_x</i>	Position of the source in the x coordinate
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>pipe_delta</i>	Pipe delta from source depth to top/bottom
<i>latlon</i>	If true, then position_y, position_x, source_y, and source_x are given in latitude and longitude coordinates

## Returns

Array containing the x, y, and z deformations

5.89.1.4 `datetimeToNumber()`

```
def skdiscovery.utilities.patterns.pbo_tools.datetimeToNumber (
    in_time )
```

Converts input pandas Timestamp or pandas DatetimeIndex to unix time.

## Parameters

<i>in_time</i>	Input pandas timestamp or pandas DatetimeIndex
----------------	--

## Returns

unix time

5.89.1.5 `dirEigenvectors()`

```
def skdiscovery.utilities.patterns.pbo_tools.dirEigenvectors (
    coord_list,
    pca_comps,
    pdir = 'H' )
```

Takes eigenvectors (north and east) and forces them to point "outward".

Flips the sign of the projection if needed so that eigenvectors point outward. Needed because the "positive" direction for PCA is arbitrary

## Parameters

<i>coord_list</i>	Location of stations for projecting the eigenvectors
<i>pca_comps</i>	PCA components
<i>pdir</i>	PCA direction, vertical or horizontal

## Returns

station\_lat\_list: the station latitude coordinates  
 station\_lon\_list: the station longitude coordinates  
 ev\_lat\_list: the properly oriented corresponding eigenvector latitude component  
 ev\_lon\_list: the properly oriented corresponding eigenvector longitude component  
 direction scale factor (1 for no flip, or -1 for flip)

5.89.1.6 `finite_sphere()`

```
def skdiscovery.utilities.patterns.pbo_tools.finite_sphere (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    alpha_rad,
    latlon = True )
```

Compute the surface deformation due to changes in a finite sphere source.

For reference, see "Volcano Deformation", Dzurisin 2006, pg 290 (<http://link.springer.com/book/10.1007/978-3-540-49302-0>)

## Parameters

<i>position_y</i>	Observation positions in the y coordinate
<i>position_x</i>	Observation positions in the x coordinate
<i>source_y</i>	Position of the source in the y coordinate
<i>source_x</i>	Position of the source in the x coordinate
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>alpha_rad</i>	Alpha radius of the source
<i>latlon</i>	If true, then position_y, position_x, source_y, and source_x are given in latitude and longitude coordinates

**Returns**

Array containing the x, y, and z deformations

**5.89.1.7 getLength()**

```
def skdiscovery.utilities.patterns.pbo_tools.getLength (
    position_y,
    position_x )
```

Get the length of the input position y and position x data.

**Parameters**

<i>position_y</i>	y positions
<i>position_x</i>	x positions

**Returns**

The maximum length between the x and y positions

**5.89.1.8 mogi()**

```
def skdiscovery.utilities.patterns.pbo_tools.mogi (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    latlon = True )
```

Compute the surface deformation due to changes in a mogi source.

**Parameters**

<i>position_y</i>	Observation positions in the y coordinate
<i>position_x</i>	Observation positions in the x coordinate
<i>source_y</i>	Position of the source in the y coordinate
<i>source_x</i>	Position of the source in the x coordinate
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of mogi source
<i>latlon</i>	If true, then position_y, position_x, source_y, and source_x are given in latitude and longitude coordinates

**Returns**

Array containing the x, y, and z deformations

**5.89.1.9 MogiVectors()**

```
def skdiscovery.utilities.patterns.pbo_tools.MogiVectors (
    mogi_res,
    station_lat_list,
    station_lon_list,
    flag3D = False )
```

Creates a set of Mogi vectors for plotting.

**Parameters**

<i>mogi_res</i>	Magma source inversion results
<i>station_lat_list</i>	List of station latitudes
<i>station_lon_list</i>	List of station longitudes
<i>flag3D</i>	Flag for generating 3 dimensional vectors instead of only horizontal

**Returns**

x and y Mogi vectors scaled by pca amplitude change

**5.89.1.10 rising\_open\_pipe()**

```
def skdiscovery.utilities.patterns.pbo_tools.rising_open_pipe (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    pipe_delta,
    latlon = True )
```

Compute the surface deformation due to changes in a rising width amplitude open pipe source.

For reference, see "Volcano Deformation", Dzurisin 2006, pg 295 (<http://link.springer.com/book/10.1007/978-3-540-49302-0>)

## Parameters

<i>position_y</i>	Observation positions in the y coordinate
<i>position_x</i>	Observation positions in the x coordinate
<i>source_y</i>	Position of the source in the y coordinate
<i>source_x</i>	Position of the source in the x coordinate
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>pipe_delta</i>	Pipe delta from source depth to top/bottom
<i>open_pipe_top</i>	Depth of the top of the open pipe
<i>latlon</i>	If true, then <i>position_y</i> , <i>position_x</i> , <i>source_y</i> , and <i>source_x</i> are given in latitude and longitude coordinates

## Returns

Array containing the x, y, and z deformations

## 5.89.1.11 sill()

```
def skdiscovery.utilities.patterns.pbo_tools.sill (
    position_y,
    position_x,
    source_y,
    source_x,
    source_depth,
    amplitude,
    latlon = True )
```

Compute the surface deformation due to changes in a sill-like source.

For reference, see "Volcano Deformation", Dzurisin 2006, pg 297 (<http://link.springer.com/book/10.1007/978-3-540-49302-0>)

## Parameters

<i>position_y</i>	Station y location
<i>position_x</i>	Station x location
<i>source_y</i>	y position of source
<i>source_x</i>	x position of source
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>latlon</i>	If true, then <i>position_y</i> , <i>position_x</i> , <i>source_y</i> , and <i>source_x</i> are given in latitude and longitude coordinates

**Returns**

Array containing the x, y, and z deformations

## 5.90 skdiscovery.utilities.patterns.polygon\_utils Namespace Reference

**Functions**

- def [shoelaceArea](#) (in\_vertices)  
*Determine the area of a polygon using the shoelace method.*
- def [parseBasemapShape](#) (aquifers, aquifers\_info)  
*Create shapely polygons from shapefile read in with basemap.*
- def [nearestEdgeDistance](#) (x, y, poly)  
*Determine the distance to the closest edge of a polygon.*
- def [findPolygon](#) (in\_data, in\_point)  
*Find the polygon that a point resides in.*
- def [getInfo](#) (row, key, fill, polygon\_data)  
*Retrieve information from polygon data:*
- def [findClosestPolygonDistance](#) (x, y, polygon\_data)  
*Find the distance to the closest polygon.*

### 5.90.1 Function Documentation

#### 5.90.1.1 findClosestPolygonDistance()

```
def skdiscovery.utilities.patterns.polygon_utils.findClosestPolygonDistance (
    x,
    y,
    polygon_data )
```

Find the distance to the closest polygon.

**Parameters**

<i>x</i>	x coordinate
<i>y</i>	y coordinate
<i>polygon_data</i>	Polygon data as read in by parseBasemapShape

**Returns**

Distance from x, y to the closest polygon polygon\_data

### 5.90.1.2 findPolygon()

```
def skdiscovery.utilities.patterns.polygon_utils.findPolygon (
    in_data,
    in_point )
```

Find the polygon that a point resides in.

#### Parameters

<i>in_data</i>	Input data containing polygons as read in by parseBasemapShape
<i>in_point</i>	Shapely point

#### Returns

: Index of shape in *in\_data* that contains *in\_point*

### 5.90.1.3 getInfo()

```
def skdiscovery.utilities.patterns.polygon_utils.getInfo (
    row,
    key,
    fill,
    polygon_data )
```

Retrieve information from polygon data:

#### Parameters

<i>row</i>	Container with key 'ShapeIndex'
<i>key</i>	Key of data to retrieve from <i>polygon_data</i> element
<i>fill</i>	Value to return if key does not exist in <i>polygon_data</i> element
<i>polygon_data</i>	Polygon data as read in by parseBasemapShape

### 5.90.1.4 nearestEdgeDistance()

```
def skdiscovery.utilities.patterns.polygon_utils.nearestEdgeDistance (
    x,
    y,
    poly )
```

Determine the distance to the closest edge of a polygon.

**Parameters**

<i>x</i>	x coordinate
<i>y</i>	y coordinate
<i>poly</i>	Shapely polygon

**Returns**

distance from x,y to nearest edge of the polygon

**5.90.1.5 parseBasemapShape()**

```
def skdiscovery.utilities.patterns.polygon_utils.parseBasemapShape (
    aquifers,
    aquifers_info )
```

Create shapely polygons from shapefile read in with basemap.

**Parameters**

<i>aquifers</i>	Data read in shapefile from basemap
<i>aquifers_info</i>	Metadata read from shapefile from basemap

**Returns**

: Dictionary containing information about shapes and shapely polygon of shapefile data

**5.90.1.6 shoelaceArea()**

```
def skdiscovery.utilities.patterns.polygon_utils.shoelaceArea (
    in_vertices )
```

Determine the area of a polygon using the shoelace method.

[https://en.wikipedia.org/wiki/Shoelace\\_formula](https://en.wikipedia.org/wiki/Shoelace_formula)

**Parameters**

<i>in_vertices</i>	The vertices of a polygon. 2d Array where the first column is the x coordinates and the second column is the y coordinates
--------------------	--



## Returns

: Area of the polygon

## 5.91 skdiscovery.utilities.patterns.random\_walks Namespace Reference

### Functions

- def `uniform_walk` (pos, grid, step\_size=None)  
*A uniform random walk function.*
- def `gaussian_walk` (pos, grid, step\_size=None)  
*A gaussian random walk function.*
- def `keep_in_bound` (pos, grid)  
*Function for truncating and bounding the random walk to within the defined grid.*

#### 5.91.1 Function Documentation

##### 5.91.1.1 `gaussian_walk()`

```
def skdiscovery.utilities.patterns.random_walks.gaussian_walk (
    pos,
    grid,
    step_size = None )
```

A gaussian random walk function.

#### Parameters

<i>pos</i>	tuple of input point
<i>grid</i>	bounds for walk
<i>step_size</i>	maximal step size

## Returns

position tuple

##### 5.91.1.2 `keep_in_bound()`

```
def skdiscovery.utilities.patterns.random_walks.keep_in_bound (
    pos,
    grid )
```

Function for truncating and bounding the random walk to within the defined grid.

#### Parameters

<i>pos</i>	tuple of the point to be checked
<i>grid</i>	the bounds for limiting the walk

#### Returns

position tuple after bounding the point

#### 5.91.1.3 uniform\_walk()

```
def skdiscovery.utilities.patterns.random_walks.uniform_walk (
    pos,
    grid,
    step_size = None )
```

A uniform random walk function.

#### Parameters

<i>pos</i>	tuple of input point
<i>grid</i>	bounds for walk
<i>step_size</i>	maximal step size

#### Returns

position tuple

## 5.92 skdiscovery.utilities.patterns.trend\_tools Namespace Reference

### Functions

- def [getTrend](#) (xdata)  
*The getTrend function applies the signal.detrend function.*
- def [sinuFits](#) (xdata, fitN=2, rmve=1)  
*The sinuFits function fits annual and semi-annual sinusoid trends.*
- def [interpNaN](#) (data)  
*Interpolate data using a linear interpolation.*
- def [medianFilter](#) (data, window, interpolate=True)  
*A median filter.*
- def [normalize](#) (in\_data)

### 5.92.1 Function Documentation

#### 5.92.1.1 `getTrend()`

```
def skdiscovery.utilities.patterns.trend_tools.getTrend (
    xdata )
```

The `getTrend` function applies the `signal.detrend` function.

Returns the trend, given a time index input.

##### Parameters

<i>xdata</i>	1D time-series data in a pandas series format
--------------	---

##### Returns

the detrended data in pandas series format  
the linear trend assuming a 1 day per sample time fit  
the parameters for the linear trend

#### 5.92.1.2 `interpNaN()`

```
def skdiscovery.utilities.patterns.trend_tools.interpNaN (
    data )
```

Interpolate data using a linear interpolation.

##### Parameters

<i>data</i>	1d numpy or pandas Series with possible NaN's
-------------	---

##### Returns

data after interpolation

#### 5.92.1.3 `medianFilter()`

```
def skdiscovery.utilities.patterns.trend_tools.medianFilter (
    data,
```

```
    window,  
    interpolate = True )
```

A median filter.

If `interpolate` is `True`, data will be interpolated before smoothing. Otherwise, all available data within the window will be used

#### Parameters

<i>data</i>	Input data
<i>window</i>	Size of filter window
<i>interpolate</i>	Interpolate data before smoothing

#### Returns

Smoothed data

#### 5.92.1.4 `normalize()`

```
def skdiscovery.utilities.patterns.trend_tools.normalize (  
    in_data )
```

#### 5.92.1.5 `sinuFits()`

```
def skdiscovery.utilities.patterns.trend_tools.sinuFits (  
    xdata,  
    fitN = 2,  
    rmve = 1 )
```

The `sinuFits` function fits annual and semi-annual sinusoid trends.

Other options allow for a monthly and seasonal sinusoid fit. The data is expected to be in pandas format

#### Parameters

<i>xdata</i>	1D time-series data in a pandas series format
<i>fitN</i>	the number of sinusoids to fit. 1-annual, 2-semi-annual, 3-seasonal, 4-monthly
<i>rmve</i>	a flag to return sinusoid removed data, or the sinusoids

## Returns

retrDat: the returned data, either sinusoid removed or the sum of the sinusoids

## 5.93 skdiscovery.utilities.planetary Namespace Reference

### Namespaces

- [ellipse\\_uncertainty](#)
- [fast\\_marching](#)
- [fuzzy\\_logic](#)
- [geographical\\_computation](#)
- [map\\_util](#)
- [morphometry](#)
- [raster\\_management](#)
- [traverse\\_emulation](#)
- [vector\\_management](#)

## 5.94 skdiscovery.utilities.planetary.ellipse\_uncertainty Namespace Reference

### Functions

- def [coordinates\\_coding](#) (ob)  
*Function definitions.*
- def [create\\_path\\_from\\_coordinates](#) (xy\_outer\_ring, xy\_inner\_rings=[])
- def [compute\\_ellipse\\_path](#) (center\_longitude, center\_latitude, a, b, azimuth, planet\_radius, number\_of\_nodes=100, basemap=None)
- def [transform\\_to\\_pixel\\_coordinates](#) (x, y, xmin, xmax, ymin, ymax, width, height)
- def [compute\\_ellipse\\_path\\_bounding\\_box](#) (ellipse\_path, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- def [compute\\_ellipse\\_path\\_and\\_bounding\\_box](#) (center\_longitude, center\_latitude, a, b, azimuth, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height, planet\_radius, number\_of\_nodes=100)
- def [compute\\_raster\\_ellipse](#) (favorability\_map\_array, rad\_center\_longitude, rad\_center\_latitude, rad\_longitudes, rad\_latitudes, planet\_radius, a, b, azimuth, ellipse\_slice)
- def [compute\\_ellipse\\_coordinates](#) (rad\_center\_longitude, rad\_center\_latitude, a, b, azimuth, planet\_radius, number\_of\_nodes=100)
- def [min\\_list](#) (list\_a)
- def [max\\_list](#) (list\_a)
- def [compute\\_ellipse\\_extremities](#) (ellipse\_path\_longitudes, ellipse\_path\_latitudes)
- def [compute\\_ellipse\\_bounding\\_box](#) (ellipse\_extremities, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- def [transform\\_to\\_pixel\\_coordinates\\_math](#) (x, y, xmin, xmax, ymin, ymax, width, height)
- def [compute\\_ellipse\\_and\\_bounding\\_box](#) (center\_longitude, center\_latitude, a, b, azimuth, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height, planet\_radius, number\_of\_nodes=100)
- def [get\\_favorability\\_inside\\_ellipse](#) (favorability\_map\_array, rad\_center\_longitude, rad\_center\_latitude, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, a, b, azimuth, slice\_i, slice\_j)

- def [compute\\_number\\_of\\_ellipse\\_nodes](#) (latitude, min\_number\_of\_nodes=100, max\_number\_of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75)
- def [compute\\_landing\\_ellipse\\_uncertainty](#) (raster\_rawfavorability\_array, i, j, rad\_longitude\_array, rad\_latitude\_array, a, b, azimuth, min\_number\_of\_nodes=100, max\_number\_of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75, raster\_lon\_min=-180, raster\_lon\_max=180, raster\_lat\_min=-90, raster\_lat\_max=90, planet\_radius=3389.50)
- def [compute\\_landing\\_ellipse\\_uncertainties](#) (raster\_rawfavorability\_array, ii, jj, rad\_longitude\_array, rad\_latitude\_array, a, b, azimuth, min\_number\_of\_nodes=100, max\_number\_of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75, raster\_lon\_min=-180, raster\_lon\_max=180, raster\_lat\_min=-90, raster\_lat\_max=90, planet\_radius=3389.50)

## 5.94.1 Function Documentation

### 5.94.1.1 `compute_ellipse_and_bounding_box()`

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_and_bounding_box (
    center_longitude,
    center_latitude,
    a,
    b,
    azimuth,
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    raster_width,
    raster_height,
    planet_radius,
    number_of_nodes = 100 )
```

### 5.94.1.2 `compute_ellipse_bounding_box()`

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_bounding_box (
    ellipse_extremities,
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    raster_width,
    raster_height )
```

#### 5.94.1.3 compute\_ellipse\_coordinates()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_coordinates (
    rad_center_longitude,
    rad_center_latitude,
    a,
    b,
    azimuth,
    planet_radius,
    number_of_nodes = 100 )
```

#### 5.94.1.4 compute\_ellipse\_extremities()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_extremities (
    ellipse_path_longitudes,
    ellipse_path_latitudes )
```

#### 5.94.1.5 compute\_ellipse\_path()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_path (
    center_longitude,
    center_latitude,
    a,
    b,
    azimuth,
    planet_radius,
    number_of_nodes = 100,
    basemap = None )
```

#### 5.94.1.6 compute\_ellipse\_path\_and\_bounding\_box()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_path_and_bounding_box (
    center_longitude,
    center_latitude,
    a,
    b,
    azimuth,
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    raster_width,
    raster_height,
    planet_radius,
    number_of_nodes = 100 )
```

#### 5.94.1.7 compute\_ellipse\_path\_bounding\_box()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_ellipse_path_bounding_box (
    ellipse_path,
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    raster_width,
    raster_height )
```

#### 5.94.1.8 compute\_landing\_ellipse\_uncertainties()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_landing_ellipse_uncertainties (
    raster_rawfavorability_array,
    ii,
    jj,
    rad_longitude_array,
    rad_latitude_array,
    a,
    b,
    azimuth,
    min_number_of_nodes = 100,
    max_number_of_nodes = 500,
    sigmoid_midlatitude = 85,
    steepness = 0.75,
    raster_lon_min = -180,
    raster_lon_max = 180,
    raster_lat_min = -90,
    raster_lat_max = 90,
    planet_radius = 3389.50 )
```

#### 5.94.1.9 compute\_landing\_ellipse\_uncertainty()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_landing_ellipse_uncertainty (
    raster_rawfavorability_array,
    i,
    j,
    rad_longitude_array,
    rad_latitude_array,
    a,
    b,
    azimuth,
    min_number_of_nodes = 100,
    max_number_of_nodes = 500,
    sigmoid_midlatitude = 85,
```



```
steepness = 0.75,  
raster_lon_min = -180,  
raster_lon_max = 180,  
raster_lat_min = -90,  
raster_lat_max = 90,  
planet_radius = 3389.50 )
```

#### 5.94.1.10 compute\_number\_of\_ellipse\_nodes()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_number_of_ellipse_nodes (  
    latitude,  
    min_number_of_nodes = 100,  
    max_number_of_nodes = 500,  
    sigmoid_midlatitude = 85,  
    steepness = 0.75 )
```

#### 5.94.1.11 compute\_raster\_ellipse()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.compute_raster_ellipse (  
    favorability_map_array,  
    rad_center_longitude,  
    rad_center_latitude,  
    rad_longitudes,  
    rad_latitudes,  
    planet_radius,  
    a,  
    b,  
    azimuth,  
    ellipse_slice )
```

#### 5.94.1.12 coordinates\_coding()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.coordinates_coding (  
    ob )
```

Function definitions.

#### 5.94.1.13 create\_path\_from\_coordinates()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.create_path_from_coordinates (
    xy_outer_ring,
    xy_inner_rings = [] )
```

#### 5.94.1.14 get\_favorability\_inside\_ellipse()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.get_favorability_inside_ellipse (
    favorability_map_array,
    rad_center_longitude,
    rad_center_latitude,
    rad_longitude_array,
    rad_latitude_array,
    planet_radius,
    a,
    b,
    azimuth,
    slice_i,
    slice_j )
```

#### 5.94.1.15 max\_list()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.max_list (
    list_a )
```

#### 5.94.1.16 min\_list()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.min_list (
    list_a )
```

#### 5.94.1.17 transform\_to\_pixel\_coordinates()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.transform_to_pixel_coordinates (
    x,
    y,
    xmin,
    xmax,
    ymin,
    ymax,
    width,
    height )
```

## 5.94.1.18 transform\_to\_pixel\_coordinates\_math()

```
def skdiscovery.utilities.planetary.ellipse_uncertainty.transform_to_pixel_coordinates_math (
    x,
    y,
    xmin,
    xmax,
    ymin,
    ymax,
    width,
    height )
```

## 5.95 skdiscovery.utilities.planetary.fast\_marching Namespace Reference

## Classes

- class [PriorityQueue](#)  
*Function definitions.*

## Functions

- def [get\\_four\\_neighborhood](#) (j, i, raster\_height, raster\_width, gap=1, is\_entire\_planet\_mapped=True)
- def [haversine\\_distance\\_math](#) (longitude\_1, latitude\_1, longitude\_2, latitude\_2, radius)
- def [get\\_quadratic\\_coefficients](#) (current\_cell\_j, current\_cell\_i, time\_array, alive\_cells, velocity\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [solve\\_quadratic\\_equation](#) (a, b, c)
- def [compute\\_time](#) (current\_cell\_j, current\_cell\_i, time\_array, alive\_cells, velocity\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [run\\_fast\\_marching](#) (initiation\_array, velocity\_array, longitude\_array, latitude\_array, planet\_radius, stopping\_time=None, is\_entire\_planet\_mapped=True, turn\_inf\_to\_nan=True)

## 5.95.1 Function Documentation

## 5.95.1.1 compute\_time()

```
def skdiscovery.utilities.planetary.fast_marching.compute_time (
    current_cell_j,
    current_cell_i,
    time_array,
    alive_cells,
    velocity_array,
    longitude_array,
    latitude_array,
    planet_radius,
    is_entire_planet_mapped = True )
```

#### 5.95.1.2 `get_four_neighborhood()`

```
def skdiscovery.utilities.planetary.fast_marching.get_four_neighborhood (
    j,
    i,
    raster_height,
    raster_width,
    gap = 1,
    is_entire_planet_mapped = True )
```

#### 5.95.1.3 `get_quadratic_coefficients()`

```
def skdiscovery.utilities.planetary.fast_marching.get_quadratic_coefficients (
    current_cell_j,
    current_cell_i,
    time_array,
    alive_cells,
    velocity_array,
    longitude_array,
    latitude_array,
    planet_radius,
    is_entire_planet_mapped = True )
```

#### 5.95.1.4 `haversine_distance_math()`

```
def skdiscovery.utilities.planetary.fast_marching.haversine_distance_math (
    longitude_1,
    latitude_1,
    longitude_2,
    latitude_2,
    radius )
```

#### 5.95.1.5 `run_fast_marching()`

```
def skdiscovery.utilities.planetary.fast_marching.run_fast_marching (
    initiation_array,
    velocity_array,
    longitude_array,
    latitude_array,
    planet_radius,
    stopping_time = None,
    is_entire_planet_mapped = True,
    turn_inf_to_nan = True )
```

#### 5.95.1.6 solve\_quadratic\_equation()

```
def skdiscovery.utilities.planetary.fast_marching.solve_quadratic_equation (
    a,
    b,
    c )
```

## 5.96 skdiscovery.utilities.planetary.fuzzy\_logic Namespace Reference

### Functions

- def [trapezoidal\\_function](#) (raster\_array, x\_start\_rise, x\_start\_plateau, x\_end\_plateau, x\_end\_slope, bottom\_value=0.2, plateau\_value=1, nan\_value=0.1)  
*Function definitions.*
- def [union](#) (args)
- def [intersection](#) (args)
- def [complement](#) (raster\_array\_a)
- def [algebraic\\_product](#) (args)
- def [algebraic\\_sum](#) (args)
- def [gamma\\_operation](#) (gamma, args)

### 5.96.1 Function Documentation

#### 5.96.1.1 algebraic\_product()

```
def skdiscovery.utilities.planetary.fuzzy_logic.algebraic_product (
    args )
```

#### 5.96.1.2 algebraic\_sum()

```
def skdiscovery.utilities.planetary.fuzzy_logic.algebraic_sum (
    args )
```

#### 5.96.1.3 complement()

```
def skdiscovery.utilities.planetary.fuzzy_logic.complement (
    raster_array_a )
```

#### 5.96.1.4 `gamma_operation()`

```
def skdiscovery.utilities.planetary.fuzzy_logic.gamma_operation (
    gamma,
    args )
```

#### 5.96.1.5 `intersection()`

```
def skdiscovery.utilities.planetary.fuzzy_logic.intersection (
    args )
```

#### 5.96.1.6 `trapezoidal_function()`

```
def skdiscovery.utilities.planetary.fuzzy_logic.trapezoidal_function (
    raster_array,
    x_start_rise,
    x_start_plateau,
    x_end_plateau,
    x_end_slope,
    bottom_value = 0.2,
    plateau_value = 1,
    nan_value = 0.1 )
```

Function definitions.

#### 5.96.1.7 `union()`

```
def skdiscovery.utilities.planetary.fuzzy_logic.union (
    args )
```

## 5.97 skdiscovery.utilities.planetary.geographical\_computation Namespace Reference

### Functions

- def [haversine\\_distance\\_math](#) (longitude\_1, latitude\_1, longitude\_2, latitude\_2, radius)
- def [nvector\\_from\\_lonlat](#) (longitude\_1, latitude\_1)
- def [compute\\_great\\_circle\\_nvector](#) (nvector\_1, bearing, distance, planet\_radius)
- def [lonlat\\_from\\_nvector](#) (nvector\_1)
- def [mod](#) (y, x)
- def [compute\\_great\\_circle\\_distance\\_and\\_bearing](#) (rad\_longitude\_1, rad\_latitude\_1, rad\_longitude\_2, rad\_latitude\_2, planet\_radius)
- def [nvector\\_from\\_lonlat\\_math](#) (rad\_longitude\_1, rad\_latitude\_1)
- def [cross](#) (vector\_a, vector\_b)
- def [scalar\\_division](#) (vector\_a, scalar)
- def [compute\\_great\\_circle\\_nvector\\_math](#) (nvector\_1, bearing, distance, planet\_radius)
- def [lonlat\\_from\\_nvector\\_math](#) (nvector\_1)
- def [mod\\_math](#) (y, x)
- def [compute\\_great\\_circle\\_distance\\_and\\_bearing\\_math](#) (rad\_longitude\_1, rad\_latitude\_1, rad\_longitude\_2, rad\_latitude\_2, planet\_radius)
- def [compute\\_longitude\\_and\\_latitude\\_maps](#) (lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- def [compute\\_surface\\_area](#) (raster\_longitude\_array, raster\_latitude\_array, lon\_min, lon\_max, lat\_min, lat\_max, planet\_radius)

### Variables

- [nopython](#)

*Function definitions.*

#### 5.97.1 Function Documentation

##### 5.97.1.1 [compute\\_great\\_circle\\_distance\\_and\\_bearing\(\)](#)

```
def skdiscovery.utilities.planetary.geographical_computation.compute_great_circle_distance_and_bearing (
    rad_longitude_1,
    rad_latitude_1,
    rad_longitude_2,
    rad_latitude_2,
    planet_radius )
```

#### 5.97.1.2 `compute_great_circle_distance_and_bearing_math()`

```
def skdiscovery.utilities.planetary.geographical_computation.compute_great_circle_distance_and_bearing_math (
    rad_longitude_1,
    rad_latitude_1,
    rad_longitude_2,
    rad_latitude_2,
    planet_radius )
```

#### 5.97.1.3 `compute_great_circle_nvector()`

```
def skdiscovery.utilities.planetary.geographical_computation.compute_great_circle_nvector (
    nvector_1,
    bearing,
    distance,
    planet_radius )
```

#### 5.97.1.4 `compute_great_circle_nvector_math()`

```
def skdiscovery.utilities.planetary.geographical_computation.compute_great_circle_nvector_math (
    nvector_1,
    bearing,
    distance,
    planet_radius )
```

#### 5.97.1.5 `compute_longitude_and_latitude_maps()`

```
def skdiscovery.utilities.planetary.geographical_computation.compute_longitude_and_latitude_maps (
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    raster_width,
    raster_height )
```



#### 5.97.1.6 compute\_surface\_area()

```
def skdiscovery.utilities.planetary.geographical_computation.compute_surface_area (
    raster_longitude_array,
    raster_latitude_array,
    lon_min,
    lon_max,
    lat_min,
    lat_max,
    planet_radius )
```

#### 5.97.1.7 cross()

```
def skdiscovery.utilities.planetary.geographical_computation.cross (
    vector_a,
    vector_b )
```

#### 5.97.1.8 haversine\_distance\_math()

```
def skdiscovery.utilities.planetary.geographical_computation.haversine_distance_math (
    longitude_1,
    latitude_1,
    longitude_2,
    latitude_2,
    radius )
```

#### 5.97.1.9 lonlat\_from\_nvector()

```
def skdiscovery.utilities.planetary.geographical_computation.lonlat_from_nvector (
    nvector_1 )
```

#### 5.97.1.10 lonlat\_from\_nvector\_math()

```
def skdiscovery.utilities.planetary.geographical_computation.lonlat_from_nvector_math (
    nvector_1 )
```

**5.97.1.11 mod()**

```
def skdiscovery.utilities.planetary.geographical_computation.mod (
    y,
    x )
```

**5.97.1.12 mod\_math()**

```
def skdiscovery.utilities.planetary.geographical_computation.mod_math (
    y,
    x )
```

**5.97.1.13 nvector\_from\_lonlat()**

```
def skdiscovery.utilities.planetary.geographical_computation.nvector_from_lonlat (
    longitude_1,
    latitude_1 )
```

**5.97.1.14 nvector\_from\_lonlat\_math()**

```
def skdiscovery.utilities.planetary.geographical_computation.nvector_from_lonlat_math (
    rad_longitude_1,
    rad_latitude_1 )
```

**5.97.1.15 scalar\_division()**

```
def skdiscovery.utilities.planetary.geographical_computation.scalar_division (
    vector_a,
    scalar )
```

**5.97.2 Variable Documentation**

## 5.97.2.1 nopython

skdiscovery.utilities.planetary.geographical\_computation.nopython

Function definitions.

## 5.98 skdiscovery.utilities.planetary.map\_util Namespace Reference

## Classes

- class [GlobalCoords](#)  
*Converts from pixel coordinates to projected coordinates.*
- class [Planet](#)  
*A class for storing variables about a planetary body.*

## Functions

- def [sanitize\\_latlon](#) (lat\_lon\_tuple, ppd=1, start\_from\_90N=False)  
*Wraps around latitude & longitudes, including interpretation of points past the poles.*
- def [trim\\_map](#) (array, ppd, nswe, lat\_npole=90, lon\_offset=0)  
*Returns a copy of a map/array trimmed to the given N, S, W, E extents.*
- def [calc\\_slopes](#) (topo\_array, ppd, planet, scaled=True, nswe="global", lon\_offset=0, lat\_npole=90)  
*Calculate a slope map from a topographic dataset.*
- def [wgs84\\_distance](#) (point1, point2, planet=[Planet](#)("wgs84"), miles=False)  
*Vincenty distance adapted from public domain vincenty package.*
- def [global\\_coords](#) (x\_in, y\_in, coeffs)  
*Transform pixel coordinates into projected coords using affine transformation coefficients.*
- def [gps\\_to\\_pixel](#) (gpsmethod, gps\_coord, bounds)  
*Function for finding the pixel coordinate associated with a gps coordinate.*

## 5.98.1 Function Documentation

## 5.98.1.1 calc\_slopes()

```
def skdiscovery.utilities.planetary.map_util.calc_slopes (
    topo_array,
    ppd,
    planet,
    scaled = True,
    nswe = "global",
    lon_offset = 0,
    lat_npole = 90 )
```

Calculate a slope map from a topographic dataset.

For now, this tool assumes a global topographic dataset; in the future, it will be expanded to work on regional datasets as well

## Parameters

<i>topo_array</i>	a global topographic dataset, in numpy array form
<i>ppd</i>	the pixels-per-degree of the topo array
<i>planet</i>	The planetary body in question
<i>scaled</i>	whether values should be scaled by latitude
<i>nswe</i>	the (NW,SE) corners of the area-of-interest
<i>lon_offset</i>	the longitude of the prime meridian in the same system as the given N, S, W, E values
<i>lat_npole</i>	the latitude of the N Pole in the same system as the given N, S, W, E values

5.98.1.2 `global_coords()`

```
def skdiscovery.utilities.planetary.map_util.global_coords (
    x_in,
    y_in,
    coeffs )
```

Transform pixel coordinates into projected coords using affine transformation coefficients.

Assumes input pixel coordinates refer to the center of the pixel, and so 0.5 is added to the inputs.

## Parameters

<i>x_in</i>	X pixel coordinates
<i>y_in</i>	Y pixel coordinates
<i>coeffs</i>	Affine transformation coefficients

## Returns

projected coordinates

5.98.1.3 `gps_to_pixel()`

```
def skdiscovery.utilities.planetary.map_util.gps_to_pixel (
    gpsmethod,
    gps_coord,
    bounds )
```

Function for finding the pixel coordinate associated with a gps coordinate.

## Parameters

<i>gpsmethod</i>	GPS coordinate mapping function from above
<i>gps_coord</i>	GPS coordinate to match, as (lat,lon)
<i>bounds</i>	Pixel bounds to search within ((y_low,y_high),(x_low,x_high))

## Returns

Nearest integer pixel value

5.98.1.4 `sanitize_latlon()`

```
def skdiscovery.utilities.planetary.map_util.sanitize_latlon (
    lat_lon_tuple,
    ppd = 1,
    start_from_90N = False )
```

Wraps around latitude & longitudes, including interpretation of points past the poles.

## Parameters

<i>lat_lon_tuple</i>	(lat, lon), in either degrees or pixels
<i>ppd</i>	pixels-per-degree
<i>start_from_90N</i>	consider 90N to be 0 latitude

## Returns

Latitude and Longitude after they have been sanitized

5.98.1.5 `trim_map()`

```
def skdiscovery.utilities.planetary.map_util.trim_map (
    array,
    ppd,
    nswe,
    lat_npole = 90,
    lon_offset = 0 )
```

Returns a copy of a map/array trimmed to the given N, S, W, E extents.

## Parameters

<i>array</i>	the input array to be trimmed
<i>ppd</i>	the pixels-per-degree of the array
<i>nswe</i>	a 1x4 array of the desired [N, S, W, E] edges
<i>lat_npole</i>	the latitude of the N Pole in the same system as the given N, S, W, E values
<i>lon_offset</i>	the longitude of the prime meridian in the same system as the given N, S, W, E values

## Returns

trimmed\_map: the input data trimmed to the desired edges

## 5.98.1.6 wgs84\_distance()

```
def skdiscovery.utilities.planetary.map_util.wgs84_distance (
    point1,
    point2,
    planet = Planet("wgs84"),
    miles = False )
```

Vincenty distance adapted from public domain vincenty package.

Adapted from <https://github.com/maurycyp/vincenty>

```
Vincenty's formula (inverse method) to calculate the distance (in
kilometers or miles) between two points on the surface of a spheroid
>>> wgs84_distance((0.0, 0.0), (0.0, 0.0)) # coincident points
0.0
>>> wgs84_distance((0.0, 0.0), (0.0, 1.0))
111.319491
>>> wgs84_distance((0.0, 0.0), (1.0, 0.0))
110.574389
>>> wgs84_distance((0.0, 0.0), (0.5, 179.5)) # slow convergence
19936.288579
>>> wgs84_distance((0.0, 0.0), (0.5, 179.7)) # failure to converge
>>> boston = (42.3541165, -71.0693514)
>>> newyork = (40.7791472, -73.9680804)
>>> wgs84_distance(boston, newyork)
298.396057
>>> wgs84_distance(boston, newyork, miles=True)
185.414657
```

## Parameters

<i>point1</i>	(lat1, lon1)
<i>point2</i>	(lat2, lon2)
<i>planet</i>	<a href="#">Planet</a> to perform the computation on
<i>miles</i>	Convert result to miles (default kilometers)

## Returns

distance between point1 and point2

## 5.99 skdiscovery.utilities.planetary.morphometry Namespace Reference

### Functions

- def [add\\_symmetric\\_border](#) (raster\_array, border\_size=1)
- def [add\\_planet\\_border](#) (raster\_array, border\_size=1)
- def [compute\\_gradient](#) (j, i, raster\_array, longitude\_array, latitude\_array, planet\_radius, axis=1)
- def [compute\\_horne\\_slope](#) (raster\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [compute\\_absolute\\_standard\\_deviation\\_filter](#) (raster\_array, window\_size=3, is\_entire\_planet\_mapped=True)

### Variables

- [nopython](#)  
*Function definitions.*

### 5.99.1 Function Documentation

#### 5.99.1.1 add\_planet\_border()

```
def skdiscovery.utilities.planetary.morphometry.add_planet_border (
    raster_array,
    border_size = 1 )
```

#### 5.99.1.2 add\_symmetric\_border()

```
def skdiscovery.utilities.planetary.morphometry.add_symmetric_border (
    raster_array,
    border_size = 1 )
```

#### 5.99.1.3 `compute_absolute_standard_deviation_filter()`

```
def skdiscovery.utilities.planetary.morphometry.compute_absolute_standard_deviation_filter (
    raster_array,
    window_size = 3,
    is_entire_planet_mapped = True )
```

#### 5.99.1.4 `compute_gradient()`

```
def skdiscovery.utilities.planetary.morphometry.compute_gradient (
    j,
    i,
    raster_array,
    longitude_array,
    latitude_array,
    planet_radius,
    axis = 1 )
```

#### 5.99.1.5 `compute_horne_slope()`

```
def skdiscovery.utilities.planetary.morphometry.compute_horne_slope (
    raster_array,
    longitude_array,
    latitude_array,
    planet_radius,
    is_entire_planet_mapped = True )
```

### 5.99.2 Variable Documentation

#### 5.99.2.1 `nopython`

`skdiscovery.utilities.planetary.morphometry.nopython`

Function definitions.

## 5.100 `skdiscovery.utilities.planetary.raster_management` Namespace Reference

### Classes

- class [DiscreteColormap](#)



## Functions

- def [open\\_raster](#) (gdal\_raster\_path, read\_only=True)  
*Function definitions.*
- def [get\\_raster\\_array](#) (gdal\_raster, remove\_ndv=True)
- def [get\\_raster\\_extent](#) (gdal\_raster)
- def [print\\_raster\\_info](#) (gdal\_raster)
- def [define\\_geotransform](#) (xmin, xmax, ymin, ymax, raster\_x\_size, raster\_y\_size)
- def [add\\_raster\\_to\\_map](#) (basemap, raster\_array, raster\_name, min\_longitude=-180, max\_longitude=180, min\_latitude=-90, max\_latitude=90, colormap='viridis', add\_colorbar=True, zorder=1, use\_latlon=True, use\_pcolormesh=True)
- def [create\\_raster\\_from\\_array](#) (raster\_array, geotransform, projection, file\_type='MEM', file\_path="", data\_type=gdal.GDT\_Float64, no\_data\_value=-99999., scale=1., offset=0., options=[])
- def [transform\\_to\\_i\\_coordinate](#) (x, xmin, xmax, width)
- def [recenter\\_raster\\_array](#) (raster\_array, old\_central\_meridian, new\_central\_meridian, old\_lon\_min, old\_lon\_max)
- def [recenter\\_raster](#) (raster, old\_central\_meridian, new\_central\_meridian, old\_lon\_min, old\_lon\_max, file\_type='MEM', file\_path="")

### 5.100.1 Function Documentation

#### 5.100.1.1 [add\\_raster\\_to\\_map\(\)](#)

```
def skdiscovery.utilities.planetary.raster_management.add_raster_to_map (
    basemap,
    raster_array,
    raster_name,
    min_longitude = -180,
    max_longitude = 180,
    min_latitude = -90,
    max_latitude = 90,
    colormap = 'viridis',
    add_colorbar = True,
    zorder = 1,
    use_latlon = True,
    use_pcolormesh = True )
```

#### 5.100.1.2 [create\\_raster\\_from\\_array\(\)](#)

```
def skdiscovery.utilities.planetary.raster_management.create_raster_from_array (
    raster_array,
    geotransform,
    projection,
    file_type = 'MEM',
    file_path = '',
```

```
data_type = gdal.GDT_Float64,  
no_data_value = -99999.,  
scale = 1.,  
offset = 0.,  
options = [] )
```

#### 5.100.1.3 `define_geotransform()`

```
def skdiscovery.utilities.planetary.raster_management.define_geotransform (   
    xmin,  
    xmax,  
    ymin,  
    ymax,  
    raster_x_size,  
    raster_y_size )
```

#### 5.100.1.4 `get_raster_array()`

```
def skdiscovery.utilities.planetary.raster_management.get_raster_array (   
    gdal_raster,  
    remove_ndv = True )
```

#### 5.100.1.5 `get_raster_extent()`

```
def skdiscovery.utilities.planetary.raster_management.get_raster_extent (   
    gdal_raster )
```

#### 5.100.1.6 `open_raster()`

```
def skdiscovery.utilities.planetary.raster_management.open_raster (   
    gdal_raster_path,  
    read_only = True )
```

Function definitions.

#### 5.100.1.7 print\_raster\_info()

```
def skdiscovery.utilities.planetary.raster_management.print_raster_info (
    gdal_raster )
```

#### 5.100.1.8 recenter\_raster()

```
def skdiscovery.utilities.planetary.raster_management.recenter_raster (
    raster,
    old_central_meridian,
    new_central_meridian,
    old_lon_min,
    old_lon_max,
    file_type = 'MEM',
    file_path = '' )
```

#### 5.100.1.9 recenter\_raster\_array()

```
def skdiscovery.utilities.planetary.raster_management.recenter_raster_array (
    raster_array,
    old_central_meridian,
    new_central_meridian,
    old_lon_min,
    old_lon_max )
```

#### 5.100.1.10 transform\_to\_i\_coordinate()

```
def skdiscovery.utilities.planetary.raster_management.transform_to_i_coordinate (
    x,
    xmin,
    xmax,
    width )
```

## 5.101 skdiscovery.utilities.planetary.traverse\_emulation Namespace Reference

### Functions

- def [get\\_target\\_types\\_at\\_cells](#) (target\_arrays)

*Function definitions.*

- def [identify\\_neighbors](#) (cells, target\_types\_at\_cells, target\_arrays, time\_limit=math.inf)
- def [compute\\_neighborhoods](#) (neighbors, target\_types\_at\_cells, time\_limit)
- def [extract\\_threshold\\_targets](#) (neighborhoods, target\_types\_at\_cells, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_groups\_per\_priority, time\_limit)
- def [compute\\_path\\_rank](#) (traverse\_path, scenarios\_visited\_groups\_per\_priorities, scenarios\_path\_duration, max\_path\_length, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_priorities, scenarios\_groups\_per\_priority, high\_resolution\_arrays, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, group\_weights, number\_weight, data\_weight, sinuosity\_weight, duration\_weight)
- def [are\\_all\\_high\\_priority\\_in\\_path](#) (traverse\_path, scenarios\_groups\_per\_priority, scenarios\_target\_priorities, scenarios\_target\_groups)
- def [check\\_path\\_validity](#) (traverse\_path, new\_target, max\_path\_duration)
- def [compute\\_traverse\\_paths](#) (threshold\_targets, neighborhoods, target\_types\_at\_cells, max\_path\_length, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_priorities, scenarios\_groups\_per\_priority, high\_resolution\_arrays, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, group\_weights, number\_weight, data\_weight, sinuosity\_weight, duration\_weight)
- def [save\\_paths\\_to\\_csv\\_file](#) (file\_path, paths\_dict)
- def [read\\_paths\\_from\\_csv\\_file](#) (file\_path)

### 5.101.1 Function Documentation

#### 5.101.1.1 [are\\_all\\_high\\_priority\\_in\\_path\(\)](#)

```
def skdiscovery.utilities.planetary.traverse_emulation.are_all_high_priority_in_path (
    traverse_path,
    scenarios_groups_per_priority,
    scenarios_target_priorities,
    scenarios_target_groups )
```

#### 5.101.1.2 [check\\_path\\_validity\(\)](#)

```
def skdiscovery.utilities.planetary.traverse_emulation.check_path_validity (
    traverse_path,
    new_target,
    max_path_duration )
```

#### 5.101.1.3 compute\_neighborhoods()

```
def skdiscovery.utilities.planetary.traverse_emulation.compute_neighborhoods (
    neighbors,
    target_types_at_cells,
    time_limit )
```

#### 5.101.1.4 compute\_path\_rank()

```
def skdiscovery.utilities.planetary.traverse_emulation.compute_path_rank (
    traverse_path,
    scenarios_visited_groups_per_priorities,
    scenarios_path_duration,
    max_path_length,
    scenarios_target_priorities,
    scenarios_target_groups,
    scenarios_priorities,
    scenarios_groups_per_priority,
    high_resolution_arrays,
    rad_longitude_array,
    rad_latitude_array,
    planet_radius,
    group_weights,
    number_weight,
    data_weight,
    sinuosity_weight,
    duration_weight )
```

#### 5.101.1.5 compute\_traverse\_paths()

```
def skdiscovery.utilities.planetary.traverse_emulation.compute_traverse_paths (
    threshold_targets,
    neighborhoods,
    target_types_at_cells,
    max_path_length,
    scenarios_target_priorities,
    scenarios_target_groups,
    scenarios_priorities,
    scenarios_groups_per_priority,
    high_resolution_arrays,
    rad_longitude_array,
    rad_latitude_array,
    planet_radius,
    group_weights,
    number_weight,
    data_weight,
    sinuosity_weight,
    duration_weight )
```

#### 5.101.1.6 `extract_threshold_targets()`

```
def skdiscovery.utilities.planetary.traverse_emulation.extract_threshold_targets (
    neighborhoods,
    target_types_at_cells,
    scenarios_target_priorities,
    scenarios_target_groups,
    scenarios_groups_per_priority,
    time_limit )
```

#### 5.101.1.7 `get_target_types_at_cells()`

```
def skdiscovery.utilities.planetary.traverse_emulation.get_target_types_at_cells (
    target_arrays )
```

Function definitions.

#### 5.101.1.8 `identify_neighbors()`

```
def skdiscovery.utilities.planetary.traverse_emulation.identify_neighbors (
    cells,
    target_types_at_cells,
    target_arrays,
    time_limit = math.inf )
```

#### 5.101.1.9 `read_paths_from_csv_file()`

```
def skdiscovery.utilities.planetary.traverse_emulation.read_paths_from_csv_file (
    file_path )
```

#### 5.101.1.10 `save_paths_to_csv_file()`

```
def skdiscovery.utilities.planetary.traverse_emulation.save_paths_to_csv_file (
    file_path,
    paths_dict )
```

## 5.102 skdiscovery.utilities.planetary.vector\_management Namespace Reference

### Functions

- def [open\\_shapefile](#) (shapefile\_path, writeable=False)

*Function definitions.*

- def [get\\_latitude\\_longitude\\_from\\_csv\\_file](#) (csv\_file\_location, longitude\_column\_index=0, latitude\_column\_index=1, other\_data\_column\_indexes=[])
- def [print\\_shapefile\\_field\\_names](#) (shapefile)
- def [get\\_field\\_values](#) (shapefile, field\_name)
- def [print\\_shapefile\\_unique\\_field\\_values](#) (shapefile, field\_name)
- def [shape\\_coding](#) (ob)
- def [create\\_path\\_from\\_shape](#) (shape)
- def [get\\_geometry\\_coordinates](#) (geometry, xy\_outer\_path, xy\_inner\_paths, basemap=None)
- def [build\\_shape\\_from\\_geometry](#) (geometry, basemap=None)
- def [add\\_shape\\_to\\_map](#) (axes, shape, legend\_label, facecolor='#cccccc', alpha=1., hatch=None, edgecolor='#999999', linewidth=0.25, linestyle='-')
- def [add\\_geometry\\_to\\_map](#) (axes, basemap, geometry, legend\_label, facecolor='#cccccc', alpha=1., hatch=None, edgecolor='#999999', linewidth=0.25, linestyle='-')
- def [add\\_vector\\_to\\_map](#) (axes, basemap, shapefile, field\_name, random\_colors=False, facecolor='#08519c', alpha=1., hatch=None, edgecolor='#252525', linewidth=0.25, linestyle='-')
- def [add\\_path\\_to\\_map](#) (axes, path, legend\_label, facecolor='#cccccc', alpha=1., edgecolor='#999999', linestyle='-', linewidth=0.25, zorder=1)
- def [filter\\_shapefile](#) (shapefile, field\_name, field\_filter\_values, file\_type='Memory', file\_path="", geom\_type=None)
- def [get\\_shapefile\\_borders](#) (shapefile, file\_type='Memory', file\_path="", geom\_type=ogr.wkbLineString)
- def [buffer\\_shapefile](#) (shapefile, buffer\_distance, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [clip\\_shapefile](#) (shapefile, polygon\_clip, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [union\\_shapefiles](#) (shapefile\_1, shapefile\_2, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [intersect\\_shapefiles](#) (shapefile\_1, shapefile\_2, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [get\\_intersected\\_features\\_from\\_shapefile](#) (input\_shapefile, method\_shapefile, look\_for\_intersection=True, file\_type='Memory', file\_path="")
- def [modify\\_shapefile\\_extent](#) (shapefile, x\_min, x\_max, y\_min, y\_max, new\_x\_min, new\_x\_max, new\_y\_min, new\_y\_max, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [rasterize\\_geometries](#) (shapes, data\_type, raster\_x\_size, raster\_y\_size, geotransform, spatial\_reference, fill\_value=0, background\_value=1, no\_data\_value=-99999, scale=1, offset=0, all\_touched=False, file\_type='MEM', file\_path="", number\_of\_bands=1)
- def [rasterize\\_shapefile](#) (shapefile, field\_name, data\_type, raster\_x\_size, raster\_y\_size, geotransform, projection, fill\_value=0, background\_value=1, no\_data\_value=-99999, scale=1, offset=0, file\_type='MEM', file\_path="", number\_of\_bands=1)

#### 5.102.1 Function Documentation

#### 5.102.1.1 add\_geometry\_to\_map()

```
def skdiscovery.utilities.planetary.vector_management.add_geometry_to_map (
    axes,
    basemap,
    geometry,
    legend_label,
    facecolor = '#cccccc',
    alpha = 1.,
    hatch = None,
    edgecolor = '#999999',
    linewidth = 0.25,
    linestyle = '-' )
```

#### 5.102.1.2 add\_path\_to\_map()

```
def skdiscovery.utilities.planetary.vector_management.add_path_to_map (
    axes,
    path,
    legend_label,
    facecolor = '#cccccc',
    alpha = 1.,
    edgecolor = '#999999',
    linestyle = '-',
    linewidth = 0.25,
    zorder = 1 )
```

#### 5.102.1.3 add\_shape\_to\_map()

```
def skdiscovery.utilities.planetary.vector_management.add_shape_to_map (
    axes,
    shape,
    legend_label,
    facecolor = '#cccccc',
    alpha = 1.,
    hatch = None,
    edgecolor = '#999999',
    linewidth = 0.25,
    linestyle = '-' )
```



#### 5.102.1.4 add\_vector\_to\_map()

```
def skdiscovery.utilities.planetary.vector_management.add_vector_to_map (
    axes,
    basemap,
    shapefile,
    field_name,
    random_colors = False,
    facecolor = '#08519c',
    alpha = 1.,
    hatch = None,
    edgecolor = '#252525',
    linewidth = 0.25,
    linestyle = '-' )
```

#### 5.102.1.5 buffer\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.buffer_shapefile (
    shapefile,
    buffer_distance,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbPolygon )
```

#### 5.102.1.6 build\_shape\_from\_geometry()

```
def skdiscovery.utilities.planetary.vector_management.build_shape_from_geometry (
    geometry,
    basemap = None )
```

#### 5.102.1.7 clip\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.clip_shapefile (
    shapefile,
    polygon_clip,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbPolygon )
```

#### 5.102.1.8 create\_path\_from\_shape()

```
def skdiscovery.utilities.planetary.vector_management.create_path_from_shape (
    shape )
```

#### 5.102.1.9 filter\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.filter_shapefile (
    shapefile,
    field_name,
    field_filter_values,
    file_type = 'Memory',
    file_path = '',
    geom_type = None )
```

#### 5.102.1.10 get\_field\_values()

```
def skdiscovery.utilities.planetary.vector_management.get_field_values (
    shapefile,
    field_name )
```

#### 5.102.1.11 get\_geometry\_coordinates()

```
def skdiscovery.utilities.planetary.vector_management.get_geometry_coordinates (
    geometry,
    xy_outer_path,
    xy_inner_paths,
    basemap = None )
```

#### 5.102.1.12 get\_intersected\_features\_from\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.get_intersected_features_from_shapefile (
    input_shapefile,
    method_shapefile,
    look_for_intersection = True,
    file_type = 'Memory',
    file_path = '' )
```

#### 5.102.1.13 get\_latitude\_longitude\_from\_csv\_file()

```
def skdiscovery.utilities.planetary.vector_management.get_latitude_longitude_from_csv_file (
    csv_file_location,
    longitude_column_index = 0,
    latitude_column_index = 1,
    other_data_column_indexes = [] )
```

#### 5.102.1.14 get\_shapefile\_borders()

```
def skdiscovery.utilities.planetary.vector_management.get_shapefile_borders (
    shapefile,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbLineString )
```

#### 5.102.1.15 intersect\_shapefiles()

```
def skdiscovery.utilities.planetary.vector_management.intersect_shapefiles (
    shapefile_1,
    shapefile_2,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbPolygon )
```

#### 5.102.1.16 modify\_shapefile\_extent()

```
def skdiscovery.utilities.planetary.vector_management.modify_shapefile_extent (
    shapefile,
    x_min,
    x_max,
    y_min,
    y_max,
    new_x_min,
    new_x_max,
    new_y_min,
    new_y_max,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbPolygon )
```

#### 5.102.1.17 open\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.open_shapefile (
    shapefile_path,
    writeable = False )
```

Function definitions.

#### 5.102.1.18 print\_shapefile\_field\_names()

```
def skdiscovery.utilities.planetary.vector_management.print_shapefile_field_names (
    shapefile )
```

#### 5.102.1.19 print\_shapefile\_unique\_field\_values()

```
def skdiscovery.utilities.planetary.vector_management.print_shapefile_unique_field_values (
    shapefile,
    field_name )
```

#### 5.102.1.20 rasterize\_geometries()

```
def skdiscovery.utilities.planetary.vector_management.rasterize_geometries (
    shapes,
    data_type,
    raster_x_size,
    raster_y_size,
    geotransform,
    spatial_reference,
    fill_value = 0,
    background_value = 1,
    no_data_value = -99999,
    scale = 1,
    offset = 0,
    all_touched = False,
    file_type = 'MEM',
    file_path = '',
    number_of_bands = 1 )
```

#### 5.102.1.21 rasterize\_shapefile()

```
def skdiscovery.utilities.planetary.vector_management.rasterize_shapefile (
    shapefile,
    field_name,
    data_type,
    raster_x_size,
    raster_y_size,
    geotransform,
    projection,
    fill_value = 0,
    background_value = 1,
    no_data_value = -99999,
    scale = 1,
    offset = 0,
    file_type = 'MEM',
    file_path = '',
    number_of_bands = 1 )
```

#### 5.102.1.22 shape\_coding()

```
def skdiscovery.utilities.planetary.vector_management.shape_coding (
    ob )
```

#### 5.102.1.23 union\_shapefiles()

```
def skdiscovery.utilities.planetary.vector_management.union_shapefiles (
    shapefile_1,
    shapefile_2,
    file_type = 'Memory',
    file_path = '',
    geom_type = ogr.wkbPolygon )
```

## 5.103 skdiscovery.visualization Namespace Reference

### Namespaces

- [emd\\_plot](#)
- [fourier\\_plot](#)
- [linear\\_decomposition\\_plot](#)
- [multi\\_ca\\_plot](#)
- [multi\\_dist](#)
- [spherical\\_voronoi](#)
- [spiral\\_plot](#)
- [vis\\_utils](#)
- [wavelets\\_plot](#)

## 5.104 skdiscovery.visualization.emd\_plot Namespace Reference

### Functions

- def [calc\\_imfs](#) (rawData, nbsym=False)  
*IMF calculation function, streamlined and quieted.*
- def [calc\\_imfs\\_sum](#) (imfs, highNum=2, high=True, residual=False)  
*IMF summation helper function.*
- def [plot\\_imfs](#) (rawData, imfs, toPlot=[], mainTitle='IMFs', show=True, figsize=(12, 10))  
*Plots raw data and IMFs in a subplot grid (n Imfs [rows] x 1 [col])*
- def [plot\\_imfs\\_split](#) (rawData, imfs, highNum=2, residual=False, mainTitle='Raw data', collage=False, show=True)  
*Plots raw data and summed IMFs based on HF/LF cut, can optionally plot the residual separately from LF.*
- def [plot\\_imfs\\_split\\_comp](#) (rawData, imfs, highNums=[2, residual=False, plotRaw=True, mainTitle='Raw data', collage=False, show=True)  
*Like plot\_imfs\_split, plots raw data and summed IMFs based on two HF/LF cuts.*
- def [plot\\_imfs\\_noise](#) (imfs, guessType='high', noiseNum=2, collage=False, show=True)  
*Plots assumed noise from IMF summation in a histogram, with overlaid graphs of fit probability distributions to check if assumption can be validated.*
- def [run\\_plotImfs](#) (inData, imfs=None, nbsym=False, toPlot=[], mainTitle='IMFs', show=True, figsize=(12, 10))  
*Wrapper for plot\_imfs.*
- def [run\\_plotImfsSplit](#) (inData, imfs=None, nbsym=False, highNum=2, residual=False, mainTitle='Raw data', collage=False, show=True)  
*Wrapper for plot\_imfs\_split.*
- def [run\\_plotImfsSplitComp](#) (inData, imfs=None, nbsym=False, highNums=[2, residual=False, plotRaw=True, mainTitle='Raw data', collage=False, show=True)  
*Wrappper for plot\_imfs\_split\_comp.*
- def [run\\_plotImfsNoise](#) (inData, imfs=None, nbsym=False, noiseNum=2, guessType='high', show=True)  
*Wrapper for plot\_imfs\_noise.*
- def [run\\_plotImfsSplitNoise](#) (inData, imfs=None, nbsym=False, highNum=2, residual=False, mainTitle='Raw data', noiseNum=2, guessType='high', show=False)  
*Wrapper for both plot\_imfs\_split and plot\_imfs\_noise.*

### 5.104.1 Function Documentation

#### 5.104.1.1 calc\_imfs()

```
def skdiscovery.visualization.emd_plot.calc_imfs (
    rawData,
    nbsym = False )
```

IMF calculation function, streamlined and quieted.

## Parameters

<i>rawData</i>	Input data for EMD calculation
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False

## Returns

2D numpy.ndarray of IMFs

## 5.104.1.2 calc\_imfs\_sum()

```
def skdiscovery.visualization.emd_plot.calc_imfs_sum (
    imfs,
    highNum = 2,
    high = True,
    residual = False )
```

IMF summation helper function.

## Parameters

<i>imfs</i>	Input array of IMFs to be summed
<i>highNum</i>	Number of high frequency IMFs to sum, starting from IMF1 (indexed at 0)
<i>high</i>	Boolean that determines which class of frequency to sum (default True to sum HF)
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)

## Returns

1D numpy.ndarray of summed IMFs

## 5.104.1.3 plot\_imfs()

```
def skdiscovery.visualization.emd_plot.plot_imfs (
    rawData,
    imfs,
    toPlot = [],
    mainTitle = 'IMFs',
    show = True,
    figsize = (12,10) )
```

Plots raw data and IMFs in a subplot grid (n Imfs [rows] x 1 [col])

**Parameters**

<i>rawData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for plotting
<i>toPlot</i>	List of which IMFs to plot (default is all)
<i>mainTitle</i>	Main title of the plot
<i>show</i>	Boolean to show plot immediately after plot creation
<i>figsize</i>	Size of figure

**5.104.1.4 plot\_imfs\_noise()**

```
def skdiscovery.visualization.emd_plot.plot_imfs_noise (
    imfs,
    guessType = 'high',
    noiseNum = 2,
    collage = False,
    show = True )
```

Plots assumed noise from IMF summation in a histogram, with overlaid graphs of fit probability distributions to check if assumption can be validated.

**Parameters**

<i>imfs</i>	Input array of IMFs to be summed
<i>guessType</i>	String of noise guess type ('high' or 'low' are possibilities)
<i>noiseNum</i>	Number of IMFs to sum
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

**Returns**

Array of plotted noise

**5.104.1.5 plot\_imfs\_split()**

```
def skdiscovery.visualization.emd_plot.plot_imfs_split (
    rawData,
    imfs,
    highNum = 2,
    residual = False,
    mainTitle = 'Raw data',
```



```
collage = False,  
show = True )
```

Plots raw data and summed IMFs based on HF/LF cut, can optionally plot the residual separately from LF.

## Parameters

<i>rawData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for summing and then plotting
<i>highNum</i>	Number of high frequency IMFs to sum, starting from IMF1 (indexed at 0)
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)
<i>mainTitle</i>	Title string of plot
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Tuple of HF summed data array and LF summed data array

5.104.1.6 `plot_imfs_split_comp()`

```
def skdiscovery.visualization.emd_plot.plot_imfs_split_comp (
    rawData,
    imfs,
    highNums = [2,
    residual = False,
    plotRaw = True,
    mainTitle = 'Raw data',
    collage = False,
    show = True )
```

Like `plot_imfs_split`, plots raw data and summed IMFs based on two HF/LF cuts.

## Parameters

<i>rawData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for summing and then plotting
<i>highNums</i>	Number of high frequency IMFs to sum and compare
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)
<i>plotRaw</i>	Boolean to optionally disinclude raw data plot above IMF summation comparison
<i>mainTitle</i>	Title string of plot
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Tuple of both HF summed data arrays and both LF summed data arrays

#### 5.104.1.7 run\_plotImfs()

```
def skdiscovery.visualization.emd_plot.run_plotImfs (
    inData,
    imfs = None,
    nbsym = False,
    toPlot = [],
    mainTitle = 'IMFs',
    show = True,
    figsize = (12,10) )
```

Wrapper for plot\_imfs.

##### Parameters

<i>inData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for plotting
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False
<i>toPlot</i>	List of which IMFs to plot (default is all)
<i>mainTitle</i>	Main title of plot
<i>figsize</i>	Tuple containing the figure size
<i>show</i>	Boolean to show plot immediately after plot creation

##### Returns

Intrinsic mode functions

#### 5.104.1.8 run\_plotImfsNoise()

```
def skdiscovery.visualization.emd_plot.run_plotImfsNoise (
    inData,
    imfs = None,
    nbsym = False,
    noiseNum = 2,
    guessType = 'high',
    show = True )
```

Wrapper for plot\_imfs\_noise.

##### Parameters

<i>inData</i>	Input data for plotting
---------------	-------------------------

## Parameters

<i>imfs</i>	Input array of IMFs to be summed
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False
<i>guessType</i>	String of noise guess type ('high' or 'low' are possibilities)
<i>noiseNum</i>	Number of IMFs to sum
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Array of noise data values

## 5.104.1.9 run\_plotImfsSplit()

```
def skdiscovery.visualization.emd_plot.run_plotImfsSplit (
    inData,
    imfs = None,
    nbsym = False,
    highNum = 2,
    residual = False,
    mainTitle = 'Raw data',
    collage = False,
    show = True )
```

Wrapper for plot\_imfs\_split.

## Parameters

<i>inData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for summing and then plotting
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False
<i>highNum</i>	Number of high frequency IMFs to sum, starting from IMF1 (indexed at 0)
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)
<i>mainTitle</i>	Title string of plot
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Tuple of HF summed data array and LF summed data array

## 5.104.1.10 run\_plotImfsSplitComp()

```
def skdiscovery.visualization.emd_plot.run_plotImfsSplitComp (
    inData,
    imfs = None,
    nbsym = False,
    highNums = [2,
    residual = False,
    plotRaw = True,
    mainTitle = 'Raw data',
    collage = False,
    show = True )
```

Wrappper for plot\_imfs\_split\_comp.

## Parameters

<i>inData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for summing and then plotting
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False
<i>highNums</i>	Number of high frequency IMFs to sum and compare
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)
<i>plotRaw</i>	Boolean to optionally disinclude raw data plot above IMF summation comparison
<i>mainTitle</i>	Title string of plot
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Tuple of both HF summed data arrays and borh LF summed data arrays

## 5.104.1.11 run\_plotImfsSplitNoise()

```
def skdiscovery.visualization.emd_plot.run_plotImfsSplitNoise (
    inData,
    imfs = None,
    nbsym = False,
    highNum = 2,
    residual = False,
    mainTitle = 'Raw data',
    noiseNum = 2,
    guessType = 'high',
    show = False )
```

Wrapper for both plot\_imfs\_split and plot\_imfs\_noise.

## Parameters

<i>inData</i>	Input data for plotting
<i>imfs</i>	Input array of IMFs for summing and then plotting
<i>nbsym</i>	Boolean that would add extra data points near boundaries when calculating; breaks some datasets unless False
<i>highNum</i>	Number of high frequency IMFs to sum
<i>residual</i>	Boolean that optionally includes the residual function when summing low frequency IMFs (default False to disinclude residual)
<i>mainTitle</i>	Title string of plot
<i>guessType</i>	String of noise guess type ('high' or 'low' are possibilities)
<i>noiseNum</i>	Number of IMFs to sum
<i>show</i>	Boolean to show plot immediately after plot creation

## Returns

Tuple of split tuple and noise array

## 5.105 skdiscovery.visualization.fourier\_plot Namespace Reference

## Functions

- def `calc_DFT` (*t*, *y*)  
*Calculates discrete Fourier transform using np.fft.fft.*
- def `plot_DFT` (*tIndex*, *yData*, *collage*=False, *show*=True, *suptitle*="", *hori*=True)  
*Plots input data and Fourier transformed coefficients in a subplot grid.*
- def `run_plotDFT` (*inData*, *inIndex*=None, *collage*=False, *show*=True, *suptitle*="", *hori*=True)  
*Wrapper for plot\_DFT.*

### 5.105.1 Function Documentation

#### 5.105.1.1 `calc_DFT()`

```
def skdiscovery.visualization.fourier_plot.calc_DFT (
    t,
    y )
```

Calculates discrete Fourier transform using np.fft.fft.

## Parameters

<i>t</i>	Time array
<i>y</i>	Y (data amplitude) array

**Returns**

Tuple of post-FT frequencies and coefficients

**5.105.1.2 plot\_DFT()**

```
def skdiscovery.visualization.fourier_plot.plot_DFT (
    tIndex,
    yData,
    collage = False,
    show = True,
    subtitle = '',
    hori = True )
```

Plots input data and Fourier transformed coefficients in a subplot grid.

**Parameters**

<i>tIndex</i>	Input time index for series
<i>yData</i>	Input data amplitude
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation
<i>subtitle</i>	Optional string to add as a plot title
<i>hori</i>	Boolean that optionally changes the orientation of the subplot configuration

**5.105.1.3 run\_plotDFT()**

```
def skdiscovery.visualization.fourier_plot.run_plotDFT (
    inData,
    inIndex = None,
    collage = False,
    show = True,
    subtitle = '',
    hori = True )
```

Wrapper for plot\_DFT.

**Parameters**

<i>inData</i>	Input data for plotting
<i>inIndex</i>	Possible input index to use in calculating DFT
<i>collage</i>	Boolean that can optionally return certain plot parameters for external usage
<i>show</i>	Boolean to show plot immediately after plot creation
<i>subtitle</i>	Optional string to add as a plot title
<i>hori</i>	Boolean that optionally changes the orientation of the subplot configuration

## 5.106 skdiscovery.visualization.linear\_decomposition\_plot Namespace Reference

### Functions

- def [lin\\_trend](#) (inData)  
*Calculates a linear polynomial fit and evaluates.*
- def [calc\\_lin\\_interp](#) (inData, iterStep=100)  
*Calculates a piecewise linear interpolated fit for some data.*
- def [plot\\_lin\\_trend](#) (inData, plotIndex=None, show=True)  
*Plots a linear linear trend against its source data.*
- def [plot\\_lin\\_interp](#) (inData, interps=None, plotIndex=None, iterSteps=[100], pRange=[ ], mainTitle='Piecewise Decomposition', plotReal=True, show=True)  
*Plots linear interpolation against its source data.*
- def [plot\\_lin\\_slope](#) (inData, interps=None, plotIndex=None, mainTitle='Piecewise Decomposition and Slopes', iterSteps=[100], pRange=[ ], plotReal=True, show=True)  
*Plots raw data, linear interpolated data, and interpolated slope.*

### 5.106.1 Function Documentation

#### 5.106.1.1 [calc\\_lin\\_interp\(\)](#)

```
def skdiscovery.visualization.linear_decomposition_plot.calc_lin_interp (
    inData,
    iterStep = 100 )
```

Calculates a piecewise linear interpolated fit for some data.

#### Parameters

<i>inData</i>	Input data to fit
<i>iterStep</i>	Number of data points per interpolation step

#### Returns

Array of interpolated values

#### 5.106.1.2 [lin\\_trend\(\)](#)

```
def skdiscovery.visualization.linear_decomposition_plot.lin_trend (
    inData )
```

Calculates a linear polynomial fit and evaluates.



**Parameters**

<i>inData</i>	Input data to fit
---------------	-------------------

**Returns**

Array of evaluated points for the linear fit

**5.106.1.3 plot\_lin\_interp()**

```
def skdiscovery.visualization.linear_decomposition_plot.plot_lin_interp (
    inData,
    interps = None,
    plotIndex = None,
    iterSteps = [100],
    pRange = [],
    mainTitle = 'Piecewise Decomposition',
    plotReal = True,
    show = True )
```

Plots linear interpolation against its source data.

**Parameters**

<i>inData</i>	Input data to fit and plot
<i>interps</i>	Optional interpolated data to be plotted, will be made if not given
<i>plotIndex</i>	Optional index array to pass for plotting
<i>iterSteps</i>	List of iterStep values to calculate/plot
<i>pRange</i>	Range over which to plot, defaults to start and end of original data
<i>mainTitle</i>	Optional string plot title
<i>plotReal</i>	Boolean variable to optionally disinclude source data
<i>show</i>	Boolean to show plot immediately after plot creation

**Returns**

Multidimensional array of interpreted data values

**5.106.1.4 plot\_lin\_slope()**

```
def skdiscovery.visualization.linear_decomposition_plot.plot_lin_slope (
    inData,
```

```

    interps = None,
    plotIndex = None,
    mainTitle = 'Piecewise Decomposition and Slopes',
    iterSteps = [100],
    pRange = [],
    plotReal = True,
    show = True )

```

Plots raw data, linear interpolated data, and interpolated slope.

#### Parameters

<i>inData</i>	Input data to fit and plot
<i>interps</i>	Optional interpolated data to be plotted, will be made if not given
<i>plotIndex</i>	Optional index array to pass for plotting
<i>iterSteps</i>	List of iterStep values to calculate/plot
<i>pRange</i>	Range over which to plot, defaults to start and end of original data
<i>mainTitle</i>	Optional string plot title
<i>plotReal</i>	Boolean variable to optionally disinclude source data
<i>show</i>	Boolean to show plot immediately after plot creation

#### Returns

Tuple of interpolated values array and corresponding gradient array

#### 5.106.1.5 plot\_lin\_trend()

```

def skdiscovery.visualization.linear_decomposition_plot.plot_lin_trend (
    inData,
    plotIndex = None,
    show = True )

```

Plots a linear linear trend against its source data.

#### Parameters

<i>inData</i>	Input data to fit and plot
<i>plotIndex</i>	Optional index array to pass for plotting
<i>show</i>	Boolean to show plot immediately after plot creation

## 5.107 skdiscovery.visualization.multi\_ca\_plot Namespace Reference

## Functions

- def [multiCaPlot](#) (pipeline, mogiFlag=False, offset=.15, direction='H', pca\_comp=0, scaleFactor=2.5, map\_res='i')  
*The multiCaPlot function generates a geographic eigenvector plot of several pipeline runs.*

### 5.107.1 Function Documentation

#### 5.107.1.1 multiCaPlot()

```
def skdiscovery.visualization.multiCaPlot (
    pipeline,
    mogiFlag = False,
    offset = .15,
    direction = 'H',
    pca_comp = 0,
    scaleFactor = 2.5,
    map_res = 'i' )
```

The multiCaPlot function generates a geographic eigenvector plot of several pipeline runs.

This function plots multiple pipeline runs over perturbed pipeline parameters. The various perturbations are plotted more transparently (alpha=.5), while the median eigen\_vector and Mogi inversion are plotted in solid blue and red

#### Parameters

<i>pipeline</i>	The pipeline object with multiple runs
<i>mogiFlag</i>	Flag to indicate plotting the Mogi source as well as the PCA
<i>offset</i>	Offset for padding the corners of the generated map
<i>direction</i>	Indicates the eigenvectors to plot. Only Horizontal component is currently supported ('H')
<i>pca_comp</i>	Choose the PCA component to use (integer)
<i>scaleFactor</i>	Size of the arrow scaling factor
<i>map_res</i>	Map data resolution for Basemap ('c', 'i', 'h', 'f', or None)

## 5.108 skdiscovery.visualization.multi\_dist Namespace Reference

## Functions

- def [calc\\_distance\\_map](#) (pipeline, ap\_name, ca\_name, ca\_type, plotFlag=True, histIdx=False, fontsize=10)  
*Calculates distances/similarities between pipeline runs.*

### 5.108.1 Function Documentation

### 5.108.1.1 `calc_distance_map()`

```
def skdiscovery.visualization.calc_distance_map (
    pipeline,
    ap_name,
    ca_name,
    ca_type,
    plotFlag = True,
    histIdx = False,
    fontsize = 10 )
```

Calculates distances/similarities between pipeline runs.

Optionally visualizes the result as a seaborn clustermap for PBO pipelines (requires multiple stations)

Calculates the square root of the summed squared differences between eigenvectors. Only works, because of internal assumptions, on pipelines with multiple stations Returns the distances as a pandas dataframe

#### Parameters

<i>pipeline</i>	Pipeline to analyze.
<i>ap_name</i>	Name of the pipeline item that is being perturbed
<i>ca_name</i>	Name of the pipeline item used as the comparison metric for calculating the distance
<i>ca_type</i>	Type of comparison metric [PCA for PCA, MogiSource of Mogi Source, MogiVector for Mogi vectors]
<i>plotFlag</i>	Boolean flag for plotting the clustermap of distances
<i>histIdx</i>	Flag for returning the perturbed pipeline item parameters
<i>fontsize</i>	Fontsize adjustments

#### Returns

cg: The generated clustermap of the calculated distances/similarities  
 dist\_mat: A matrix of the calculated distances/similarities  
 history: The record of the perturbed pipeline item parameters

## 5.109 `skdiscovery.visualization.spherical_voronoi` Namespace Reference

### Functions

- def [sphericalToXYZ](#) (lat, lon, radius=1)  
*Convert spherical coordinates to x,y,z.*
- def [xyzToSpherical](#) (x, y, z)  
*Convert x,y,z to spherical coordinates.*
- def [find\\_match](#) (region\_index, region\_list)  
*Find neighboring regions.*
- def [getVoronoiCollection](#) (data, lat\_name, lon\_name, bmap=None, v\_name=None, full\_sphere=False, max\_v=.3, min\_v=-0.3, cmap=matplotlib.cm.get\_cmap("jet"), test\_point=None, proj1=None, proj2=None, kwargs)  
*Perform a Spherical Voronoi Tessellation on the input data.*

### 5.109.1 Function Documentation

#### 5.109.1.1 find\_match()

```
def skdiscovery.visualization.spherical_voronoi.find_match (
    region_index,
    region_list )
```

Find neighboring regions.

##### Parameters

<i>region_index</i>	Numeric index of region to find matches for (number between 0 and len(vertices))
<i>region_list</i>	list of lists of vertices that define regions

##### Returns

Numeric indices of regions that border the region specified by region\_index

#### 5.109.1.2 getVoronoiCollection()

```
def skdiscovery.visualization.spherical_voronoi.getVoronoiCollection (
    data,
    lat_name,
    lon_name,
    bmap = None,
    v_name = None,
    full_sphere = False,
    max_v = .3,
    min_v = -0.3,
    cmap = matplotlib.cm.get_cmap('jet'),
    test_point = None,
    proj1 = None,
    proj2 = None,
    kwargs )
```

Perform a Spherical Voronoi Tessellation on the input data.

In the case where the data is restricted to one part of the globe, a polygon will not be returned for all objects, as matplotlib polygons won't be able to stretch over half the globe.

##### Parameters

<i>data</i>	Input pandas data frame
-------------	-------------------------

## Parameters

<i>lat_name</i>	Name of latitude column
<i>lon_name</i>	Name of longitude column
<i>bmap</i>	Basemap instance used to convert from lat, lon coordinates to projection coordinates
<i>v_name</i>	Name of value column. Use this to color each cell according to a value.
<i>full_sphere</i>	Set to true if the data spans the entire globe. If false, a fictional point is created during tessellation and removed later to work around issues when polygons are suppose to span the over half the globe.
<i>max_v</i>	Specify a maximum value to use when assigning values to the tessellation
<i>min_v</i>	Specify a minimum value to use when assigning values to the tessellation
<i>cmap</i>	Matplotlib color map to use
<i>test_point</i>	Tuple containing the latitude and longitude of the ficitonal point to used to remove polygons that wrap around the earth. If none, a point is automatically chosen
<i>proj1</i>	PyProj projection of input coordinates
<i>proj2</i>	PyProj projection of sphere
<i>kwargs</i>	Extra keyword arguments are passed to SphericalVoronoi class in scipy

## Returns

Matplotlib patch collection of tessellation, scipy.spatial.SphericalVoronoi object, integer index of objects in patch collection.

## 5.109.1.3 sphericalToXYZ()

```
def skdiscovery.visualization.spherical_voronoi.sphericalToXYZ (
    lat,
    lon,
    radius = 1 )
```

Convert spherical coordinates to x,y,z.

## Parameters

<i>lat</i>	Latitude, scalar or array
<i>lon</i>	Longitude, scalar or array
<i>radius</i>	Sphere's radius

## Returns

Numpy array of x,y,z coordinates

## 5.109.1.4 xyzToSpherical()

```
def skdiscovery.visualization.spherical_voronoi.xyzToSpherical (
    x,
    y,
    z )
```

Convert x,y,z to spherical coordinates.

## Parameters

x	Cartesian coordinate x
y	Cartesian coordinate y
z	Cartesian coordinate z

## Returns

numpy array of latitude,longitude, and radius

## 5.110 skdiscovery.visualization.spiral\_plot Namespace Reference

## Functions

- def [plot\\_spiral](#) (plotData, plotIndex, T, mainTitle='Spiral plot', barLabel='Amplitude', plotTS=False, show=True)  
*Plots data in a spiral pattern via a polar plot.*
- def [run\\_spiral](#) (inData, period, inIndex=None, mainTitle='Spiral plot', barLabel='Amplitude', plotTS=False, show=True)  
*Wrapper for plot\_spiral.*
- def [run\\_spiralInteractive](#) (inData, period, pParams=[ ], inIndex=None, mainTitle='Spiral plot', barLabel='Amplitude', plotTS=False)  
*Wrapper for plot\_spiral that is interactive when used in Jupyter notebooks.*

## 5.110.1 Function Documentation

## 5.110.1.1 plot\_spiral()

```
def skdiscovery.visualization.spiral_plot.plot_spiral (
    plotData,
    plotIndex,
    T,
    mainTitle = 'Spiral plot',
    barLabel = 'Amplitude',
    plotTS = False,
    show = True )
```

Plots data in a spiral pattern via a polar plot.

## Parameters

<i>plotData</i>	Input data values/amplitudes
<i>plotIndex</i>	Input index (series time coordinates)
<i>T</i>	Period value with which to wrap data around the plot
<i>mainTitle</i>	Title for plot
<i>barLabel</i>	Colorbar label
<i>plotTS</i>	Optional flag to plot the time series of the data in a separate window
<i>show</i>	Boolean to show plot immediately after plot creation

5.110.1.2 `run_spiral()`

```
def skdiscovery.visualization.spiral_plot.run_spiral (
    inData,
    period,
    inIndex = None,
    mainTitle = 'Spiral plot',
    barLabel = 'Amplitude',
    plotTS = False,
    show = True )
```

Wrapper for `plot_spiral`.

## Parameters

<i>inData</i>	Input data to use in plot
<i>period</i>	Period value with which to wrap data around the plot
<i>inIndex</i>	Input index (series time coordinates)
<i>mainTitle</i>	Title for plot
<i>barLabel</i>	Colorbar label
<i>plotTS</i>	Optional flag to plot the time series of the data in a separate window
<i>show</i>	Boolean to show plot immediately after plot creation

5.110.1.3 `run_spiralInteractive()`

```
def skdiscovery.visualization.spiral_plot.run_spiralInteractive (
    inData,
    period,
    pParams = [],
    inIndex = None,
    mainTitle = 'Spiral plot',
```



```

    barLabel = 'Amplitude',
    plotTS = False )

```

Wrapper for plot\_spiral that is interactive when used in Jupyter notebooks.

#### Parameters

<i>inData</i>	Input data to use in plot
<i>period</i>	Period value with which to wrap data around the plot
<i>pParams</i>	List of plot's period parameters [min, max, step] necessary for interactive
<i>inIndex</i>	Input index (series time coordinates)
<i>mainTitle</i>	Title for plot
<i>barLabel</i>	Colorbar label
<i>plotTS</i>	Optional flag to plot the time series of the data in a separate window

## 5.111 skdiscovery.visualization.vis\_utils Namespace Reference

### Functions

- def [lin\\_trend](#) (inData, toReturn='eval')
- def [index\\_scale](#) (toScale, endRange=[])
- def [block\\_output](#) ()
- def [enable\\_output](#) ()
- def [mod\\_data](#) (inData, inIndex=None, makeType=None)  
*modifies data for run\_spiral so that plotted data is uniform*

### Variables

- list [types](#) = [int, float, complex, np.float32, np.float64, np.int32, np.int64, np.complex64, np.complex128,]
- dictionary [coldict](#) = {0 : 'C0', 1 : 'C1', 2 : 'C2', 3 : 'C3', 4 : 'C4', 5 : 'C5', 6 : 'C6', 7 : 'C7', 8 : '#92C7Ed', 9 : '#FFBB80', 10 : '#9BE49B', 11 : '#EB9393', 12 : '#C0A6D8', 13 : '#D2B3AC', 14 : '#E995D0', 15 : '#BFBFBF'}

### 5.111.1 Function Documentation

#### 5.111.1.1 block\_output()

```
def skdiscovery.visualization.vis_utils.block_output ( )
```

#### 5.111.1.2 `enable_output()`

```
def skdiscovery.visualization.vis_utils.enable_output ( )
```

#### 5.111.1.3 `index_scale()`

```
def skdiscovery.visualization.vis_utils.index_scale (
    toScale,
    endRange = [] )
```

#### 5.111.1.4 `lin_trend()`

```
def skdiscovery.visualization.vis_utils.lin_trend (
    inData,
    toReturn = 'eval' )
```

#### 5.111.1.5 `mod_data()`

```
def skdiscovery.visualization.vis_utils.mod_data (
    inData,
    inIndex = None,
    makeType = None )
```

modifies data for `run_spiral` so that plotted data is uniform

##### Parameters

<i>inData</i>	data values to be used as intensity
<i>inIndex</i>	data values to be used as radial and angular components (once period is applied)
<i>makeType</i>	variable tied to <code>makeIndex</code> which will create different types of index if necessary

## 5.111.2 Variable Documentation

## 5.111.2.1 coldict

```
dictionary skdiscovery.visualization.vis_utils.coldict = {0 : 'C0', 1 : 'C1', 2 : 'C2', 3 : 'C3', 4 : 'C4', 5 : 'C5', 6 : 'C6', 7 : 'C7', 8 : '#92C7Ed', 9 : '#FFBB80', 10 : '#9BE49B', 11 : '#EB9393', 12 : '#C0A6D8', 13 : '#D2B3AC', 14 : '#E995D0', 15 : '#BFBFBF'}
```

## 5.111.2.2 types

```
list skdiscovery.visualization.vis_utils.types = [int, float, complex, np.float32, np.float64, np.int32, np.int64, np.complex64, np.complex128,]
```

## 5.112 skdiscovery.visualization.wavelets\_plot Namespace Reference

## Functions

- def [calc\\_wp\\_deconstruct](#) (calcData, wavelet=None)  
*simple function to calculate a wavelet deconstruction*
- def [calc\\_wp\\_reconstruct](#) (deconPacket=None, calcData=None, wavelet=None, reconNodes=[])
- def [plot\\_wp\\_deconstruct](#) (deconPacket, deconNodes=[], mainTitle='Wavelet Deconstruction', plotRaw=True, show=True)
- def [plot\\_wp\\_showall](#) (deconPacket, deconNodes=[], mainTitle='Individual Wavelet Nodes', plotRaw=True, show=True)
- def [plot\\_wp\\_reconstruct](#) (reconPacket, calcData, mainTitle='Wavelet Reconstruction', plotRaw=True, show=True)
- def [run\\_plotWPDecon](#) (inData, wavelet=None, deconNodes=[], mainTitle='Wavelet Deconstruction', plotRaw=True, show=True)
- def [run\\_plotWPRecon](#) (inData, wavelet=None, reconNodes=[], mainTitle='Individual Wavelet Nodes', plotRaw=True, show=True)
- def [run\\_plotWPShowall](#) (inData, wavelet=None, deconNodes=[], mainTitle='Wavelet Reconstruction', plotRaw=True, show=True)

## 5.112.1 Function Documentation

## 5.112.1.1 calc\_wp\_deconstruct()

```
def skdiscovery.visualization.wavelets_plot.calc_wp_deconstruct (
    calcData,
    wavelet = None )
```

simple function to calculate a wavelet deconstruction

#### 5.112.1.2 `calc_wp_reconstruct()`

```
def skdiscovery.visualization.wavelets_plot.calc_wp_reconstruct (
    deconPacket = None,
    calcData = None,
    wavelet = None,
    reconNodes = [] )
```

#### 5.112.1.3 `plot_wp_deconstruct()`

```
def skdiscovery.visualization.wavelets_plot.plot_wp_deconstruct (
    deconPacket,
    deconNodes = [],
    mainTitle = 'Wavelet Deconstruction',
    plotRaw = True,
    show = True )
```

#### 5.112.1.4 `plot_wp_reconstruct()`

```
def skdiscovery.visualization.wavelets_plot.plot_wp_reconstruct (
    reconPacket,
    calcData,
    mainTitle = 'Wavelet Reconstruction',
    plotRaw = True,
    show = True )
```

#### 5.112.1.5 `plot_wp_showall()`

```
def skdiscovery.visualization.wavelets_plot.plot_wp_showall (
    deconPacket,
    deconNodes = [],
    mainTitle = 'Individual Wavelet Nodes',
    plotRaw = True,
    show = True )
```

#### 5.112.1.6 run\_plotWPDecon()

```
def skdiscovery.visualization.wavelets_plot.run_plotWPDecon (
    inData,
    wavelet = None,
    deconNodes = [],
    mainTitle = 'Wavelet Deconstruction',
    plotRaw = True,
    show = True )
```

#### 5.112.1.7 run\_plotWPRecon()

```
def skdiscovery.visualization.wavelets_plot.run_plotWPRecon (
    inData,
    wavelet = None,
    reconNodes = [],
    mainTitle = 'Individual Wavelet Nodes',
    plotRaw = True,
    show = True )
```

#### 5.112.1.8 run\_plotWPShowall()

```
def skdiscovery.visualization.wavelets_plot.run_plotWPShowall (
    inData,
    wavelet = None,
    deconNodes = [],
    mainTitle = 'Wavelet Reconstruction',
    plotRaw = True,
    show = True )
```



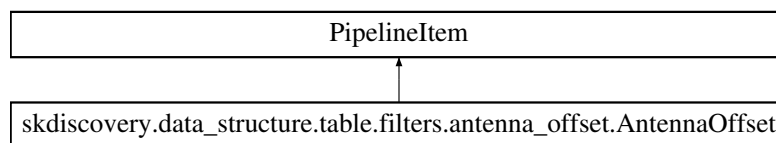
## Chapter 6

# Class Documentation

### 6.1 skdiscovery.data\_structure.table.filters.AntennaOffset Class Reference

Applies corrections to fix offsets in PBO GPS data induced by antenna changes.

Inheritance diagram for skdiscovery.data\_structure.table.filters.AntennaOffset:



#### Public Member Functions

- def `__init__` (self, str\_description, [antenna\\_data](#), min\_diff=0.0, [column\\_list](#)=None)  
*Initialize [AntennaOffset](#) function.*
- def [process](#) (self, obj\_data)  
*Applies the function to the data, updating in place.*

#### Public Attributes

- [antenna\\_data](#)
- [column\\_list](#)
- [min\\_diff](#)

#### 6.1.1 Detailed Description

Applies corrections to fix offsets in PBO GPS data induced by antenna changes.

## 6.1.2 Constructor & Destructor Documentation

### 6.1.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.AntennaOffset.__init__ (
    self,
    str_description,
    antenna_data,
    min_diff = 0.0,
    column_list = None )
```

Initialize [AntennaOffset](#) function.

#### Parameters

<i>str_description</i>	String describing the filter
<i>antenna_data</i>	Data containing the log of antenna changes
<i>min_diff</i>	Difference in position needed to be considered an offset
<i>column_list</i>	Names of the columns to apply the function to

## 6.1.3 Member Function Documentation

### 6.1.3.1 `process()`

```
def skdiscovery.data_structure.table.filters.AntennaOffset.process (
    self,
    obj_data )
```

Applies the function to the data, updating in place.

#### Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------

## 6.1.4 Member Data Documentation



## 6.1.4.1 antenna\_data

```
skdiscovery.data_structure.table.filters.AntennaOffset.antenna_data
```

## 6.1.4.2 column\_list

```
skdiscovery.data_structure.table.filters.AntennaOffset.column_list
```

## 6.1.4.3 min\_diff

```
skdiscovery.data_structure.table.filters.AntennaOffset.min_diff
```

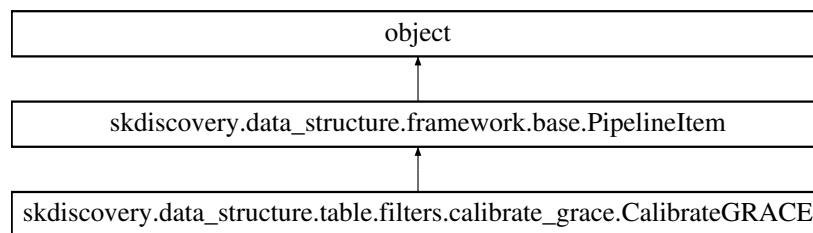
The documentation for this class was generated from the following file:

- data\_structure/table/filters/[antenna\\_offset.py](#)

## 6.2 skdiscovery.data\_structure.table.filters.CalibrateGRACE Class Reference

Calibrate Grace Data.

Inheritance diagram for skdiscovery.data\_structure.table.filters.CalibrateGRACE:



## Public Member Functions

- def `__init__` (self, [str\\_description](#), [ewd\\_column\\_name](#)='EWD', [round\\_dates](#)=True, [apply\\_scale\\_factor](#)=True)  
*Initialize GRACE calibration filter.*
- def [process](#) (self, obj\_data)  
*Calibrates GRACE, updating in place.*
- def [perturbParams](#) (self)  
*choose other random value for all parameters*
- def [resetParams](#) (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String representation of object.*
- def [getMetadata](#) (self)  
*Retrieve metadata about filter.*

## Public Attributes

- [ewd\\_column\\_name](#)
- [round\\_dates](#)
- [apply\\_scale\\_factor](#)
- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.2.1 Detailed Description

Calibrate Grace Data.

Averages the three solutions and applies a scale factor

### 6.2.2 Constructor & Destructor Documentation

#### 6.2.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.CalibrateGRACE.__init__ (
    self,
    str_description,
    ewd_column_name = 'EWD',
    round_dates = True,
    apply_scale_factor = True )
```

Initialize GRACE calibration filter.

#### Parameters

<i>str_description</i>	String describing filter
<i>ewd_column_name</i>	Name of new column for the calibrated GRACE data
<i>round_dates</i>	Option for rounding to dates to the nearest day
<i>apply_scale_factor</i>	Boolean indicating whether or not a corrective scale factor should be applied

### 6.2.3 Member Function Documentation

### 6.2.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all current parameters

### 6.2.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.2.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.2.3.4 process()

```
def skdiscovery.data_structure.table.filters.CalibrateGRACE.process (
    self,
    obj_data )
```

Calibrates GRACE, updating in place.

#### Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------

#### 6.2.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.2.4 Member Data Documentation

#### 6.2.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

#### 6.2.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

#### 6.2.4.3 apply\_scale\_factor

```
skdiscovery.data_structure.table.filters.CalibrateGRACE.apply_scale_factor
```

#### 6.2.4.4 ewd\_column\_name

```
skdiscovery.data_structure.table.filters.CalibrateGRACE.ewd_column_name
```

#### 6.2.4.5 round\_dates

```
skdiscovery.data_structure.table.filters.CalibrateGRACE.round_dates
```

## 6.2.4.6 str\_description

skdiscovery.data\_structure.framework.PipelineItem.str\_description [inherited]

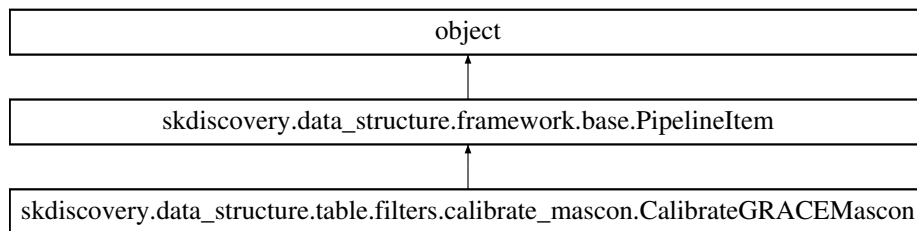
The documentation for this class was generated from the following file:

- data\_structure/table/filters/calibrate\_py

## 6.3 skdiscovery.data\_structure.table.filters.CalibrateGRACEMascon Class Reference

Calibrate Grace Data.

Inheritance diagram for skdiscovery.data\_structure.table.filters.CalibrateGRACEMascon:



## Public Member Functions

- def `__init__` (self, `str_description`, `round_dates`=True, `apply_scale_factor`=True)  
*Initialize GRACE Mascon calibration filter.*
- def `process` (self, `obj_data`)  
*Calibrates GRACE, updating in place.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String represntation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

## Public Attributes

- `round_dates`
- `apply_scale_factor`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.3.1 Detailed Description

Calibrate Grace Data.

This can apply a scale factor and round dates to the nearest day

### 6.3.2 Constructor & Destructor Documentation

#### 6.3.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.CalibrateGRACEMascon.__init__ (
    self,
    str_description,
    round_dates = True,
    apply_scale_factor = True )
```

Initialize GRACE Mascon calibration filter.

#### Parameters

<i>str_description</i>	String describing filter
<i>round_dates</i>	Option for rounding to dates to the nearest day
<i>apply_scale_factor</i>	Boolean indicating whether or not a corrective scale factor should be applied

### 6.3.3 Member Function Documentation

#### 6.3.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all current parameters

#### 6.3.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

##### Returns

String containing the item description and current parameters for filter.

#### 6.3.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.3.3.4 process()

```
def skdiscovery.data_structure.table.filters.CalibrateGRACEMascon.process (
    self,
    obj_data )
```

Calibrates GRACE, updating in place.

##### Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------

#### 6.3.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.3.4 Member Data Documentation

**6.3.4.1 ap\_paramList**

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList` [inherited]

**6.3.4.2 ap\_paramNames**

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames` [inherited]

**6.3.4.3 apply\_scale\_factor**

`skdiscovery.data_structure.table.filters.CalibrateGRACEMascon.apply_scale_factor`

**6.3.4.4 round\_dates**

`skdiscovery.data_structure.table.filters.CalibrateGRACEMascon.round_dates`

**6.3.4.5 str\_description**

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

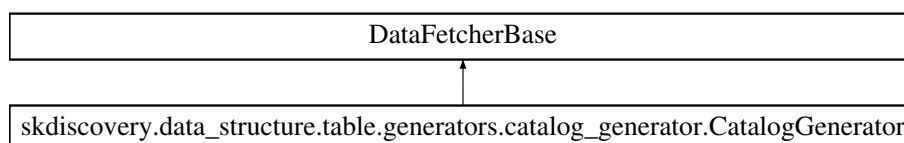
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/calibrate\\_mascon.py](#)

**6.4 skdiscovery.data\_structure.table.generators.CatalogGenerator Class Reference**

*In Development* Generates galaxy catalogs for use in DiscoveryPipeline

Inheritance diagram for `skdiscovery.data_structure.table.generators.CatalogGenerator`:





## Public Member Functions

- def `__init__` (self, ap\_paramList, ra1, dec1, ra2, dec2, background\_density, z)
- def `output` (self)  
*Generates galaxy catalog.*
- def `nfw_cumulative` (self, R)  
*Cumulative radial NFW distribution.*
- def `inverse_nfw_cumulative` (self, p)  
*inverse of radial nfw cumulative distribution*

## Public Attributes

- ra1
- dec1
- ra2
- dec2
- background\_density
- z

### 6.4.1 Detailed Description

*In Development* Generates galaxy catalogs for use in DiscoveryPipeline

### 6.4.2 Constructor & Destructor Documentation

#### 6.4.2.1 `__init__()`

```
def skdiscovery.data_structure.table.generators.CatalogGenerator.__init__ (
    self,
    ap_paramList,
    ra1,
    dec1,
    ra2,
    dec2,
    background_density,
    z )
```

#### Parameters

<code>ap_paramList[seed]</code>	Seed for random number generator
<code>ra1</code>	Left right ascension
<code>dec1</code>	Bottom declination
<code>ra2</code>	Right right ascension
<code>dec2</code>	Top declination
<code>background_density</code>	galaxy background density in galaxies/square degree
<code>z</code>	Redshift of galaxy cluster

### 6.4.3 Member Function Documentation

#### 6.4.3.1 `inverse_nfw_cumulative()`

```
def skdiscovery.data_structure.table.generators.CatalogGenerator.inverse_nfw_cumulative (
    self,
    p )
```

inverse of radial nfw cumulative distribution

##### Parameters

$p$	Probability
-----	-------------

##### Returns

float: Radius corresponding to probability  $p$

#### 6.4.3.2 `nfw_cumulative()`

```
def skdiscovery.data_structure.table.generators.CatalogGenerator.nfw_cumulative (
    self,
    R )
```

Cumulative radial NFW distribution.

##### Parameters

$R$	Radius
-----	--------

##### Returns

float: Probability of being within  $R$

#### 6.4.3.3 `output()`

```
def skdiscovery.data_structure.table.generators.CatalogGenerator.output (
    self )
```

Generates galaxy catalog.

**Returns**

DataWrapper: Table data wrapper of galaxy catalog

**6.4.4 Member Data Documentation****6.4.4.1 background\_density**

skdiscovery.data\_structure.table.generators.CatalogGenerator.background\_density

**6.4.4.2 dec1**

skdiscovery.data\_structure.table.generators.CatalogGenerator.dec1

**6.4.4.3 dec2**

skdiscovery.data\_structure.table.generators.CatalogGenerator.dec2

**6.4.4.4 ra1**

skdiscovery.data\_structure.table.generators.CatalogGenerator.ra1

**6.4.4.5 ra2**

skdiscovery.data\_structure.table.generators.CatalogGenerator.ra2

**6.4.4.6 z**

skdiscovery.data\_structure.table.generators.CatalogGenerator.z

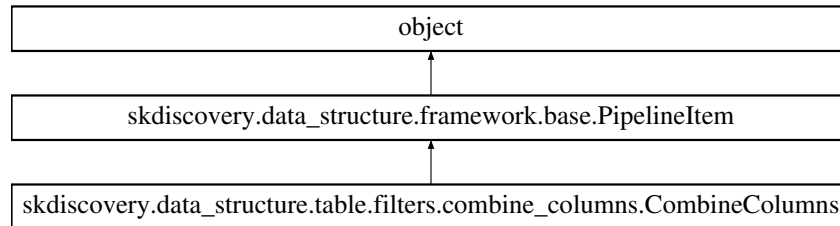
The documentation for this class was generated from the following file:

- data\_structure/table/generators/[catalog\\_generator.py](#)

## 6.5 skdiscovery.data\_structure.table.filters.CombineColumns Class Reference

Create a new column by selecting data from a column.

Inheritance diagram for skdiscovery.data\_structure.table.filters.CombineColumns:



### Public Member Functions

- `def __init__ (self, str_description, column_1, column_2, new_column_name)`  
Initialize a [CombineColumns](#) object.
- `def process (self, obj_data)`  
Apply combine column filter to data set, operating on the data\_obj.
- `def perturbParams (self)`  
choose other random value for all parameters
- `def resetParams (self)`  
set all parameters to initial value
- `def __str__ (self)`  
String representation of object.
- `def getMetadata (self)`  
Retrieve metadata about filter.

### Public Attributes

- [column\\_1](#)
- [column\\_2](#)
- [new\\_column\\_name](#)
- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.5.1 Detailed Description

Create a new column by selecting data from a column.

Fills in any missing values using a second column

## 6.5.2 Constructor & Destructor Documentation

### 6.5.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.CombineColumns.__init__ (
    self,
    str_description,
    column_1,
    column_2,
    new_column_name )
```

Initialize a [CombineColumns](#) object.

#### Parameters

<i>str_description</i>	String describing filter
<i>column_1</i>	Name of primary column
<i>column_2</i>	Name of secondary column to be used when data from the primary column is not available
<i>new_column_name</i>	Name of resulting column

## 6.5.3 Member Function Documentation

### 6.5.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

#### Returns

String listing all current parameters

### 6.5.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.5.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.5.3.4 process()

```
def skdiscovery.data_structure.table.filters.CombineColumns.process (
    self,
    obj_data )
```

Apply combine column filter to data set, operating on the data\_obj.

#### Parameters

<i>obj_data</i>	Table data wrapper.
-----------------	---------------------

### 6.5.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.5.4 Member Data Documentation

### 6.5.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

### 6.5.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

## 6.5.4.3 column\_1

```
skdiscovery.data_structure.table.filters.CombineColumns.column_1
```

## 6.5.4.4 column\_2

```
skdiscovery.data_structure.table.filters.CombineColumns.column_2
```

## 6.5.4.5 new\_column\_name

```
skdiscovery.data_structure.table.filters.CombineColumns.new_column_name
```

## 6.5.4.6 str\_description

```
skdiscovery.data_structure.framework.PipelineItem.str_description [inherited]
```

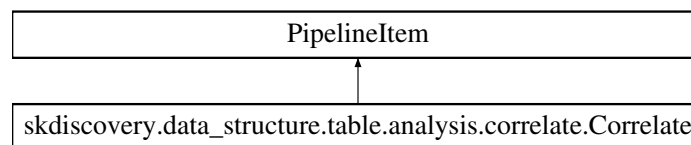
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/combine\\_columns.py](#)

## 6.6 skdiscovery.data\_structure.table.analysis.Correlate Class Reference

Computes the correlation for table data and stores the result as a matrix.

Inheritance diagram for skdiscovery.data\_structure.table.analysis.Correlate:



### Public Member Functions

- `def __init__(self, str_description, column\_names=None, local\_match=False, correlation_type='pearson')`  
*Initialize [Correlate](#) analysis item for use on tables.*
- `def process(self, obj_data)`  
*Computes the correlation between columns and stores the results in obj\_*

## Public Attributes

- [column\\_names](#)
- [local\\_match](#)
- [corr\\_type](#)

### 6.6.1 Detailed Description

Computes the correlation for table data and stores the result as a matrix.

### 6.6.2 Constructor & Destructor Documentation

#### 6.6.2.1 `__init__()`

```
def skdiscovery.data_structure.table.analysis.Correlate.__init__ (
    self,
    str_description,
    column_names = None,
    local_match = False,
    correlation_type = 'pearson' )
```

Initialize [Correlate](#) analysis item for use on tables.

#### Parameters

<i>str_description</i>	String describing analysis item
<i>column_names</i>	List of column names to correlate
<i>local_match</i>	Only correlate data on the same frames
<i>correlation_type</i>	Type of correlation to be passed to pandas ('pearson', 'kendall', 'spearman')

### 6.6.3 Member Function Documentation

#### 6.6.3.1 `process()`

```
def skdiscovery.data_structure.table.analysis.Correlate.process (
    self,
    obj_data )
```

Computes the correlation between columns and stores the results in `obj_`



## Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

## 6.6.4 Member Data Documentation

### 6.6.4.1 column\_names

`skdiscovery.data_structure.table.analysis.Correlate.column_names`

### 6.6.4.2 corr\_type

`skdiscovery.data_structure.table.analysis.Correlate.corr_type`

### 6.6.4.3 local\_match

`skdiscovery.data_structure.table.analysis.Correlate.local_match`

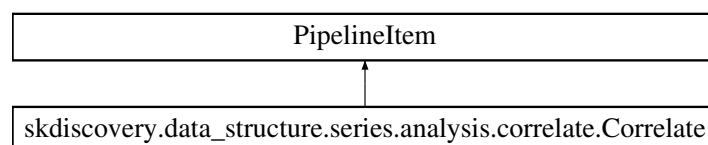
The documentation for this class was generated from the following file:

- `data_structure/table/analysis/correlate.py`

## 6.7 skdiscovery.data\_structure.series.analysis.Correlate Class Reference

Computes the correlation for series data.

Inheritance diagram for `skdiscovery.data_structure.series.analysis.Correlate`:



## Public Member Functions

- `def __init__ (self, str_description, labels=None, column_names=None)`  
Initialize *Correlate* analysis item.
- `def process (self, obj_data)`  
Computes the correlation between all the time series.

## Public Attributes

- `labels`
- `column_names`

### 6.7.1 Detailed Description

Computes the correlation for series data.

Stores the result as a matrix

### 6.7.2 Constructor & Destructor Documentation

#### 6.7.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.series.analysis.Correlate.__init__ (
    self,
    str_description,
    labels = None,
    column_names = None )
```

Initialize *Correlate* analysis item.

#### Parameters

<i>str_description</i>	String describing analysis item
<i>labels</i>	List of labels used to select data
<i>column_names</i>	List of column names used to select data

### 6.7.3 Member Function Documentation

## 6.7.3.1 process()

```
def skdiscovery.data_structure.series.analysis.Correlate.process (
    self,
    obj_data )
```

Computes the correlation between all the time series.

The results are stored in `obj_data`

## Parameters

<code>obj_data</code>	Data wrapper for correlating
-----------------------	------------------------------

## 6.7.4 Member Data Documentation

## 6.7.4.1 column\_names

```
skdiscovery.data_structure.series.analysis.Correlate.column_names
```

## 6.7.4.2 labels

```
skdiscovery.data_structure.series.analysis.Correlate.labels
```

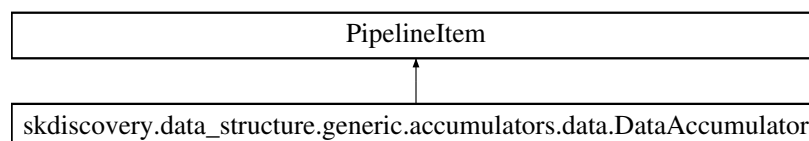
The documentation for this class was generated from the following file:

- `data_structure/series/analysis/correlate.py`

## 6.8 skdiscovery.data\_structure.generic.accumulators.DataAccumulator Class Reference

Stores a copy of the data in its current state in the pipeline.

Inheritance diagram for `skdiscovery.data_structure.generic.accumulators.data.DataAccumulator`:



## Public Member Functions

- def `__init__` (self, str\_description, save\_wrapper=False)  
*Initialize [DataAccumulator](#) Item.*
- def `process` (self, obj\_data)  
*Store a copy of the data in the object wrapper results.*

### 6.8.1 Detailed Description

Stores a copy of the data in its current state in the pipeline.

### 6.8.2 Constructor & Destructor Documentation

#### 6.8.2.1 `__init__()`

```
def skdiscovery.data_structure.generic.accumulators.DataAccumulator.__init__ (
    self,
    str_description,
    save_wrapper = False )
```

Initialize [DataAccumulator](#) Item.

#### Parameters

<i>str_description</i>	String description of item
<i>save_wrapper</i>	Save the data wrapper instead of just the data

### 6.8.3 Member Function Documentation

#### 6.8.3.1 `process()`

```
def skdiscovery.data_structure.generic.accumulators.DataAccumulator.process (
    self,
    obj_data )
```

Store a copy of the data in the object wrapper results.

## Parameters

<code>obj_data</code>	Data Wrapper to be copied
-----------------------	---------------------------

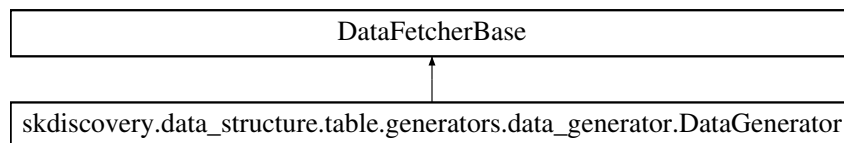
The documentation for this class was generated from the following file:

- `data_structure/generic/accumulators/data.py`

## 6.9 skdiscovery.data\_structure.table.generators.DataGenerator Class Reference

In Class for generating random data.

Inheritance diagram for `skdiscovery.data_structure.table.generators.DataGenerator`:



### Public Member Functions

- `def __init__ (self, length, args, seed=None, final_function=None)`  
*Initialize Random data generator.*
- `def output (self)`  
*Generate data.*

### Public Attributes

- `length`
- `seed`
- `args`
- `final_function`

### 6.9.1 Detailed Description

In Class for generating random data.

### 6.9.2 Constructor & Destructor Documentation

### 6.9.2.1 `__init__()`

```
def skdiscovery.data_structure.table.generators.DataGenerator.__init__ (
    self,
    length,
    args,
    seed = None,
    final_function = None )
```

Initialize Random data generator.

#### Parameters

<i>length</i>	Number of rows to generate
<i>*args</i>	Dictionaries containing entries: 'name', 'start', 'end', and optionally 'func'
<i>seed</i>	Seed to use when generating random data
<i>final_function</i>	Final function to call on random data

## 6.9.3 Member Function Documentation

### 6.9.3.1 `output()`

```
def skdiscovery.data_structure.table.generators.DataGenerator.output (
    self )
```

Generate data.

#### Returns

Table data wrapper of generated data

## 6.9.4 Member Data Documentation

### 6.9.4.1 `args`

```
skdiscovery.data_structure.table.generators.DataGenerator.args
```

## 6.9.4.2 final\_function

```
skdiscovery.data_structure.table.generators.DataGenerator.final_function
```

## 6.9.4.3 length

```
skdiscovery.data_structure.table.generators.DataGenerator.length
```

## 6.9.4.4 seed

```
skdiscovery.data_structure.table.generators.DataGenerator.seed
```

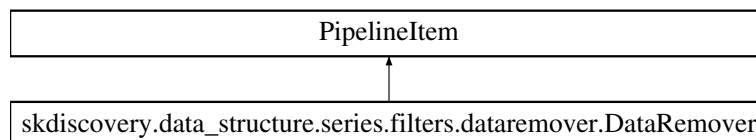
The documentation for this class was generated from the following file:

- [data\\_structure/table/generators/data\\_generator.py](#)

## 6.10 skdiscovery.data\_structure.series.filters.DataRemover Class Reference

Sets specified series data to NaN.

Inheritance diagram for skdiscovery.data\_structure.series.filters.DataRemover:



## Public Member Functions

- `def __init__(self, str_description, start=None, end=None, labels=None, column_names=None)`  
Initialize `DataRemover`.
- `def process(self, obj_data)`  
NaN's data from `DataWrapper`.

## Public Attributes

- `labels`
- `column_names`
- `start`
- `end`

### 6.10.1 Detailed Description

Sets specified series data to NaN.

### 6.10.2 Constructor & Destructor Documentation

#### 6.10.2.1 `__init__()`

```
def skdiscovery.data_structure.series.filters.DataRemover.__init__ (
    self,
    str_description,
    start = None,
    end = None,
    labels = None,
    column_names = None )
```

Initialize [DataRemover](#).

#### Parameters

<i>str_description</i>	String describing filter
<i>start</i>	Starting index value
<i>end</i>	Ending index value (inclusive)
<i>labels</i>	List of labels used to select data to be removed (None will operate on all labels)
<i>column_names</i>	List of column names to select data to be removed (None will operate on all columns)

### 6.10.3 Member Function Documentation

#### 6.10.3.1 `process()`

```
def skdiscovery.data_structure.series.filters.DataRemover.process (
    self,
    obj_data )
```

NaN's data from DataWrapper.

#### Parameters

<i>obj_data</i>	Input DataWrapper, which will be modified in place
-----------------	--



## 6.10.4 Member Data Documentation

### 6.10.4.1 column\_names

`skdiscovery.data_structure.series.filters.DataRemover.column_names`

### 6.10.4.2 end

`skdiscovery.data_structure.series.filters.DataRemover.end`

### 6.10.4.3 labels

`skdiscovery.data_structure.series.filters.DataRemover.labels`

### 6.10.4.4 start

`skdiscovery.data_structure.series.filters.DataRemover.start`

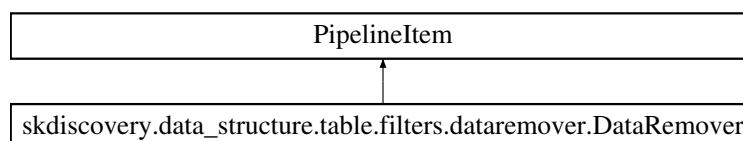
The documentation for this class was generated from the following file:

- `data_structure/series/filters/dataremover.py`

## 6.11 skdiscovery.data\_structure.table.filters.DataRemover Class Reference

Sets specified table data to NaN.

Inheritance diagram for `skdiscovery.data_structure.table.filters.DataRemover`:



## Public Member Functions

- `def __init__ (self, str_description, column_names, start=None, end=None, labels=None)`  
Initialize [DataRemover](#).
- `def process (self, obj_data)`  
NaN's data from *DataWrapper*.

## Public Attributes

- [labels](#)
- [column\\_names](#)
- [start](#)
- [end](#)

### 6.11.1 Detailed Description

Sets specified table data to NaN.

### 6.11.2 Constructor & Destructor Documentation

#### 6.11.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.DataRemover.__init__ (
    self,
    str_description,
    column_names,
    start = None,
    end = None,
    labels = None )
```

Initialize [DataRemover](#).

#### Parameters

<i>str_description</i>	String describing filter
<i>column_names</i>	List of column names to select data to be removed (using None will apply to all columns)
<i>start</i>	Starting index value
<i>end</i>	Ending index value (inclusive)
<i>labels</i>	List of labels used to select data to be removed (using None will apply to all labels)

### 6.11.3 Member Function Documentation

#### 6.11.3.1 process()

```
def skdiscovery.data_structure.table.filters.DataRemover.process (
    self,
    obj_data )
```

NaN's data from DataWrapper.

##### Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

### 6.11.4 Member Data Documentation

#### 6.11.4.1 column\_names

```
skdiscovery.data_structure.table.filters.DataRemover.column_names
```

#### 6.11.4.2 end

```
skdiscovery.data_structure.table.filters.DataRemover.end
```

#### 6.11.4.3 labels

```
skdiscovery.data_structure.table.filters.DataRemover.labels
```

#### 6.11.4.4 start

```
skdiscovery.data_structure.table.filters.DataRemover.start
```

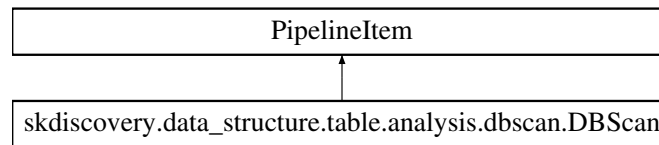
The documentation for this class was generated from the following file:

- data\_structure/table/filters/[dataremover.py](#)

## 6.12 skdiscovery.data\_structure.table.analysis.DBScan Class Reference

Runs [DBScan](#) on table data.

Inheritance diagram for skdiscovery.data\_structure.table.analysis.DBScan:



### Public Member Functions

- `def __init__(self, str_description, ap_paramList, column\_names)`  
*Initialize [DBScan](#) pipeline item.*
- `def process(self, obj_data)`  
*Run [DBScan](#) on data.*

### Public Attributes

- [column\\_names](#)

### 6.12.1 Detailed Description

Runs [DBScan](#) on table data.

Adds cluster information column to data

### 6.12.2 Constructor & Destructor Documentation

#### 6.12.2.1 \_\_init\_\_()

```

def skdiscovery.data_structure.table.analysis.DBScan.__init__(
    self,
    str_description,
    ap_paramList,
    column_names )
  
```

Initialize [DBScan](#) pipeline item.

## Parameters

<i>str_description</i>	Description of item
<i>ap_paramList[epsilon]</i>	Distance between two nodes for them to be considered connected
<i>ap_paramList[min_points]</i>	Minimum number of points for a cluster
<i>column_names</i>	List of column names to use

## 6.12.3 Member Function Documentation

## 6.12.3.1 process()

```
def skdiscovery.data_structure.table.analysis.DBScan.process (
    self,
    obj_data )
```

Run [DBScan](#) on data.

Stores result in data wrapper

```
@param obj_data: Data wrapper to be processed
```

## 6.12.4 Member Data Documentation

## 6.12.4.1 column\_names

```
skdiscovery.data_structure.table.analysis.DBScan.column_names
```

The documentation for this class was generated from the following file:

- [data\\_structure/table/analysis/dbscan.py](#)

## 6.13 skdiscovery.data\_structure.framework.DiscoveryPipeline Class Reference

Pipeline for running the analysis.

## Public Member Functions

- def `__init__` (self, `data_fetcher`, list\_StageContainers)  
*Initialize a new pipeline.*
- def `run` (self, num\_runs=1, `perturb`='pipeline', num\_cores=1, offload=None, verbose=False)  
*Run the pipeline.*
- def `perturb` (self)  
*Perturb the paramters in the stage containers.*
- def `reset` (self)  
*Reset the stage containers to their default values and clear previous runs.*
- def `getMetadata` (self)  
*Retrieve Metadata from stage containers.*
- def `getMetadataHistory` (self)  
*Get the metadata for each run in the pipeline.*
- def `perturbData` (self)  
*Perturb the input data.*
- def `getResults` (self, index=None)  
*Return results from previous runs.*
- def `resultIter` (self)  
*Retrieves and iterator to the results and history of the pipeline.*
- def `plotPipelineInstance` (self)  
*Plot current instance of pipeline stages with metadata.*
- def `plotPipelineStructure` (self)  
*Plot pipeline structure.*
- def `getMetadataNestedTypes` (self)  
*Get the Metadata Nested Types.*
- def `getMetadataNestedGraph` (self)  
*Retrieve the metadata nested graph.*
- def `__str__` (self)  
*String representation of the pipeline.*

## Public Attributes

- `stage_containers`
- `data_fetcher`
- `stageConfigurationHistory`
- `RA_results`

### 6.13.1 Detailed Description

Pipeline for running the analysis.

### 6.13.2 Constructor & Destructor Documentation

#### 6.13.2.1 `__init__()`

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.__init__ (
    self,
    data_fetcher,
    list_StageContainers )
```

Initialize a new pipeline.

##### Parameters

<i>data_fetcher</i>	Data fetcher to use as a data source (from skdaccess)
<i>list_StageContainers</i>	List of stage containers

### 6.13.3 Member Function Documentation

#### 6.13.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.__str__ (
    self )
```

String representation of the pipeline.

##### Returns

String of current metadata of pipeline containers.

#### 6.13.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.getMetadata (
    self )
```

Retrieve Metadata from stage containers.

##### Returns

list of metadata for the current run

### 6.13.3.3 getMetadataHistory()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.getMetadataHistory (
    self )
```

Get the metadata for each run in the pipeline.

#### Returns

list of metadata configurations for all runs

### 6.13.3.4 getMetadataNestedGraph()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.getMetadataNestedGraph (
    self )
```

Retrieve the metadata nested graph.

#### Returns

String: Metadata nested graph

### 6.13.3.5 getMetadataNestedTypes()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.getMetadataNestedTypes (
    self )
```

Get the Metadata Nested Types.

#### Returns

String: Metadata Nested types

### 6.13.3.6 getResults()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.getResults (
    self,
    index = None )
```

Return results from previous runs.



**Parameters**

<i>index</i>	Index of run. If None, return all previous results
--------------	--

**Returns**

results from a run at index. If index=None, returns list of all results

**6.13.3.7 perturb()**

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.perturb (
    self )
```

Perturb the paramters in the stage containers.

**6.13.3.8 perturbData()**

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.perturbData (
    self )
```

Perturb the input data.

**6.13.3.9 plotPipelineInstance()**

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.plotPipelineInstance (
    self )
```

Plot current instance of pipeline stages with metadata.

**Returns**

iPython display object

#### 6.13.3.10 plotPipelineStructure()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.plotPipelineStructure (
    self )
```

Plot pipeline structure.

##### Returns

iPython display object

#### 6.13.3.11 reset()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.reset (
    self )
```

Reset the stage containers to their default values and clear previous runs.

#### 6.13.3.12 resultIter()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.resultIter (
    self )
```

Retrieves and iterator to the results and history of the pipeline.

##### Returns

A 2 component iterator to the results and history of previous runs

#### 6.13.3.13 run()

```
def skdiscovery.data_structure.framework.DiscoveryPipeline.run (
    self,
    num_runs = 1,
    perturb = 'pipeline',
    num_cores = 1,
    offload = None,
    verbose = False )
```

Run the pipeline.

## Parameters

<i>num_runs</i>	Number of times to run the pipeline
<i>perturb</i>	Perturb the "pipeline", the "data", or "both"
<i>num_cores</i>	Number of cores on the local machine to use. Defaults to 1 core. Use 0 to select the minimum between the number of runs and cpu cores.
<i>offload</i>	Offload the pipeline to 'amazon' or 'cluster'
<i>verbose</i>	Display the pipeline for each run

### 6.13.4 Member Data Documentation

#### 6.13.4.1 data\_fetcher

`skdiscovery.data_structure.framework.DiscoveryPipeline.data_fetcher`

#### 6.13.4.2 RA\_results

`skdiscovery.data_structure.framework.DiscoveryPipeline.RA_results`

#### 6.13.4.3 stage\_containers

`skdiscovery.data_structure.framework.DiscoveryPipeline.stage_containers`

#### 6.13.4.4 stageConfigurationHistory

`skdiscovery.data_structure.framework.DiscoveryPipeline.stageConfigurationHistory`

The documentation for this class was generated from the following file:

- `data_structure/framework/discoverypipeline.py`

## 6.14 skdiscovery.utilities.planetary.raster\_management.DiscreteColormap Class Reference

### Public Member Functions

- `def \_\_init\_\_(self, cmap, norm, boundaries, ticks)`

### Public Attributes

- [cmap](#)
- [norm](#)
- [boundaries](#)
- [ticks](#)

### 6.14.1 Constructor & Destructor Documentation

#### 6.14.1.1 `__init__()`

```
def skdiscovery.utilities.planetary.raster_management.DiscreteColormap.__init__ (
    self,
    cmap,
    norm,
    boundaries,
    ticks )
```

### 6.14.2 Member Data Documentation

#### 6.14.2.1 `boundaries`

```
skdiscovery.utilities.planetary.raster_management.DiscreteColormap.boundaries
```

#### 6.14.2.2 `cmap`

```
skdiscovery.utilities.planetary.raster_management.DiscreteColormap.cmap
```

## 6.14.2.3 norm

```
skdiscovery.utilities.planetary.raster_management.DiscreteColormap.norm
```

## 6.14.2.4 ticks

```
skdiscovery.utilities.planetary.raster_management.DiscreteColormap.ticks
```

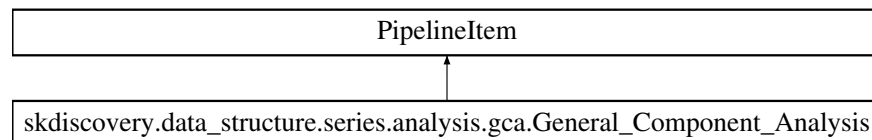
The documentation for this class was generated from the following file:

- [utilities/planetary/raster\\_management.py](#)

## 6.15 skdiscovery.data\_structure.series.analysis.General\_Component\_Analysis Class Reference

Performs either ICA or PCA analysis on series data.

Inheritance diagram for `skdiscovery.data_structure.series.analysis.General_Component_Analysis`:



### Public Member Functions

- `def __init__(self, str\_description, ap\_paramList)`  
*Initialize Analysis object.*
- `def process(self, obj_data)`  
*Perform component analysis on data:*

### Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)
- [results](#)

### 6.15.1 Detailed Description

Performs either ICA or PCA analysis on series data.

### 6.15.2 Constructor & Destructor Documentation

#### 6.15.2.1 `__init__()`

```
def skdiscovery.data_structure.series.analysis.General_Component_Analysis.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Analysis object.

#### Parameters

<i>str_description</i>	String description of analysis
<i>ap_paramList[num_components]</i>	Number of components
<i>ap_paramList[component_type]</i>	Type of component analysis (CA); either PCA or ICA
<i>ap_paramList[start_time]</i>	Starting time for CA
<i>ap_paramList[end_time]</i>	ending time for CA
<i>ap_paramList[labels]</i>	Optional list of label names

### 6.15.3 Member Function Documentation

#### 6.15.3.1 `process()`

```
def skdiscovery.data_structure.series.analysis.General_Component_Analysis.process (
    self,
    obj_data )
```

Perform component analysis on data:

Results are added to the data wrapper as a dictionary with results['CA'] = Eigenvenctors results['Projection'] = Projection on to the eigenvectors

## Parameters

<i>obj_data</i>	Data wrapper containing the data
-----------------	----------------------------------

## 6.15.4 Member Data Documentation

## 6.15.4.1 ap\_paramList

```
skdiscovery.data_structure.series.analysis.General_Component_Analysis.ap_paramList
```

## 6.15.4.2 ap\_paramNames

```
skdiscovery.data_structure.series.analysis.General_Component_Analysis.ap_paramNames
```

## 6.15.4.3 results

```
skdiscovery.data_structure.series.analysis.General_Component_Analysis.results
```

## 6.15.4.4 str\_description

```
skdiscovery.data_structure.series.analysis.General_Component_Analysis.str_description
```

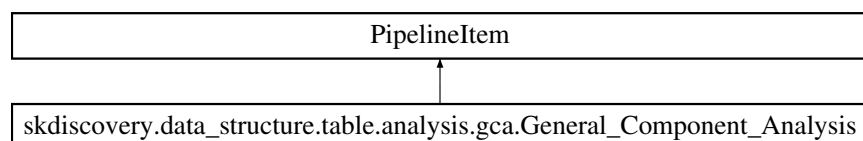
The documentation for this class was generated from the following file:

- [data\\_structure/series/analysis/gca.py](#)

## 6.16 skdiscovery.data\_structure.table.analysis.General\_Component\_Analysis Class Reference

Performs a general component analysis on table data.

Inheritance diagram for skdiscovery.data\_structure.table.analysis.General\_Component\_Analysis:



## Public Member Functions

- `def __init__ (self, str_description, ap_paramList, n_components, column_names, kwargs)`  
*Initialize Analysis object.*
- `def process (self, obj_data)`  
*Perform component analysis on data.*

## Public Attributes

- `str_description`
- `ap_paramList`
- `ap_paramNames`
- `n_components`
- `column_names`
- `kwargs`
- `results`

### 6.16.1 Detailed Description

Performs a general component analysis on table data.

Currently, the two built-in types of analysis are either ICA or PCA.

### 6.16.2 Constructor & Destructor Documentation

#### 6.16.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.analysis.General_Component_Analysis.__init__ (
    self,
    str_description,
    ap_paramList,
    n_components,
    column_names,
    kwargs )
```

Initialize Analysis object.

#### Parameters

<code>str_description</code>	String description of analysis
<code>ap_paramList[component_type]</code>	Type of CA; either PCA or ICA
<code>ap_paramList[start_time]</code>	Starting time for CA
<code>ap_paramList[end_time]</code>	ending time for CA
<code>n_components</code>	Number of components to compute
<code>column_names</code>	Columns names to use
<code>kwargs</code>	Extra keyword arguments to pass on to ICA (ignored for PCA)



### 6.16.3 Member Function Documentation

#### 6.16.3.1 process()

```
def skdiscovery.data_structure.table.analysis.General_Component_Analysis.process (
    self,
    obj_data )
```

Perform component analysis on data.

Results are added to the data wrapper as a dictionary with results['CA'] = Eigenvenctors results['Projection'] = Projection on to the eigenvectors

##### Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

### 6.16.4 Member Data Documentation

#### 6.16.4.1 ap\_paramList

```
skdiscovery.data_structure.table.analysis.General_Component_Analysis.ap_paramList
```

#### 6.16.4.2 ap\_paramNames

```
skdiscovery.data_structure.table.analysis.General_Component_Analysis.ap_paramNames
```

#### 6.16.4.3 column\_names

```
skdiscovery.data_structure.table.analysis.General_Component_Analysis.column_names
```

#### 6.16.4.4 `kwargs`

`skdiscovery.data_structure.table.analysis.General_Component_Analysis.kwargs`

#### 6.16.4.5 `n_components`

`skdiscovery.data_structure.table.analysis.General_Component_Analysis.n_components`

#### 6.16.4.6 `results`

`skdiscovery.data_structure.table.analysis.General_Component_Analysis.results`

#### 6.16.4.7 `str_description`

`skdiscovery.data_structure.table.analysis.General_Component_Analysis.str_description`

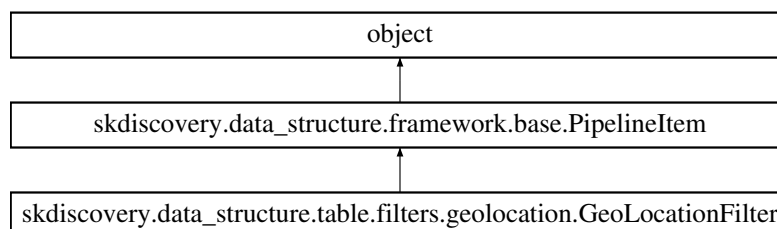
The documentation for this class was generated from the following file:

- `data_structure/table/analysis/gca.py`

## 6.17 `skdiscovery.data_structure.table.filters.GeoLocationFilter` Class Reference

Removes objects not located in a specified region.

Inheritance diagram for `skdiscovery.data_structure.table.filters.GeoLocationFilter`:



## Public Member Functions

- def `__init__` (self, `str_description`, `ap_paramList`)  
*Initialize GeolocationFilter.*
- def `process` (self, `obj_data`)  
*Apply geolocation filter to data set.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String representation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

## Public Attributes

- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.17.1 Detailed Description

Removes objects not located in a specified region.

### 6.17.2 Constructor & Destructor Documentation

#### 6.17.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.GeoLocationFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize GeolocationFilter.

#### Parameters

<code>str_description</code>	String describing filter
<code>ap_paramList[ap_lat]</code>	Latitude coordinate
<code>ap_paramList[ap_lon]</code>	Longitude coordinate
<code>ap_paramList[ap_radius]</code>	cut objects whose distance from lat/lon is greater than <code>ap_radius</code>

### 6.17.3 Member Function Documentation

#### 6.17.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

##### Returns

String listing all current parameters

#### 6.17.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

##### Returns

String containing the item description and current parameters for filter.

#### 6.17.3.3 `perturbParams()`

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.17.3.4 `process()`

```
def skdiscovery.data_structure.table.filters.GeoLocationFilter.process (
    self,
    obj_data )
```

Apply geolocation filter to data set.

## Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------

## 6.17.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.17.4 Member Data Documentation

## 6.17.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

## 6.17.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

## 6.17.4.3 str\_description

```
skdiscovery.data_structure.framework.PipelineItem.str_description [inherited]
```

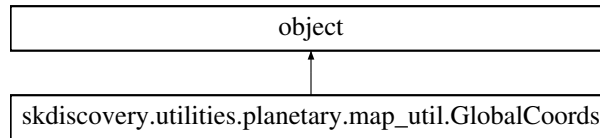
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/geolocation.py](#)

## 6.18 skdiscovery.utilities.planetary.map\_util.GlobalCoords Class Reference

Converts from pixel coordinates to projected coordinates.

Inheritance diagram for skdiscovery.utilities.planetary.map\_util.GlobalCoords:



### Public Member Functions

- `def __init__(self, aff_coeffs, center_pixels=True)`  
Initialize [GlobalCoords](#) object.
- `def __call__(self, y_in, x_in)`  
Get projected coordinates from pixel coordinates.

### 6.18.1 Detailed Description

Converts from pixel coordinates to projected coordinates.

### 6.18.2 Constructor & Destructor Documentation

#### 6.18.2.1 \_\_init\_\_()

```

def skdiscovery.utilities.planetary.map_util.GlobalCoords.__init__(
    self,
    aff_coeffs,
    center_pixels = True )
  
```

Initialize [GlobalCoords](#) object.

#### Parameters

<i>aff_coeffs</i>	Array containing affine coefficients
<i>center_pixels</i>	Pixel coordinates refer to the center of each pixel so 0.5 is added to inputs

### 6.18.3 Member Function Documentation

#### 6.18.3.1 \_\_call\_\_()

```
def skdiscovery.utilities.planetary.map_util.GlobalCoords.__call__ (
    self,
    y_in,
    x_in )
```

Get projected coordinates from pixel coordinates.

#### Parameters

$y_{in}$	Pixel location in x
$x_{in}$	Pixel location in y

#### Returns

: y projected coordinate, x projected coordinate

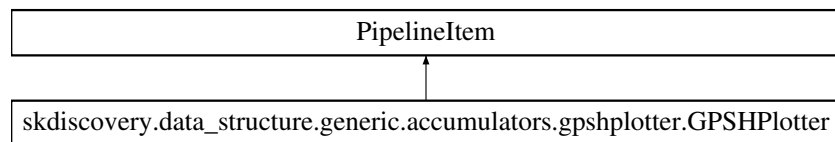
The documentation for this class was generated from the following file:

- [utilities/planetary/map\\_util.py](#)

## 6.19 skdiscovery.data\_structure.generic.accumulators.GPSHPlotter Class Reference

Plots results from General\_Component\_Analysis, for the GPS horizontal or vertical components.

Inheritance diagram for skdiscovery.data\_structure.generic.accumulators.gpshplotter.GPSHPlotter:



#### Public Member Functions

- def `__init__` (self, str\_description, comp\_name, mogi\_name=None, pca\_dir='H', pca\_comp=0, scaleFactor=2.5, offset=.15, KF\_tau=0, errorEllipses=False, map\_resolution='i')  
Initialize GPSSHPlotter.
- def `process` (self, obj\_data)  
Plot the General Component Analysis results present stored in obj\_

## Public Attributes

- [dir\\_sign](#)
- [pca\\_dir](#)
- [pca\\_comp](#)
- [scaleFactor](#)
- [offset](#)
- [errorE](#)
- [KF\\_tau](#)
- [comp\\_name](#)
- [mogi\\_name](#)

### 6.19.1 Detailed Description

Plots results from General\_Component\_Analysis, for the GPS horizontal or vertical components.

### 6.19.2 Constructor & Destructor Documentation

#### 6.19.2.1 `__init__()`

```
def skdiscovery.data_structure.generic.accumulators.GPShPlotter.__init__ (
    self,
    str_description,
    comp_name,
    mogi_name = None,
    pca_dir = 'H',
    pca_comp = 0,
    scaleFactor = 2.5,
    offset = .15,
    KF_tau = 0,
    errorEllipses = False,
    map_resolution = 'i' )
```

Initialize GPShPlotter.

#### Parameters

<i>str_description</i>	String describing accumulator
<i>comp_name</i>	Name of the GPCA results for accessing the GPCA output
<i>mogi_name</i>	Name of the Mogi results (optional)
<i>pca_dir</i>	PCA direction to plot, horizontal (H) or vertical (V)
<i>pca_comp</i>	The PCA component that will be plotted
<i>scaleFactor</i>	Scale factor for arrows
<i>offset</i>	Offset for plotting larger area on map
<i>KF_tau</i>	Tau used in kalman filter
<i>errorEllipses</i>	Boolean indicating whether or not to plot errorEllipses
<i>map_resolution</i>	Resolution of map features (coastline) to use



### 6.19.3 Member Function Documentation

#### 6.19.3.1 process()

```
def skdiscovery.data_structure.generic.accumulators.GPSHPlotter.process (
    self,
    obj_data )
```

Plot the General Component Analysis results present stored in obj\_

Saves the basemap in obj\_data results.

##### Parameters

<i>obj_data</i>	Data Wrapper that holds component analysis HPCA
-----------------	---

### 6.19.4 Member Data Documentation

#### 6.19.4.1 comp\_name

```
skdiscovery.data_structure.generic.accumulators.GPSHPlotter.comp_name
```

#### 6.19.4.2 dir\_sign

```
skdiscovery.data_structure.generic.accumulators.GPSHPlotter.dir_sign
```

#### 6.19.4.3 errorE

```
skdiscovery.data_structure.generic.accumulators.GPSHPlotter.errorE
```

#### 6.19.4.4 KF\_tau

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.KF_tau`

#### 6.19.4.5 mogi\_name

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.mogi_name`

#### 6.19.4.6 offset

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.offset`

#### 6.19.4.7 pca\_comp

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.pca_comp`

#### 6.19.4.8 pca\_dir

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.pca_dir`

#### 6.19.4.9 scaleFactor

`skdiscovery.data_structure.generic.accumulators.GPSHPlotter.scaleFactor`

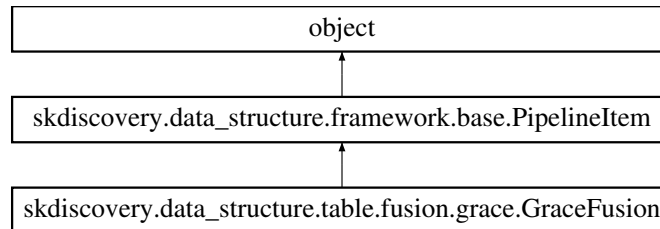
The documentation for this class was generated from the following file:

- [data\\_structure/generic/accumulators/gpshplotter.py](#)

## 6.20 skdiscovery.data\_structure.table.fusion.GraceFusion Class Reference

Fuses GRACE equivalent water depth time series.

Inheritance diagram for skdiscovery.data\_structure.table.fusion.GraceFusion:



### Public Member Functions

- `def __init__ (self, str_description, ap_paramList, metadata, column_data_name='Grace', column_error_name='Grace_Uncertainty')`  
*Initialize Grace Fusion item.*
- `def process (self, obj_data)`  
*Adds columns for GRACE data and uncertainties.*
- `def perturbParams (self)`  
*choose other random value for all parameters*
- `def resetParams (self)`  
*set all parameters to initial value*
- `def __str__ (self)`  
*String representation of object.*
- `def getMetadata (self)`  
*Retrieve metadata about filter.*

### Public Attributes

- `metadata`
- `column_data_name`
- `column_error_name`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.20.1 Detailed Description

Fuses GRACE equivalent water depth time series.

Works on table data (original data from <http://grace.jpl.nasa.gov/data/get-data/monthly-mass-grids-land/>)

## 6.20.2 Constructor & Destructor Documentation

### 6.20.2.1 `__init__()`

```
def skdiscovery.data_structure.table.fusion.GraceFusion.__init__ (
    self,
    str_description,
    ap_paramList,
    metadata,
    column_data_name = 'Grace',
    column_error_name = 'Grace_Uncertainty' )
```

Initialize Grace Fusion item.

#### Parameters

<i>str_description</i>	String describing item
<i>ap_paramList[gldas]</i>	How to use of the global land data assimilation water model
<i>ap_paramList[mascons]</i>	Boolean indicating if the mascon solution should be used
<i>ap_paramList[apply_scale_factor]</i>	Boolean indicating if the scaling factors should be applied
<i>metadata</i>	Metadata that contains lat,lon coordinates based on data labels
<i>column_data_name</i>	Name of column for GRACE data
<i>column_error_name</i>	Grace Uncertainty column name

## 6.20.3 Member Function Documentation

### 6.20.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all currenter parameters

### 6.20.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.20.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.20.3.4 process()

```
def skdiscovery.data_structure.table.fusion.GraceFusion.process (
    self,
    obj_data )
```

Adds columns for GRACE data and uncertainties.

#### Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

### 6.20.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.20.4 Member Data Documentation

#### 6.20.4.1 `ap_paramList`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList` [inherited]

#### 6.20.4.2 `ap_paramNames`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames` [inherited]

#### 6.20.4.3 `column_data_name`

`skdiscovery.data_structure.table.fusion.GraceFusion.column_data_name`

#### 6.20.4.4 `column_error_name`

`skdiscovery.data_structure.table.fusion.GraceFusion.column_error_name`

#### 6.20.4.5 `metadata`

`skdiscovery.data_structure.table.fusion.GraceFusion.metadata`

#### 6.20.4.6 `str_description`

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

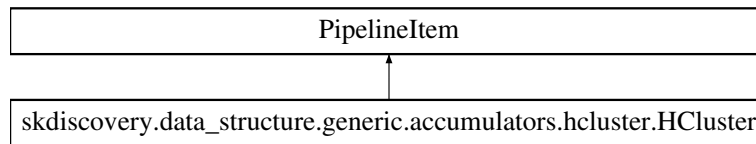
The documentation for this class was generated from the following file:

- [data\\_structure/table/fusion/grace.py](#)

## 6.21 skdiscovery.data\_structure.generic.accumulators.HCluster Class Reference

Hierarchical Clustering function that produces a cluster map of the distance matrix.

Inheritance diagram for skdiscovery.data\_structure.generic.accumulators.HCluster:



### Public Member Functions

- `def __init__(self, str_description, obj_name)`  
*Initialize [HCluster](#).*
- `def process(self, obj_data)`  
*Produces a cluster map and stores the linkage results.*

### Public Attributes

- `obj_name`

#### 6.21.1 Detailed Description

Hierarchical Clustering function that produces a cluster map of the distance matrix.

#### 6.21.2 Constructor & Destructor Documentation

##### 6.21.2.1 \_\_init\_\_()

```

def skdiscovery.data_structure.generic.accumulators.HCluster.__init__(
    self,
    str_description,
    obj_name )
  
```

Initialize [HCluster](#).

#### Parameters

<code>str_description</code>	String describing accumulator
<code>obj_name</code>	Name of distance matrix parameter in the <code>obj_data</code> results

Generated by Doxygen

### 6.21.3 Member Function Documentation

#### 6.21.3.1 process()

```
def skdiscovery.data_structure.generic.accumulators.HCluster.process (
    self,
    obj_data )
```

Produces a cluster map and stores the linkage results.

#### Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

### 6.21.4 Member Data Documentation

#### 6.21.4.1 obj\_name

```
skdiscovery.data_structure.generic.accumulators.HCluster.obj_name
```

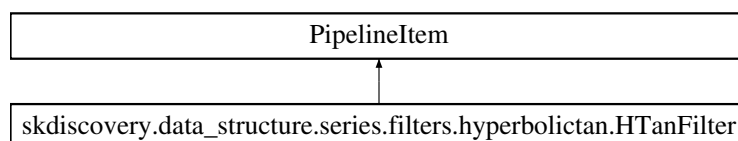
The documentation for this class was generated from the following file:

- [data\\_structure/generic/accumulators/hcluster.py](#)

## 6.22 skdiscovery.data\_structure.series.filters.HTanFilter Class Reference

Filter to subtract arctan fit from data.

Inheritance diagram for `skdiscovery.data_structure.series.filters.HTanFilter`:





## Public Member Functions

- `def __init__ (self, str_description, t0, amplitude=5, timescale=1., offset=0, slope=0, labels=None, column_names=None, start_time_limit=None, end_time_limit=None, start=None, end=None)`  
*Fit and remove hyperbolic tangent function from data.*
- `def process (self, obj_data)`  
*Apply Arctangent filter to data param.*

## Public Attributes

- `a`
- `t0`
- `c`
- `slope`
- `offset`
- `labels`
- `column_names`
- `start_time_limit`
- `end_time_limit`
- `start`
- `end`

### 6.22.1 Detailed Description

Filter to subtract arctan fit from data.

[DEPRECATED] [will be removed]

### 6.22.2 Constructor & Destructor Documentation

#### 6.22.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.series.filters.HTanFilter.__init__ (
    self,
    str_description,
    t0,
    amplitude = 5,
    timescale = 1.,
    offset = 0,
    slope = 0,
    labels = None,
    column_names = None,
    start_time_limit = None,
    end_time_limit = None,
    start = None,
    end = None )
```

Fit and remove hyperbolic tangent function from data.

## Parameters

<i>str_description</i>	String description of data
<i>t0</i>	Initial time offset of arctangent
<i>amplitude</i>	Initial amplitude of arctangent
<i>timescale</i>	Timescale of fit
<i>offset</i>	Initial Y offset of arctangent
<i>slope</i>	Slope of the data
<i>labels</i>	Labels to apply arctangent function to
<i>column_names</i>	Column names to apply arctanget function to
<i>start_time_limit</i>	Starting time bound for fit to arctan (default: no bound)
<i>end_time_limit</i>	Ending time bound for fit to arctan (default: no bound)
<i>start</i>	Index of the first data point to fit (default: index of first data point)
<i>end</i>	Index of the last data point to fit (default: index of last data point)

## 6.22.3 Member Function Documentation

## 6.22.3.1 process()

```
def skdiscovery.data_structure.series.filters.HTanFilter.process (
    self,
    obj_data )
```

Apply Arctangent filter to data param.

## Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

## 6.22.4 Member Data Documentation

## 6.22.4.1 a

```
skdiscovery.data_structure.series.filters.HTanFilter.a
```

#### 6.22.4.2 c

`skdiscovery.data_structure.series.filters.HTanFilter.c`

#### 6.22.4.3 column\_names

`skdiscovery.data_structure.series.filters.HTanFilter.column_names`

#### 6.22.4.4 end

`skdiscovery.data_structure.series.filters.HTanFilter.end`

#### 6.22.4.5 end\_time\_limit

`skdiscovery.data_structure.series.filters.HTanFilter.end_time_limit`

#### 6.22.4.6 labels

`skdiscovery.data_structure.series.filters.HTanFilter.labels`

#### 6.22.4.7 offset

`skdiscovery.data_structure.series.filters.HTanFilter.offset`

#### 6.22.4.8 slope

`skdiscovery.data_structure.series.filters.HTanFilter.slope`

#### 6.22.4.9 start

```
skdiscovery.data_structure.series.filters.HTanFilter.start
```

#### 6.22.4.10 start\_time\_limit

```
skdiscovery.data_structure.series.filters.HTanFilter.start_time_limit
```

#### 6.22.4.11 t0

```
skdiscovery.data_structure.series.filters.HTanFilter.t0
```

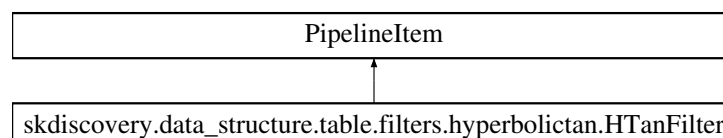
The documentation for this class was generated from the following file:

- [data\\_structure/series/filters/hyperbolic\\_tan.py](#)

## 6.23 skdiscovery.data\_structure.table.filters.HTanFilter Class Reference

Filter to subtract an arctan fit from data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.HTanFilter`:



### Public Member Functions

- `def __init__` (self, str\_description, [t0](#), amplitude=5, timescale=1., [offset](#)=0, [slope](#)=0, [labels](#)=None, [column\\_names](#)=None, [start\\_time\\_limit](#)=None, [end\\_time\\_limit](#)=None, [start](#)=None, [end](#)=None)  
Fit and remove hyperbolic tangent function from data.
- `def process` (self, obj\_data)  
Apply Arctangent filter to data param.

## Public Attributes

- [a](#)
- [t0](#)
- [c](#)
- [slope](#)
- [offset](#)
- [labels](#)
- [column\\_names](#)
- [start\\_time\\_limit](#)
- [end\\_time\\_limit](#)
- [start](#)
- [end](#)

### 6.23.1 Detailed Description

Filter to subtract an arctan fit from data.

### 6.23.2 Constructor & Destructor Documentation

#### 6.23.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.HTanFilter.__init__ (
    self,
    str_description,
    t0,
    amplitude = 5,
    timescale = 1.,
    offset = 0,
    slope = 0,
    labels = None,
    column_names = None,
    start_time_limit = None,
    end_time_limit = None,
    start = None,
    end = None )
```

Fit and remove hyperbolic tangent function from data.

#### Parameters

<i>str_description</i>	String description of data
<i>t0</i>	Initial time offset of arctangent
<i>amplitude</i>	initial amplitude of arctangent
<i>timescale</i>	Timescale of fit

## Parameters

<i>offset</i>	Initial Y offset of arctangent
<i>slope</i>	Slope of the data
<i>labels</i>	Labels to apply arctangent function to
<i>column_names</i>	Column names to apply arctanget function to
<i>start_time_limit</i>	Starting time bound for fit to arctan (default: no bound)
<i>end_time_limit</i>	Ending time bound for fit to arctan (default: no bound)
<i>start</i>	Index of the first data point to fit (default: index of first data point)
<i>end</i>	Index of the last data point to fit (default: index of last data point)

## 6.23.3 Member Function Documentation

## 6.23.3.1 process()

```
def skdiscovery.data_structure.table.filters.HTanFilter.process (
    self,
    obj_data )
```

Apply Arctangent filter to data param.

## Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

## 6.23.4 Member Data Documentation

## 6.23.4.1 a

```
skdiscovery.data_structure.table.filters.HTanFilter.a
```

## 6.23.4.2 c

```
skdiscovery.data_structure.table.filters.HTanFilter.c
```

#### 6.23.4.3 column\_names

skdiscovery.data\_structure.table.filters.HTanFilter.column\_names

#### 6.23.4.4 end

skdiscovery.data\_structure.table.filters.HTanFilter.end

#### 6.23.4.5 end\_time\_limit

skdiscovery.data\_structure.table.filters.HTanFilter.end\_time\_limit

#### 6.23.4.6 labels

skdiscovery.data\_structure.table.filters.HTanFilter.labels

#### 6.23.4.7 offset

skdiscovery.data\_structure.table.filters.HTanFilter.offset

#### 6.23.4.8 slope

skdiscovery.data\_structure.table.filters.HTanFilter.slope

#### 6.23.4.9 start

skdiscovery.data\_structure.table.filters.HTanFilter.start

#### 6.23.4.10 start\_time\_limit

`skdiscovery.data_structure.table.filters.HTanFilter.start_time_limit`

#### 6.23.4.11 t0

`skdiscovery.data_structure.table.filters.HTanFilter.t0`

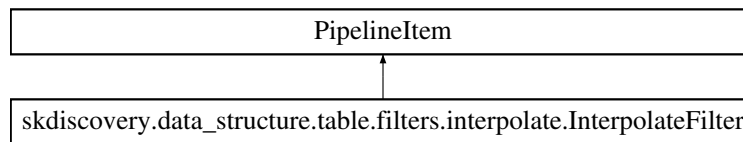
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/hyperbolictan.py](#)

## 6.24 skdiscovery.data\_structure.table.filters.InterpolateFilter Class Reference

Interpolate missing values on table data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.InterpolateFilter`:



### Public Member Functions

- def [process](#) (self, obj\_data)  
*Interpolate missing data in obj\_data DataWrapper.*

#### 6.24.1 Detailed Description

Interpolate missing values on table data.

#### 6.24.2 Member Function Documentation

##### 6.24.2.1 process()

```
def skdiscovery.data_structure.table.filters.InterpolateFilter.process (
    self,
    obj_data )
```

Interpolate missing data in `obj_data` DataWrapper.



## Parameters

<code>obj_data</code>	Input DataWrapper, will be modified in place
-----------------------	--

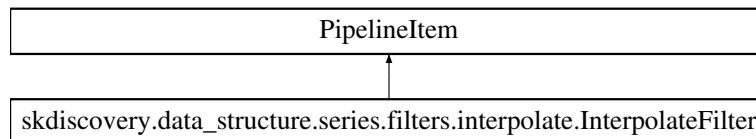
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/interpolate.py](#)

## 6.25 skdiscovery.data\_structure.series.filters.InterpolateFilter Class Reference

Interpolate missing values on series data.

Inheritance diagram for `skdiscovery.data_structure.series.filters.InterpolateFilter`:



### Public Member Functions

- `def process (self, obj_data)`  
*Interpolate missing data in obj\_data DataWrapper.*

#### 6.25.1 Detailed Description

Interpolate missing values on series data.

#### 6.25.2 Member Function Documentation

##### 6.25.2.1 process()

```
def skdiscovery.data_structure.series.filters.InterpolateFilter.process (
    self,
    obj_data )
```

Interpolate missing data in `obj_data` DataWrapper.

**Parameters**

<code>obj_data</code>	Input DataWrapper, will be modified in place
-----------------------	--

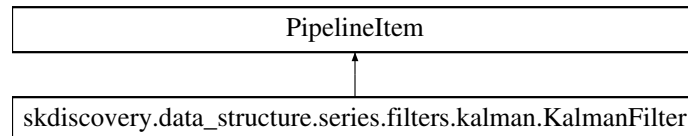
The documentation for this class was generated from the following file:

- [data\\_structure/series/filters/interpolate.py](#)

## 6.26 skdiscovery.data\_structure.series.filters.KalmanFilter Class Reference

Runs a forward and backward Kalman Smoother with a FOGM state on series data.

Inheritance diagram for `skdiscovery.data_structure.series.filters.KalmanFilter`:

**Public Member Functions**

- `def __init__(self, str_description, ap_paramList, uncertainty\_clip=5)`  
*Initialize Kalman Smoother.*
- `def process(self, obj_data)`  
*Apply kalman smoother to data set.*

**Public Attributes**

- [uncertainty\\_clip](#)
- [ap\\_paramNames](#)

### 6.26.1 Detailed Description

Runs a forward and backward Kalman Smoother with a FOGM state on series data.

For more information see: Ji, K. H. 2011, PhD thesis, MIT, and Fraser, D. C., and Potter, J. E. 1969, IEEE Trans. Automat. Contr., Acl4, 4, 387-390

### 6.26.2 Constructor & Destructor Documentation

6.26.2.1 `__init__()`

```
def skdiscovery.data_structure.series.filters.KalmanFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    uncertainty_clip = 5 )
```

Initialize Kalman Smoother.

## Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ap_tau]</i>	the correlation time
<i>ap_paramList[ap_sigmaSq]</i>	the data noise
<i>ap_paramList[ap_R]</i>	the process noise
<i>uncertainty_clip</i>	Clip data with uncertainties greater than <code>uncertainty_clip * median uncertainty</code>

## 6.26.3 Member Function Documentation

6.26.3.1 `process()`

```
def skdiscovery.data_structure.series.filters.KalmanFilter.process (
    self,
    obj_data )
```

Apply kalman smoother to data set.

## Parameters

<i>obj_data</i>	Input DataWrapper. Changes are made in place.
-----------------	---

## 6.26.4 Member Data Documentation

6.26.4.1 `ap_paramNames`

```
skdiscovery.data_structure.series.filters.KalmanFilter.ap_paramNames
```

### 6.26.4.2 uncertainty\_clip

`skdiscovery.data_structure.series.filters.KalmanFilter.uncertainty_clip`

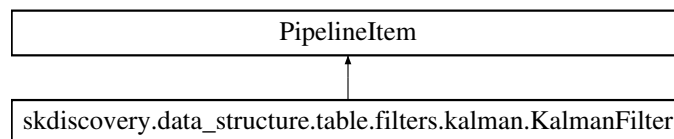
The documentation for this class was generated from the following file:

- `data_structure/series/filters/kalman.py`

## 6.27 skdiscovery.data\_structure.table.filters.KalmanFilter Class Reference

Runs a forward and backward Kalman Smoother with a FOGM state on table data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.KalmanFilter`:



### Public Member Functions

- `def __init__(self, str_description, ap_paramList, uncertainty_clip=5, column_names=None, error_column_names=None, fillna=True)`  
*Initialize Kalman Smoother.*
- `def process(self, obj_data)`  
*Apply kalman smoother to data set.*

### Public Attributes

- `uncertainty_clip`
- `ap_paramNames`
- `column_names`
- `error_column_names`
- `fillna`

### 6.27.1 Detailed Description

Runs a forward and backward Kalman Smoother with a FOGM state on table data.

For more information see: Ji, K. H. 2011, PhD thesis, MIT, and Fraser, D. C., and Potter, J. E. 1969, IEEE Trans. Automat. Contr., Acl4, 4, 387-390

## 6.27.2 Constructor & Destructor Documentation

### 6.27.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.KalmanFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    uncertainty_clip = 5,
    column_names = None,
    error_column_names = None,
    fillna = True )
```

Initialize Kalman Smoother.

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ap_tau]</i>	the correlation time
<i>ap_paramList[ap_sigmaSq]</i>	the data noise
<i>ap_paramList[ap_R]</i>	the process noise
<i>uncertainty_clip</i>	Clip data with uncertainties greater than <i>uncertainty_clip</i> * median uncertainty
<i>column_names</i>	List of column names to smooth (using None will apply to all columns)
<i>error_column_names</i>	List of error column names to smooth (using None will use default error columns)
<i>fillna</i>	Fill in missing values

## 6.27.3 Member Function Documentation

### 6.27.3.1 process()

```
def skdiscovery.data_structure.table.filters.KalmanFilter.process (
    self,
    obj_data )
```

Apply kalman smoother to data set.

#### Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

## 6.27.4 Member Data Documentation

### 6.27.4.1 `ap_paramNames`

`skdiscovery.data_structure.table.filters.KalmanFilter.ap_paramNames`

### 6.27.4.2 `column_names`

`skdiscovery.data_structure.table.filters.KalmanFilter.column_names`

### 6.27.4.3 `error_column_names`

`skdiscovery.data_structure.table.filters.KalmanFilter.error_column_names`

### 6.27.4.4 `fillna`

`skdiscovery.data_structure.table.filters.KalmanFilter.fillna`

### 6.27.4.5 `uncertainty_clip`

`skdiscovery.data_structure.table.filters.KalmanFilter.uncertainty_clip`

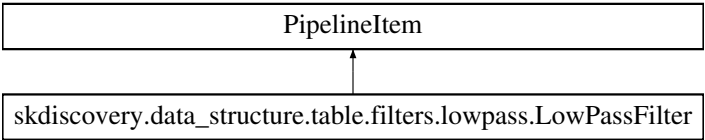
The documentation for this class was generated from the following file:

- `data_structure/table/filters/kalman.py`

## 6.28 skdiscovery.data\_structure.table.filters.LowPassFilter Class Reference

A remez low pass filter for table data.

Inheritance diagram for skdiscovery.data\_structure.table.filters.LowPassFilter:



### Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList)  
*Initialize [LowPassFilter](#).*
- def `process` (self, obj\_data)  
*Apply lowpass filter to data set.*

### Public Attributes

- [ap\\_paramNames](#)

### 6.28.1 Detailed Description

A remez low pass filter for table data.

### 6.28.2 Constructor & Destructor Documentation

#### 6.28.2.1 `__init__`()

```
def skdiscovery.data_structure.table.filters.LowPassFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize [LowPassFilter](#).

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ntaps]</i>	number of filter taps
<i>ap_paramList[passf_per]</i>	frequency passband ratio/percentage
<i>ap_paramList[fstopf_per]</i>	frequency stopband ratio/percentage
<i>ap_paramList[wgths]</i>	band importance weights
<i>ap_paramList[miter]</i>	maximum number of iterations for generating the filter

### 6.28.3 Member Function Documentation

#### 6.28.3.1 process()

```
def skdiscovery.data_structure.table.filters.LowPassFilter.process (
    self,
    obj_data )
```

Apply lowpass filter to data set.

##### Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

### 6.28.4 Member Data Documentation

#### 6.28.4.1 ap\_paramNames

```
skdiscovery.data_structure.table.filters.LowPassFilter.ap_paramNames
```

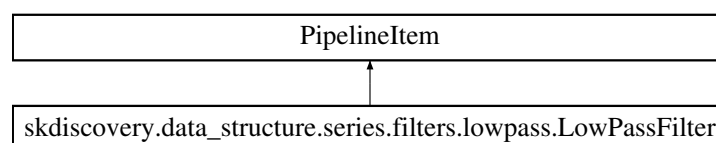
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/lowpass.py](#)

## 6.29 skdiscovery.data\_structure.series.filters.LowPassFilter Class Reference

A FIR Remez (Parks-McLellan) designed low pass filter for series data.

Inheritance diagram for `skdiscovery.data_structure.series.filters.LowPassFilter`:





## Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList)  
*Initialize [LowPassFilter](#).*
- def `process` (self, obj\_data)  
*Apply lowpass filter to data set, with changes applied in place.*

## Public Attributes

- `ap_paramNames`

### 6.29.1 Detailed Description

A FIR Remez (Parks-McLellan) designed low pass filter for series data.

### 6.29.2 Constructor & Destructor Documentation

#### 6.29.2.1 `__init__()`

```
def skdiscovery.data_structure.series.filters.LowPassFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize [LowPassFilter](#).

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ntaps]</i>	Number of filter taps
<i>ap_paramList[fpassf_per]</i>	Frequency passband ratio/percentage
<i>ap_paramList[fstopf_per]</i>	Frequency stopband ratio/percentage
<i>ap_paramList[wgths]</i>	Band importance weights
<i>ap_paramList[miter]</i>	Maximum number of iterations for generating the filter

### 6.29.3 Member Function Documentation

### 6.29.3.1 process()

```
def skdiscovery.data_structure.series.filters.LowPassFilter.process (
    self,
    obj_data )
```

Apply lowpass filter to data set, with changes applied in place.

#### Parameters

<i>obj_data</i>	Input data with data
-----------------	----------------------

## 6.29.4 Member Data Documentation

### 6.29.4.1 ap\_paramNames

```
skdiscovery.data_structure.series.filters.LowPassFilter.ap_paramNames
```

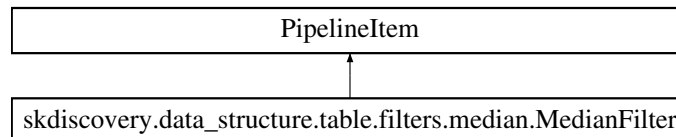
The documentation for this class was generated from the following file:

- [data\\_structure/series/filters/lowpass.py](#)

## 6.30 skdiscovery.data\_structure.table.filters.MedianFilter Class Reference

A Median filter for table data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.MedianFilter`:



### Public Member Functions

- `def __init__ (self, str_description, ap_paramList, interpolate=True, subtract=False, regular\_period=True, min\_periods=1)`  
Initialize [MedianFilter](#).
- `def process (self, obj_data)`  
Apply median filter to data set.

## Public Attributes

- [interpolate](#)
- [subtract](#)
- [ap\\_paramNames](#)
- [regular\\_period](#)
- [min\\_periods](#)

### 6.30.1 Detailed Description

A Median filter for table data.

### 6.30.2 Constructor & Destructor Documentation

#### 6.30.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.MedianFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    interpolate = True,
    subtract = False,
    regular_period = True,
    min_periods = 1 )
```

Initialize [MedianFilter](#).

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ap_window]</i>	median filter window width
<i>interpolate</i>	Interpolate data points before filtering
<i>subtract</i>	Subtract filtered result from original
<i>regular_period</i>	Assume the data is regularly sampled
<i>min_periods</i>	Minimum required number of data points in window

### 6.30.3 Member Function Documentation

#### 6.30.3.1 process()

```
def skdiscovery.data_structure.table.filters.MedianFilter.process (
    self,
    obj_data )
```

Apply median filter to data set.

##### Parameters

<i>obj_data</i>	Input panda's data series. Changes are made in place.
-----------------	---

### 6.30.4 Member Data Documentation

#### 6.30.4.1 ap\_paramNames

```
skdiscovery.data_structure.table.filters.MedianFilter.ap_paramNames
```

#### 6.30.4.2 interpolate

```
skdiscovery.data_structure.table.filters.MedianFilter.interpolate
```

#### 6.30.4.3 min\_periods

```
skdiscovery.data_structure.table.filters.MedianFilter.min_periods
```

#### 6.30.4.4 regular\_period

```
skdiscovery.data_structure.table.filters.MedianFilter.regular_period
```

## 6.30.4.5 subtract

```
skdiscovery.data_structure.table.filters.MedianFilter.subtract
```

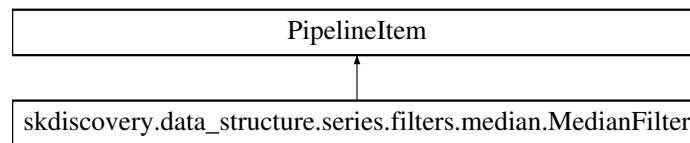
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/median.py](#)

## 6.31 skdiscovery.data\_structure.series.filters.MedianFilter Class Reference

A Median filter for series data.

Inheritance diagram for skdiscovery.data\_structure.series.filters.MedianFilter:



## Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList, [interpolate](#)=True, [subtract](#)=False)  
Initialize [MedianFilter](#).
- def [process](#) (self, obj\_data)  
Apply median filter to data set.

## Public Attributes

- [interpolate](#)
- [subtract](#)
- [ap\\_paramNames](#)

## 6.31.1 Detailed Description

A Median filter for series data.

## 6.31.2 Constructor &amp; Destructor Documentation

6.31.2.1 `__init__()`

```
def skdiscovery.data_structure.series.filters.MedianFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    interpolate = True,
    subtract = False )
```

Initialize [MedianFilter](#).

**Parameters**

<i>str_description</i>	String describing filter
<i>ap_paramList[ap_window]</i>	median filter window width
<i>interpolate</i>	Flag to interpolate data points before filtering
<i>subtract</i>	Flag to subtract filtered result from original

**6.31.3 Member Function Documentation****6.31.3.1 process()**

```
def skdiscovery.data_structure.series.filters.MedianFilter.process (
    self,
    obj_data )
```

Apply median filter to data set.

**Parameters**

<i>obj_data</i>	Input DataWrapper. Changes are made in place.
-----------------	---

**6.31.4 Member Data Documentation****6.31.4.1 ap\_paramNames**

```
skdiscovery.data_structure.series.filters.MedianFilter.ap_paramNames
```

**6.31.4.2 interpolate**

```
skdiscovery.data_structure.series.filters.MedianFilter.interpolate
```

## 6.31.4.3 subtract

```
skdiscovery.data_structure.series.filters.MedianFilter.subtract
```

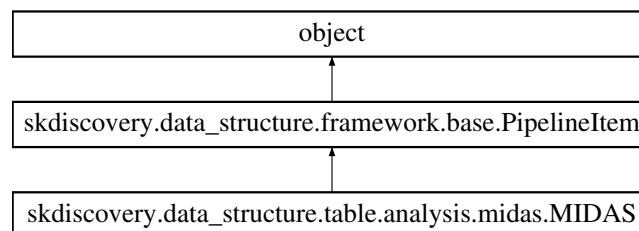
The documentation for this class was generated from the following file:

- [data\\_structure/series/filters/median.py](#)

## 6.32 skdiscovery.data\_structure.table.analysis.MIDAS Class Reference

*In Development* A basic [MIDAS](#) trend estimator

Inheritance diagram for `skdiscovery.data_structure.table.analysis.MIDAS`:



## Public Member Functions

- `def __init__(self, str_description, column_names=None)`  
*Initiatlize the [MIDAS](#) filtering item.*
- `def process(self, obj_data)`  
*Apply the [MIDAS](#) estimator to generate velocity estimates.*
- `def perturbParams(self)`  
*choose other random value for all parameters*
- `def resetParams(self)`  
*set all parameters to initial value*
- `def __str__(self)`  
*String represntation of object.*
- `def getMetadata(self)`  
*Retrieve metadata about filter.*

## Public Attributes

- [column\\_names](#)
- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.32.1 Detailed Description

*In Development* A basic MIDAS trend estimator

See <http://onlinelibrary.wiley.com/doi/10.1002/2015JB012552/full>

### 6.32.2 Constructor & Destructor Documentation

#### 6.32.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.analysis.MIDAS.__init__ (
    self,
    str_description,
    column_names = None )
```

Initiatlize the MIDAS filtering item.

##### Parameters

<i>str_description</i>	String description of filter
<i>column_names</i>	List of column names to analyze

### 6.32.3 Member Function Documentation

#### 6.32.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

##### Returns

String listing all currenter parameters



### 6.32.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.32.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.32.3.4 process()

```
def skdiscovery.data_structure.table.analysis.MIDAS.process (
    self,
    obj_data )
```

Apply the [MIDAS](#) estimator to generate velocity estimates.

Adds the result to the data wrapper

#### Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

### 6.32.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.32.4 Member Data Documentation

#### 6.32.4.1 `ap_paramList`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList` [inherited]

#### 6.32.4.2 `ap_paramNames`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames` [inherited]

#### 6.32.4.3 `column_names`

`skdiscovery.data_structure.table.analysis.MIDAS.column_names`

#### 6.32.4.4 `str_description`

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

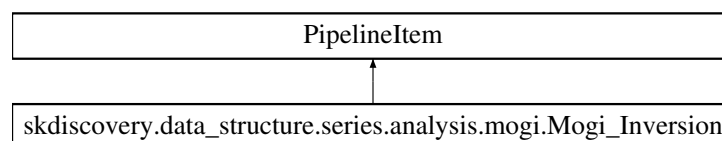
The documentation for this class was generated from the following file:

- `data_structure/table/analysis/midas.py`

## 6.33 `skdiscovery.data_structure.series.analysis.Mogi_Inversion` Class Reference

Perform a Mogi source inversion on a set of gps series data.

Inheritance diagram for `skdiscovery.data_structure.series.analysis.Mogi_Inversion`:



## Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList)  
*Initialize Mogi analysis item.*
- def `FitPCA` (self, hPCA\_Proj)  
*Determine the timing of the inflation event.*
- def `FitTimeSeries` (self, pd\_series, ct)  
*Fits the amplitude and offset of an inflation event given the time and length of the event.*
- def `process` (self, obj\_data)  
*Finds the magma source (default-mogi) from PBO GPS data.*

## Public Attributes

- `ap_paramNames`

### 6.33.1 Detailed Description

Perform a Mogi source inversion on a set of gps series data.

The source is assumed to be a Mogi source (point source), but other source models can be selected. Assumes directions are named ('dN', 'dE', 'dU').

### 6.33.2 Constructor & Destructor Documentation

#### 6.33.2.1 `__init__()`

```
def skdiscovery.data_structure.series.analysis.Mogi_Inversion.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Mogi analysis item.

#### Parameters

<code>str_description</code>	Description of the item
<code>ap_paramList[h_pca_name]</code>	Name of the pca computed by General_Component_Analysis. Gets start and end date from the PCA fit.
<code>ap_paramList[source_type]</code>	Type of magma chamber source model to use (mogi [default],finite_sphere,closed_pipe,constant_open_pipe,rising_open_pipe,sill)

### 6.33.3 Member Function Documentation

#### 6.33.3.1 FitPCA()

```
def skdiscovery.data_structure.series.analysis.Mogi_Inversion.FitPCA (
    self,
    hPCA_Proj )
```

Determine the timing of the inflation event.

Uses the first component of the pca projection and fits  $A * \arctan( (t - t_0) / c ) + B$  to the first pca projection.

##### Parameters

<i>hPCA_Proj</i>	The sklearn PCA projection
------------------	----------------------------

##### Returns

[t0, c]

#### 6.33.3.2 FitTimeSeries()

```
def skdiscovery.data_structure.series.analysis.Mogi_Inversion.FitTimeSeries (
    self,
    pd_series,
    ct )
```

Fits the amplitude and offset of an inflation event given the time and length of the event.

Fits A and B in  $A * \arctan( (t - t_0) / c ) + B$

##### Parameters

<i>pd_series</i>	Time series to be fit
<i>ct</i>	[t0, c]

##### Returns

Amplitude of fit

## 6.33.3.3 process()

```
def skdiscovery.data_structure.series.analysis.Mogi_Inversion.process (
    self,
    obj_data )
```

Finds the magma source (default-mogi) from PBO GPS data.

Assumes time series columns are named ('dN', 'dE', 'dU'). Predicts location of the magma source using `scipy.optimize.curve_fit`

The location of the magma source is stored in the data wrapper as a list `res[0]` = latitude `res[1]` = longitude `res[2]` = source depth (km) `res[3]` = volume change (meters<sup>3</sup>) `res[4]` = extra parameters (depends on mogi fit type)

## Parameters

<code>obj_data</code>	Data object containing the results from the PCA stage
-----------------------	---

## 6.33.4 Member Data Documentation

## 6.33.4.1 ap\_paramNames

```
skdiscovery.data_structure.series.analysis.Mogi_Inversion.ap_paramNames
```

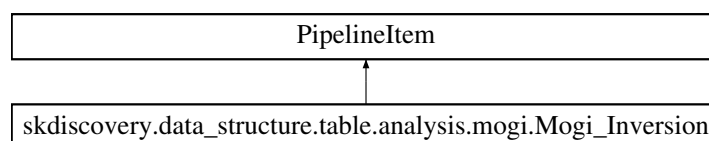
The documentation for this class was generated from the following file:

- `data_structure/series/analysis/mogi.py`

## 6.34 skdiscovery.data\_structure.table.analysis.Mogi\_Inversion Class Reference

Perform a mogi source inversion on a set of gps table data.

Inheritance diagram for `skdiscovery.data_structure.table.analysis.Mogi_Inversion`:



## Public Member Functions

- `def __init__ (self, str_description, ap_paramList, pca\_name, column\_names=['dN', dE, dU])`
- Initialize Mogi analysis item.*
- `def FitPCA (self, hPCA_Proj)`
- Determine the timing of the inflation event from the first component of the pca projection.*
- `def FitTimeSeries (self, pd_series, ct)`
- Fits the amplitude and offset of an inflation event given the time and length of the event.*
- `def process (self, obj_data)`
- Finds the magma source (default-mogi) from PBO GPS data.*

## Public Attributes

- [pca\\_name](#)
- [column\\_names](#)
- [ap\\_paramNames](#)

### 6.34.1 Detailed Description

Perform a mogi source inversion on a set of gps table data.

The source is assumed to be a mogi source (point source), but other source models can be selected. Assumes directions are named ('dN', 'dE', 'dU').

### 6.34.2 Constructor & Destructor Documentation

#### 6.34.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.analysis.Mogi_Inversion.__init__ (
    self,
    str_description,
    ap_paramList,
    pca_name,
    column_names = ['dN',
    dE,
    dU ]
)
```

Initialize Mogi analysis item.

#### Parameters

<i>str_description</i>	Description of item
<i>ap_paramList[source_type]</i>	Type of magma chamber source model to use (default-mogi,finite_sphere,closed_pipe,constant_open_pipe,rising_open_pipe,sill)
<i>pca_name</i>	Name of pca result
<i>column_names</i>	The data direction column names

### 6.34.3 Member Function Documentation

#### 6.34.3.1 FitPCA()

```
def skdiscovery.data_structure.table.analysis.Mogi_Inversion.FitPCA (
    self,
    hPCA_Proj )
```

Determine the timing of the inflation event from the first component of the pca projection.

fits  $A * \arctan( (t - t_0) / c ) + B$  to the first pca projection, in order to estimate source amplitude parameters

##### Parameters

<i>hPCA_Proj</i>	The sklearn PCA
------------------	-----------------

##### Returns

ct: the t0, c, and B parameters from the fit  
pA[0]: the fitted amplitude parameter

#### 6.34.3.2 FitTimeSeries()

```
def skdiscovery.data_structure.table.analysis.Mogi_Inversion.FitTimeSeries (
    self,
    pd_series,
    ct )
```

Fits the amplitude and offset of an inflation event given the time and length of the event.

Fits A and B in  $A * \arctan( (t - t_0) / c ) + B$

##### Parameters

<i>pd_series</i>	Time series to be fit
<i>ct</i>	the time constants for the arctan

##### Returns

res: Amplitude of the fit  
perr\_leastsq: Error of the fit

### 6.34.3.3 process()

```
def skdiscovery.data_structure.table.analysis.Mogi_Inversion.process (
    self,
    obj_data )
```

Finds the magma source (default-mogi) from PBO GPS data.

Assumes time series columns are named ('dN', 'dE', 'dU'). Predicts the location of the magma source using `scipy.optimize.curve_fit`.

The result is added to the data wrapper as a list, with the four elements describing the location of the magma source: `res[0]` = latitude `res[1]` = longitude `res[2]` = source depth (km) `res[3]` = volume change (meters<sup>3</sup>)

#### Parameters

<code>obj_data</code>	
-----------------------	--

## 6.34.4 Member Data Documentation

### 6.34.4.1 ap\_paramNames

```
skdiscovery.data_structure.table.analysis.Mogi_Inversion.ap_paramNames
```

### 6.34.4.2 column\_names

```
skdiscovery.data_structure.table.analysis.Mogi_Inversion.column_names
```

### 6.34.4.3 pca\_name

```
skdiscovery.data_structure.table.analysis.Mogi_Inversion.pca_name
```

The documentation for this class was generated from the following file:

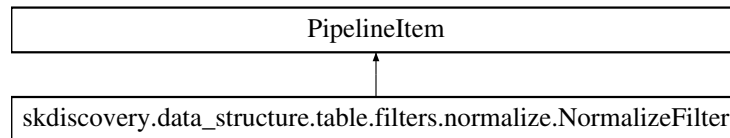
- `data_structure/table/analysis/mogi.py`



## 6.35 skdiscovery.data\_structure.table.filters.NormalizeFilter Class Reference

Normalize data using median filter.

Inheritance diagram for skdiscovery.data\_structure.table.filters.NormalizeFilter:



### Public Member Functions

- `def __init__ (self, str_description, column='PDCSAP_FLUX', group_column='QUARTER')`  
*Initilaize [NormalizeFilter](#).*
- `def process (self, obj_data)`  
*Apply Normalization filter to data wrapper.*

### Public Attributes

- `column`
- `group_column`

#### 6.35.1 Detailed Description

Normalize data using median filter.

#### 6.35.2 Constructor & Destructor Documentation

##### 6.35.2.1 \_\_init\_\_()

```

def skdiscovery.data_structure.table.filters.NormalizeFilter.__init__ (
    self,
    str_description,
    column = 'PDCSAP_FLUX',
    group_column = 'QUARTER' )
  
```

Initilaize [NormalizeFilter](#).

**Parameters**

<i>str_description</i>	String describing filter
<i>column</i>	Name of column to normalize
<i>group_column</i>	Column to use to group data

**6.35.3 Member Function Documentation****6.35.3.1 process()**

```
def skdiscovery.data_structure.table.filters.NormalizeFilter.process (
    self,
    obj_data )
```

Apply Normalization filter to data wrapper.

**Parameters**

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

**6.35.4 Member Data Documentation****6.35.4.1 column**

```
skdiscovery.data_structure.table.filters.NormalizeFilter.column
```

**6.35.4.2 group\_column**

```
skdiscovery.data_structure.table.filters.NormalizeFilter.group_column
```

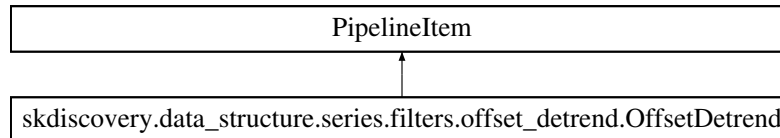
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/normalize.py](#)

## 6.36 skdiscovery.data\_structure.series.filters.OffsetDetrend Class Reference

Trend filter that fits a stepwise function to linearly detrended series data.

Inheritance diagram for skdiscovery.data\_structure.series.filters.OffsetDetrend:



### Public Member Functions

- `def __init__ (self, str_description, ap_paramList=[], labels=None, column_names=None, time_point=None, time_interval=None)`  
Initialize *OffsetDetrend* filter.
- `def process (self, obj_data)`  
Apply offset estimation and detrending filter to data set.

### Public Attributes

- `labels`
- `column_names`
- `time_point`
- `time_interval`
- `ap_paramNames`

#### 6.36.1 Detailed Description

Trend filter that fits a stepwise function to linearly detrended series data.

On detrended data this filter fits a stepwise function (number of steps provided by the user) to correct the linear fit by accounting for discontinuous offsets, such as due to a change in the antenna or from an earthquake. The final linear fit handles each portion of the offset independently. If the number of discontinuities is not provided as an autoparam, the filter assumes a single discontinuity.

#### 6.36.2 Constructor & Destructor Documentation

### 6.36.2.1 `__init__()`

```
def skdiscovery.data_structure.series.filters.OffsetDetrend.__init__ (
    self,
    str_description,
    ap_paramList = [],
    labels = None,
    column_names = None,
    time_point = None,
    time_interval = None )
```

Initialize [OffsetDetrend](#) filter.

## Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[step_count]</i>	Number of steps to remove from data (Default: 1)
<i>labels</i>	List of labels used to select data to be removed (using None will apply to all labels)
<i>column_names</i>	List of column names to select data to be removed (using None will apply to all columns)
<i>time_point</i>	Time of offset
<i>time_interval</i>	Interval within which the offset occurs

## 6.36.3 Member Function Documentation

## 6.36.3.1 process()

```
def skdiscovery.data_structure.series.filters.OffsetDetrend.process (
    self,
    obj_data )
```

Apply offset estimation and detrending filter to data set.

## Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

## 6.36.4 Member Data Documentation

## 6.36.4.1 ap\_paramNames

```
skdiscovery.data_structure.series.filters.OffsetDetrend.ap_paramNames
```

## 6.36.4.2 column\_names

```
skdiscovery.data_structure.series.filters.OffsetDetrend.column_names
```

#### 6.36.4.3 labels

```
skdiscovery.data_structure.series.filters.OffsetDetrend.labels
```

#### 6.36.4.4 time\_interval

```
skdiscovery.data_structure.series.filters.OffsetDetrend.time_interval
```

#### 6.36.4.5 time\_point

```
skdiscovery.data_structure.series.filters.OffsetDetrend.time_point
```

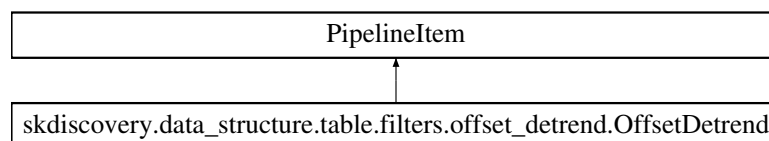
The documentation for this class was generated from the following file:

- [data\\_structure/series/filters/offset\\_detrend.py](#)

### 6.37 skdiscovery.data\_structure.table.filters.OffsetDetrend Class Reference

Trend filter that fits a stepwise function to linearly detrended table data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.OffsetDetrend`:



#### Public Member Functions

- `def __init__` (self, str\_description, [column\\_names](#), ap\_paramList=[], [labels](#)=None, [time\\_point](#)=None, [time\\_interval](#)=None)  
Initialize [OffsetDetrend](#) filter for use on table data.
- `def process` (self, obj\_data)  
Apply offset estimation and detrending filter to data set.

## Public Attributes

- [labels](#)
- [column\\_names](#)
- [time\\_point](#)
- [time\\_interval](#)
- [ap\\_paramNames](#)

### 6.37.1 Detailed Description

Trend filter that fits a stepwise function to linearly detrended table data.

On detrended data this filter fits a stepwise function (number of steps provided by the user) to correct the linear fit by accounting for discontinuous offsets, such as due to a change in the antenna or from an earthquake. The final linear fit handles each portion of the offset independently. If the number of discontinuities is not provided as an autoparam, the filter assumes a single discontinuity.

### 6.37.2 Constructor & Destructor Documentation

#### 6.37.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.OffsetDetrend.__init__ (
    self,
    str_description,
    column_names,
    ap_paramList = [],
    labels = None,
    time_point = None,
    time_interval = None )
```

Initialize [OffsetDetrend](#) filter for use on table data.

#### Parameters

<i>str_description</i>	String describing filter
<i>column_names</i>	List of column names to select data to be removed (using None will apply to all columns)
<i>ap_paramList[step_count]</i>	Number of steps to remove from data (Default: 1)
<i>labels</i>	List of labels used to select data to be removed (using None will apply to all labels)
<i>time_point</i>	Time of offset
<i>time_interval</i>	Interval within which the offset occurs

### 6.37.3 Member Function Documentation

#### 6.37.3.1 process()

```
def skdiscovery.data_structure.table.filters.OffsetDetrend.process (
    self,
    obj_data )
```

Apply offset estimation and detrending filter to data set.

##### Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

### 6.37.4 Member Data Documentation

#### 6.37.4.1 ap\_paramNames

```
skdiscovery.data_structure.table.filters.OffsetDetrend.ap_paramNames
```

#### 6.37.4.2 column\_names

```
skdiscovery.data_structure.table.filters.OffsetDetrend.column_names
```

#### 6.37.4.3 labels

```
skdiscovery.data_structure.table.filters.OffsetDetrend.labels
```

#### 6.37.4.4 time\_interval

```
skdiscovery.data_structure.table.filters.OffsetDetrend.time_interval
```



## 6.37.4.5 time\_point

skdiscovery.data\_structure.table.filters.OffsetDetrend.time\_point

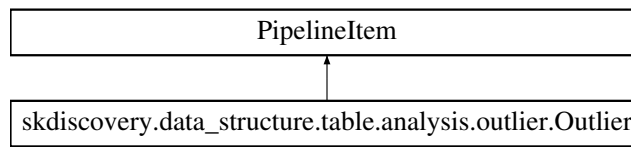
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/offset\\_detrend.py](#)

## 6.38 skdiscovery.data\_structure.table.analysis.Outlier Class Reference

Computes (data / mad(data)) for outlier detection.

Inheritance diagram for skdiscovery.data\_structure.table.analysis.Outlier:



## Public Member Functions

- `def __init__(self, str_description, columns=None, name_prefix='MAD_Scale_')`  
Initialize *Outlier* Item.
- `def process(self, obj_data)`  
Process the data object to add a column with the outlier scores.

## Public Attributes

- `columns`
- `name_prefix`

## 6.38.1 Detailed Description

Computes (data / mad(data)) for outlier detection.

Creates a new column for the result

## 6.38.2 Constructor &amp; Destructor Documentation

## 6.38.2.1 \_\_init\_\_()

```

def skdiscovery.data_structure.table.analysis.Outlier.__init__(
    self,
    str_description,
    columns = None,
    name_prefix = 'MAD_Scale_' )

```

Initialize *Outlier* Item.

**Parameters**

<i>str_description</i>	Name of Item
<i>columns</i>	List of of column names
<i>name_prefix</i>	Prefix of newly created column

**6.38.3 Member Function Documentation****6.38.3.1 process()**

```
def skdiscovery.data_structure.table.analysis.Outlier.process (
    self,
    obj_data )
```

Process the data object to add a column with the outlier scores.

**Parameters**

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

**6.38.4 Member Data Documentation****6.38.4.1 columns**

```
skdiscovery.data_structure.table.analysis.Outlier.columns
```

**6.38.4.2 name\_prefix**

```
skdiscovery.data_structure.table.analysis.Outlier.name_prefix
```

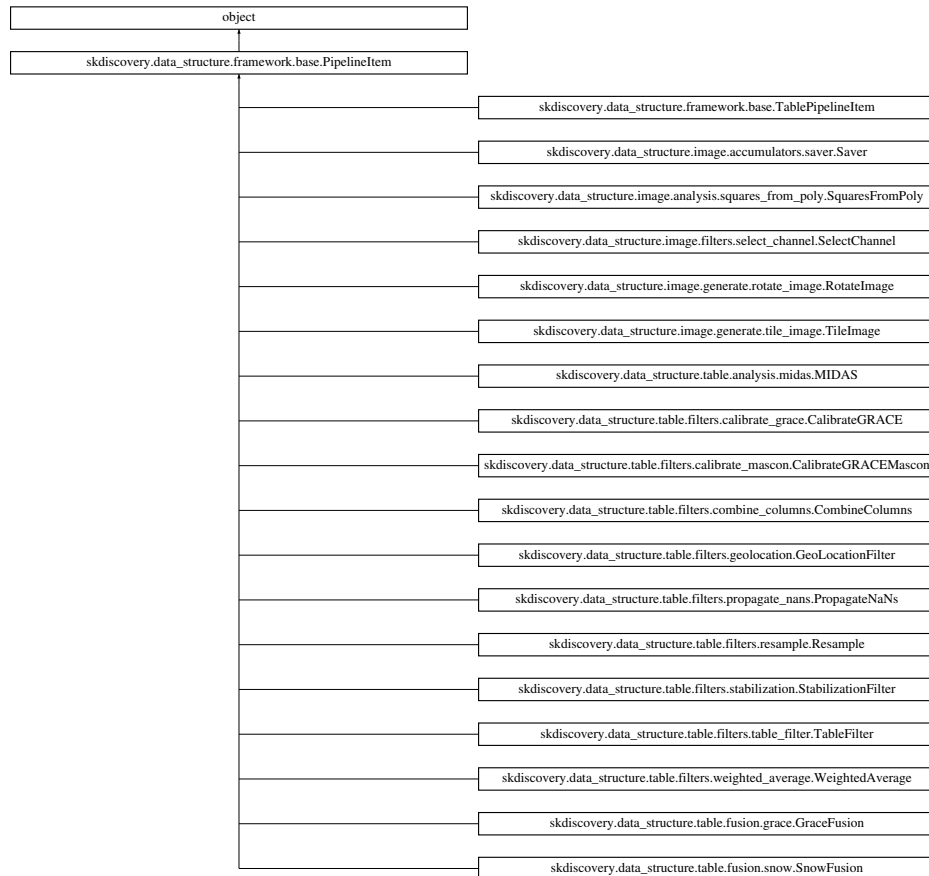
The documentation for this class was generated from the following file:

- data\_structure/table/analysis/[outlier.py](#)

## 6.39 skdiscovery.data\_structure.framework.PipelineItem Class Reference

The general class used to create pipeline items.

Inheritance diagram for skdiscovery.data\_structure.framework.PipelineItem:



### Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList=[])  
*Initialize an object.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `process` (self, obj\_data)  
*The actual filter processing.*
- def `__str__` (self)  
*String representation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

## Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.39.1 Detailed Description

The general class used to create pipeline items.

### 6.39.2 Constructor & Destructor Documentation

#### 6.39.2.1 `__init__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__init__ (
    self,
    str_description,
    ap_paramList = [] )
```

Initialize an object.

#### Parameters

<i>str_description</i>	String description of filter
<i>ap_paramList</i>	List of AutoParam parameters.

### 6.39.3 Member Function Documentation

#### 6.39.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self )
```

String representation of object.

#### Returns

String listing all current parameters

### 6.39.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self )
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.39.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self )
```

choose other random value for all parameters

### 6.39.3.4 process()

```
def skdiscovery.data_structure.framework.PipelineItem.process (
    self,
    obj_data )
```

The actual filter processing.

Empty in this generic filter.

```
@param obj_data: Data wrapper that will be processed
```

### 6.39.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self )
```

set all parameters to initial value

## 6.39.4 Member Data Documentation

#### 6.39.4.1 `ap_paramList`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList`

#### 6.39.4.2 `ap_paramNames`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames`

#### 6.39.4.3 `str_description`

`skdiscovery.data_structure.framework.PipelineItem.str_description`

The documentation for this class was generated from the following file:

- `data_structure/framework/base.py`

## 6.40 `skdiscovery.utilities.planetary.map_util.Planet` Class Reference

A class for storing variables about a planetary body.

### Public Member Functions

- `def __init__(self, name)`  
*Initialize [Planet](#) object.*
- `def get_lateral_dist_array(self, ppd)`  
*Retrieve the lateral distance array.*
- `def get_lateral_dist(self, lats, ppd)`  
*Get the lateral distance in meters for an input of lats.*
- `def get_medial_dist(self, lats, ppd)`  
*Get the medial distance at specific latitudes.*

### Public Attributes

- `a`
- `b`
- `e_sq`
- `equator_1deg`
- `avg_radius`

### 6.40.1 Detailed Description

A class for storing variables about a planetary body.

### 6.40.2 Constructor & Destructor Documentation

#### 6.40.2.1 `__init__()`

```
def skdiscovery.utilities.planetary.map_util.Planet.__init__ (
    self,
    name )
```

Initialize [Planet](#) object.

##### Parameters

<i>name</i>	The name of the planetary body choice of ('earth', 'wgs84', 'grs80', or 'moon'). 'wgs84' and 'earth' provide the same planet.
-------------	---

### 6.40.3 Member Function Documentation

#### 6.40.3.1 `get_lateraldist()`

```
def skdiscovery.utilities.planetary.map_util.Planet.get_lateraldist (
    self,
    lats,
    ppd )
```

Get the lateral distance in meters for an input of lats.

##### Parameters

<i>lats</i>	Either a scalar or an array of latitudes
<i>ppd</i>	Pixels per degree of latitude

##### Returns

Lateral distance at each latitude in meters

### 6.40.3.2 `get_lateraldist_array()`

```
def skdiscovery.utilities.planetary.map_util.Planet.get_lateraldist_array (
    self,
    ppd )
```

Retrieve the lateral distance array.

Get an array of the lateral size of 1/ppd of a degree of longitude at every 1/ppd of a degree of latitude. Results given in meters.

Example input of ppd = 1 for the body "Earth" results in an array 180 cells long with lateraldist\_array[90] = 111 (m).

#### Parameters

<i>ppd</i>	the number of pixels-per-degree-of-latitude; the resulting array will therefore be (180*ppd) cells tall
------------	---

#### Returns

lateraldist\_array: an array of the size (in meters) of 1 degree of longitude at each 1/ppd-th of a degree of latitude

### 6.40.3.3 `get_medialdist()`

```
def skdiscovery.utilities.planetary.map_util.Planet.get_medialdist (
    self,
    lats,
    ppd )
```

Get the medial distance at specific latitudes.

#### Parameters

<i>lats</i>	Either a scalar or an array of latitudes
<i>ppd</i>	Pixels per degree of latitude

#### Returns

Medial distance at each latitude in meters

## 6.40.4 Member Data Documentation



#### 6.40.4.1 a

`skdiscovery.utilities.planetary.map_util.Planet.a`

#### 6.40.4.2 avg\_radius

`skdiscovery.utilities.planetary.map_util.Planet.avg_radius`

#### 6.40.4.3 b

`skdiscovery.utilities.planetary.map_util.Planet.b`

#### 6.40.4.4 e\_sq

`skdiscovery.utilities.planetary.map_util.Planet.e_sq`

#### 6.40.4.5 equator\_1deg

`skdiscovery.utilities.planetary.map_util.Planet.equator_1deg`

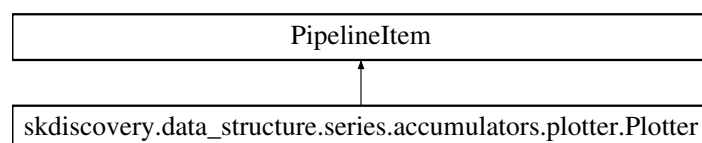
The documentation for this class was generated from the following file:

- [utilities/planetary/map\\_util.py](#)

## 6.41 skdiscovery.data\_structure.series.accumulators.Plotter Class Reference

Make a plot of series data.

Inheritance diagram for `skdiscovery.data_structure.series.accumulators.Plotter`:



## Public Member Functions

- `def __init__ (self, str_description, num_columns=3, errorbars=False, width=13, height=4, kwargs)`  
*Initialize [Plotter](#).*
- `def process (self, obj_data)`  
*Plot each column in obj\_*

## Public Attributes

- [kwargs](#)
- [num\\_columns](#)
- [errorbars](#)
- [height](#)
- [width](#)

### 6.41.1 Detailed Description

Make a plot of series data.

### 6.41.2 Constructor & Destructor Documentation

#### 6.41.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.series.accumulators.Plotter.__init__ (
    self,
    str_description,
    num_columns = 3,
    errorbars = False,
    width = 13,
    height = 4,
    kwargs )
```

Initialize [Plotter](#).

#### Parameters

<i>str_description</i>	String describing accumulator
<i>num_columns</i>	Number of columns to use when plotting data
<i>errorbars</i>	Flag indicating if errorbars should be used
<i>width</i>	Total width of all columns combined
<i>height</i>	Height of single row of plots
<i>**kwargs</i>	Any additional keyword arguments are passed on to matplotlib

### 6.41.3 Member Function Documentation

#### 6.41.3.1 process()

```
def skdiscovery.data_structure.series.accumulators.Plotter.process (
    self,
    obj_data )
```

Plot each column in obj\_

##### Parameters

<i>obj_data</i>	Data Wrapper
-----------------	--------------

### 6.41.4 Member Data Documentation

#### 6.41.4.1 errorbars

```
skdiscovery.data_structure.series.accumulators.Plotter.errorbars
```

#### 6.41.4.2 height

```
skdiscovery.data_structure.series.accumulators.Plotter.height
```

#### 6.41.4.3 kwargs

```
skdiscovery.data_structure.series.accumulators.Plotter.kwargs
```

#### 6.41.4.4 num\_columns

```
skdiscovery.data_structure.series.accumulators.Plotter.num_columns
```

#### 6.41.4.5 width

```
skdiscovery.data_structure.series.accumulators.Plotter.width
```

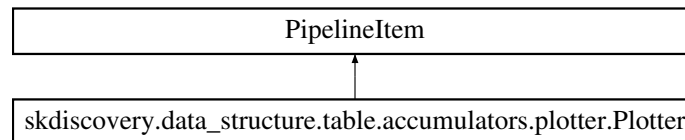
The documentation for this class was generated from the following file:

- [data\\_structure/series/accumulators/plotter.py](#)

## 6.42 skdiscovery.data\_structure.table.accumulators.Plotter Class Reference

Make a plot of table data.

Inheritance diagram for `skdiscovery.data_structure.table.accumulators.Plotter`:



### Public Member Functions

- `def __init__ (self, str_description, column_names=None, error_column_names=None, num_columns=3, width=13, height=4, columns_together=False, annotate_column=None, annotate_data=None, xlim=None, ylim=None, kwargs)`  
*Initialize `Plotter`.*
- `def process (self, obj_data)`  
*Plot each column in `obj_data`*

### Public Attributes

- `xlim`
- `ylim`
- `kwargs`
- `num_columns`
- `height`
- `width`
- `column_names`
- `annotate_column`
- `annotate_data`
- `error_column_names`
- `columns_together`

### 6.42.1 Detailed Description

Make a plot of table data.

### 6.42.2 Constructor & Destructor Documentation

#### 6.42.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.accumulators.Plotter.__init__ (
    self,
    str_description,
    column_names = None,
    error_column_names = None,
    num_columns = 3,
    width = 13,
    height = 4,
    columns_together = False,
    annotate_column = None,
    annotate_data = None,
    xlim = None,
    ylim = None,
    kwargs )
```

Initialize [Plotter](#).

#### Parameters

<i>str_description</i>	String describing accumulator
<i>column_names</i>	Columns to be plot
<i>error_column_names</i>	Columns containing uncertainties to be plot, no errorbars if None
<i>num_columns</i>	Number of columns to use when plotting data
<i>width</i>	Total width of all columns combined
<i>height</i>	Height of single row of plots
<i>columns_together</i>	If true, plot the columns on the same graph
<i>annotate_column</i>	Column of annotation data to use for annotation
<i>annotate_data</i>	Annotation data
<i>xlim</i>	The x limit
<i>ylim</i>	The y limit
<i>**kwargs</i>	Any additional keyword arguments are passed on to matplotlib

### 6.42.3 Member Function Documentation

#### 6.42.3.1 process()

```
def skdiscovery.data_structure.table.accumulators.Plotter.process (
    self,
    obj_data )
```

Plot each column in obj\_

##### Parameters

<i>obj_data</i>	Data Wrapper
-----------------	--------------

### 6.42.4 Member Data Documentation

#### 6.42.4.1 annotate\_column

```
skdiscovery.data_structure.table.accumulators.Plotter.annotate_column
```

#### 6.42.4.2 annotate\_data

```
skdiscovery.data_structure.table.accumulators.Plotter.annotate_data
```

#### 6.42.4.3 column\_names

```
skdiscovery.data_structure.table.accumulators.Plotter.column_names
```

#### 6.42.4.4 columns\_together

```
skdiscovery.data_structure.table.accumulators.Plotter.columns_together
```

#### 6.42.4.5 error\_column\_names

`skdiscovery.data_structure.table.accumulators.Plotter.error_column_names`

#### 6.42.4.6 height

`skdiscovery.data_structure.table.accumulators.Plotter.height`

#### 6.42.4.7 kwargs

`skdiscovery.data_structure.table.accumulators.Plotter.kwargs`

#### 6.42.4.8 num\_columns

`skdiscovery.data_structure.table.accumulators.Plotter.num_columns`

#### 6.42.4.9 width

`skdiscovery.data_structure.table.accumulators.Plotter.width`

#### 6.42.4.10 xlim

`skdiscovery.data_structure.table.accumulators.Plotter.xlim`

#### 6.42.4.11 ylim

`skdiscovery.data_structure.table.accumulators.Plotter.ylim`

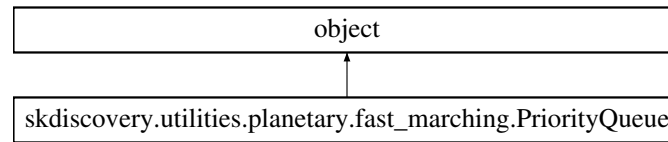
The documentation for this class was generated from the following file:

- [data\\_structure/table/accumulators/plotter.py](#)

## 6.43 skdiscovery.utilities.planetary.fast\_marching.PriorityQueue Class Reference

Function definitions.

Inheritance diagram for skdiscovery.utilities.planetary.fast\_marching.PriorityQueue:



### Public Member Functions

- def `__init__` (self, task\_list, priority\_list)
- def `__repr__` (self)
- def `add_task` (self, task, priority=0)
- def `remove_task` (self, task)
- def `pop_task` (self)
- def `length` (self)
- def `is_empty` (self)
- def `empty` (self)

### Public Attributes

- `pq_`
- `entry_finder_`
- `counter_`

### 6.43.1 Detailed Description

Function definitions.

### 6.43.2 Constructor & Destructor Documentation

#### 6.43.2.1 `__init__()`

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.__init__ (
    self,
    task_list,
    priority_list )
```



### 6.43.3 Member Function Documentation

#### 6.43.3.1 \_\_repr\_\_()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.__repr__ (
    self )
```

#### 6.43.3.2 add\_task()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.add_task (
    self,
    task,
    priority = 0 )
```

#### 6.43.3.3 empty()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.empty (
    self )
```

#### 6.43.3.4 is\_empty()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.is_empty (
    self )
```

#### 6.43.3.5 length()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.length (
    self )
```

#### 6.43.3.6 pop\_task()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.pop_task (
    self )
```

#### 6.43.3.7 remove\_task()

```
def skdiscovery.utilities.planetary.fast_marching.PriorityQueue.remove_task (
    self,
    task )
```

### 6.43.4 Member Data Documentation

#### 6.43.4.1 counter\_

```
skdiscovery.utilities.planetary.fast_marching.PriorityQueue.counter_
```

#### 6.43.4.2 entry\_finder\_

```
skdiscovery.utilities.planetary.fast_marching.PriorityQueue.entry_finder_
```

#### 6.43.4.3 pq\_

```
skdiscovery.utilities.planetary.fast_marching.PriorityQueue.pq_
```

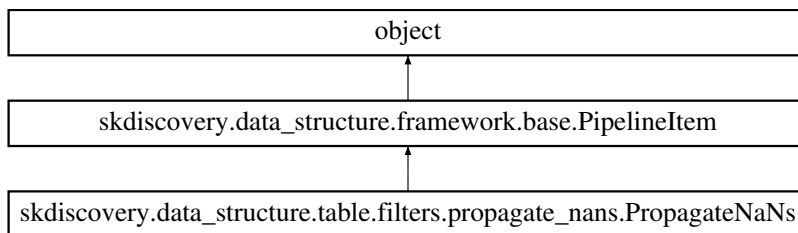
The documentation for this class was generated from the following file:

- [utilities/planetary/fast\\_marching.py](#)

## 6.44 skdiscovery.data\_structure.table.filters.PropagateNaNs Class Reference

Propagates NaN's from one column to other columns.

Inheritance diagram for skdiscovery.data\_structure.table.filters.PropagateNaNs:



### Public Member Functions

- `def __init__ (self, str_description, nan_column, target_columns)`  
Initialize *PropagateNaNs* Filter.
- `def process (self, obj_data)`  
*PropagateNaNs* on table data wrapper.
- `def perturbParams (self)`  
choose other random value for all parameters
- `def resetParams (self)`  
set all parameters to initial value
- `def __str__ (self)`  
String representation of object.
- `def getMetadata (self)`  
Retrieve metadata about filter.

### Public Attributes

- `nan_column`
- `target_columns`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

#### 6.44.1 Detailed Description

Propagates NaN's from one column to other columns.

#### 6.44.2 Constructor & Destructor Documentation

#### 6.44.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.PropagateNaNs.__init__ (
    self,
    str_description,
    nan_column,
    target_columns )
```

Initialize [PropagateNaNs](#) Filter.

##### Parameters

<i>str_description</i>	String describing filter
<i>nan_column</i>	Column used to select which rows should be NaN's
<i>target_columns</i>	Rows in these column will be set to NaN's based on nan_column

### 6.44.3 Member Function Documentation

#### 6.44.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

##### Returns

String listing all current parameters

#### 6.44.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

##### Returns

String containing the item description and current parameters for filter.

### 6.44.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.44.3.4 process()

```
def skdiscovery.data_structure.table.filters.PropagateNaNs.process (
    self,
    obj_data )
```

[PropagateNaNs](#) on table data wrapper.

#### Parameters

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

### 6.44.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.44.4 Member Data Documentation

### 6.44.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

### 6.44.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

#### 6.44.4.3 nan\_column

`skdiscovery.data_structure.table.filters.PropagateNaNs.nan_column`

#### 6.44.4.4 str\_description

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

#### 6.44.4.5 target\_columns

`skdiscovery.data_structure.table.filters.PropagateNaNs.target_columns`

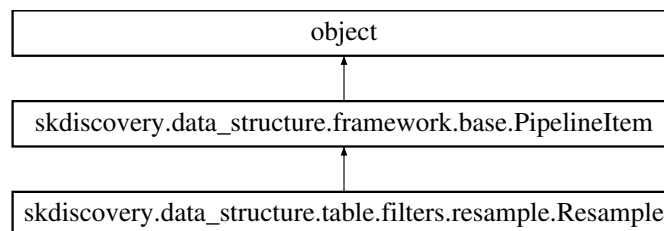
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/propagate\\_nans.py](#)

### 6.45 skdiscovery.data\_structure.table.filters.Resample Class Reference

[Resample](#) data.

Inheritance diagram for `skdiscovery.data_structure.table.filters.Resample`:



#### Public Member Functions

- `def __init__(self, str_description, start_date=None, end_date=None, frequency='D')`  
*Initialize [Resample](#) filter.*
- `def process(self, obj_data)`  
*Calibrates GRACE, updating in place.*
- `def perturbParams(self)`  
*choose other random value for all parameters*
- `def resetParams(self)`  
*set all parameters to initial value*
- `def __str__(self)`  
*String representation of object.*
- `def getMetadata(self)`  
*Retrieve metadata about filter.*

## Public Attributes

- [start\\_date](#)
- [end\\_date](#)
- [frequency](#)
- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.45.1 Detailed Description

[Resample](#) data.

### 6.45.2 Constructor & Destructor Documentation

#### 6.45.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.Resample.__init__ (
    self,
    str_description,
    start_date = None,
    end_date = None,
    frequency = 'D' )
```

Initialize [Resample](#) filter.

#### Parameters

<i>str_description</i>	String describing filter
<i>start_date</i>	Starting date
<i>end_date</i>	Ending date
<i>period</i>	New sampling rate
<i>frequency</i>	Frequency of the resampled data (see Pandas DataFrame reindex for more options)

### 6.45.3 Member Function Documentation

#### 6.45.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

#### Returns

String listing all current parameters

#### 6.45.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

#### 6.45.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.45.3.4 process()

```
def skdiscovery.data_structure.table.filters.Resample.process (
    self,
    obj_data )
```

Calibrates GRACE, updating in place.

#### Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------



#### 6.45.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.45.4 Member Data Documentation

#### 6.45.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

#### 6.45.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

#### 6.45.4.3 end\_date

```
skdiscovery.data_structure.table.filters.Resample.end_date
```

#### 6.45.4.4 frequency

```
skdiscovery.data_structure.table.filters.Resample.frequency
```

#### 6.45.4.5 start\_date

```
skdiscovery.data_structure.table.filters.Resample.start_date
```

#### 6.45.4.6 str\_description

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

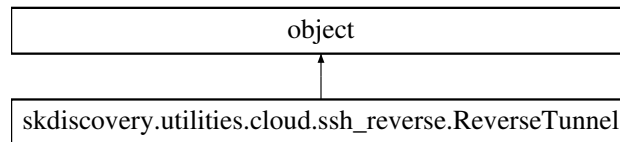
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/resample.py](#)

## 6.46 skdiscovery.utilities.cloud.ssh\_reverse.ReverseTunnel Class Reference

Create a reverse ssh tunnel.

Inheritance diagram for `skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel`:



### Public Member Functions

- `def __init__(self, server_address, username, key_filename, server_port, remote_host, remote_port, check=30, verbose=False)`  
*Initialize `ReverseTunnel` object.*
- `def create_reverse_tunnel(self)`  
*Create the reverse tunnel.*
- `def __del__(self)`  
*Deconstructor.*

### Public Attributes

- `server_address`
- `username`
- `key_filename`
- `server_port`
- `remote_host`
- `remote_port`
- `check`
- `verbose`
- `ssh`
- `event`
- `child_threads`

### 6.46.1 Detailed Description

Create a reverse ssh tunnel.

### 6.46.2 Constructor & Destructor Documentation

#### 6.46.2.1 \_\_init\_\_()

```
def skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.__init__ (
    self,
    server_address,
    username,
    key_filename,
    server_port,
    remote_host,
    remote_port,
    check = 30,
    verbose = False )
```

Initialize [ReverseTunnel](#) object.

#### Parameters

<i>server_address</i>	Local server address
<i>username</i>	Valid username on remote host
<i>key_filename</i>	Filename of ssh key associated with remote host
<i>server_port</i>	Local port
<i>remote_host</i>	Address of remote host
<i>remote_port</i>	Remote port
<i>check</i>	Amount of time to wait in seconds when opening up a channel
<i>verbose</i>	Print status information

#### 6.46.2.2 \_\_del\_\_()

```
def skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.__del__ (
    self )
```

Deconstructor.

### 6.46.3 Member Function Documentation

#### 6.46.3.1 create\_reverse\_tunnel()

```
def skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.create_reverse_tunnel (
    self )
```

Create the reverse tunnel.

### 6.46.4 Member Data Documentation

#### 6.46.4.1 check

```
skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.check
```

#### 6.46.4.2 child\_threads

```
skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.child_threads
```

#### 6.46.4.3 event

```
skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.event
```

#### 6.46.4.4 key\_filename

```
skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.key_filename
```

#### 6.46.4.5 remote\_host

```
skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.remote_host
```

#### 6.46.4.6 remote\_port

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.remote_port`

#### 6.46.4.7 server\_address

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.server_address`

#### 6.46.4.8 server\_port

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.server_port`

#### 6.46.4.9 ssh

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.ssh`

#### 6.46.4.10 username

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.username`

#### 6.46.4.11 verbose

`skdiscovery.utilities.cloud.ssh_reverse.ReverseTunnel.verbose`

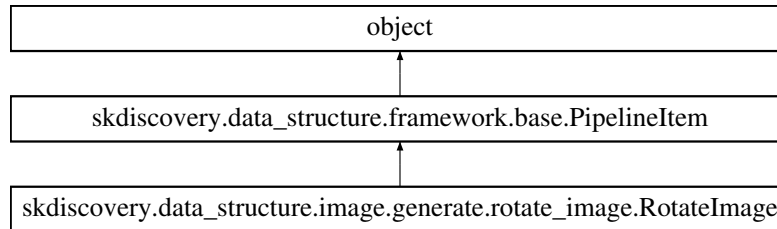
The documentation for this class was generated from the following file:

- [utilities/cloud/ssh\\_reverse.py](#)

## 6.47 skdiscovery.data\_structure.image.generate.RotateImage Class Reference

Create new images by rotating 90, 180, and 270 degrees.

Inheritance diagram for skdiscovery.data\_structure.image.generate.RotateImage:



### Public Member Functions

- def [process](#) (self, obj\_data)  
*Generate new images by rotate input images.*
- def [perturbParams](#) (self)  
*choose other random value for all parameters*
- def [resetParams](#) (self)  
*set all parameters to initial value*
- def [\\_\\_str\\_\\_](#) (self)  
*String represntation of object.*
- def [getMetadata](#) (self)  
*Retrieve metadata about filter.*

### Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.47.1 Detailed Description

Create new images by rotating 90, 180, and 270 degrees.

### 6.47.2 Member Function Documentation

6.47.2.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

**Returns**

String listing all current parameters

6.47.2.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

**Returns**

String containing the item description and current parameters for filter.

6.47.2.3 `perturbParams()`

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

6.47.2.4 `process()`

```
def skdiscovery.data_structure.image.generate.RotateImage.process (
    self,
    obj_data )
```

Generate new images by rotate input images.

**Parameters**

<code>obj_data</code>	Image data wrapper
-----------------------	--------------------

#### 6.47.2.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.47.3 Member Data Documentation

#### 6.47.3.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

#### 6.47.3.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

#### 6.47.3.3 str\_description

```
skdiscovery.data_structure.framework.PipelineItem.str_description [inherited]
```

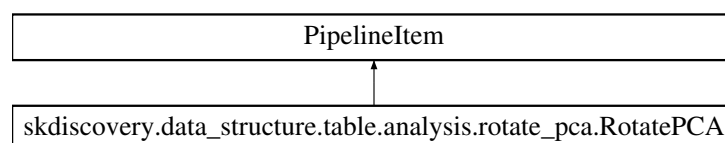
The documentation for this class was generated from the following file:

- data\_structure/image/generate/[rotate\\_image.py](#)

## 6.48 skdiscovery.data\_structure.table.analysis.RotatePCA Class Reference

\*\*\* In Development \*\*\* Class for rotating PCA to seperate superimposed signals

Inheritance diagram for skdiscovery.data\_structure.table.analysis.RotatePCA:





## Public Member Functions

- `def __init__ (self, str_description, ap_paramList, pca_name, model, norm=None, num_components=3)`
- `def process (self, obj_data)`  
*Compute rotation angles for PCA.*

## Public Attributes

- `norm`
- `num_components`

### 6.48.1 Detailed Description

\*\*\* In Development \*\*\* Class for rotating PCA to seperate superimposed signals

### 6.48.2 Constructor & Destructor Documentation

#### 6.48.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.analysis.RotatePCA.__init__ (
    self,
    str_description,
    ap_paramList,
    pca_name,
    model,
    norm = None,
    num_components = 3 )
```

#### Parameters

<i>str_description</i>	String description of this item
<i>ap_paramList[fit_type]</i>	Fitness test to use (either 'dtw' or 'remove')
<i>ap_paramList[resolution]</i>	Fitting resolution when using brute force
<i>pca_name</i>	Name of pca results
<i>model</i>	Model to compare to (used in dtw)
<i>norm</i>	Normalization to use when comparing data and model (if None, absolute differences are used)
<i>num_components</i>	Number of pca components to use

### 6.48.3 Member Function Documentation

#### 6.48.3.1 process()

```
def skdiscovery.data_structure.table.analysis.RotatePCA.process (
    self,
    obj_data )
```

Compute rotation angles for PCA.

#### Parameters

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

### 6.48.4 Member Data Documentation

#### 6.48.4.1 norm

```
skdiscovery.data_structure.table.analysis.RotatePCA.norm
```

#### 6.48.4.2 num\_components

```
skdiscovery.data_structure.table.analysis.RotatePCA.num_components
```

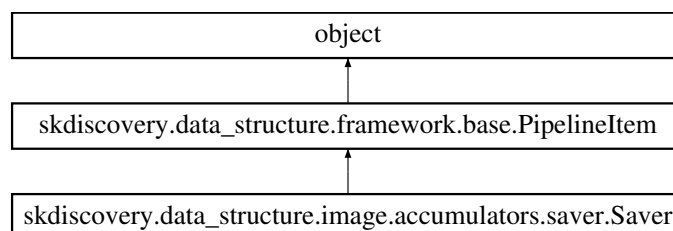
The documentation for this class was generated from the following file:

- [data\\_structure/table/analysis/rotate\\_pca.py](#)

## 6.49 skdiscovery.data\_structure.image.accumulators.Saver Class Reference

Write images out to a hdf5 file.

Inheritance diagram for `skdiscovery.data_structure.image.accumulators.Saver`:



## Public Member Functions

- def `__init__` (self, `str_description`, `folder_name`, `data_type`=None)  
*Initialize coherence pipeline item.*
- def `process` (self, `obj_data`)  
*Save images to hdf files.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String representation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

## Public Attributes

- `folder_name`
- `data_type`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.49.1 Detailed Description

Write images out to a hdf5 file.

### 6.49.2 Constructor & Destructor Documentation

#### 6.49.2.1 `__init__`()

```
def skdiscovery.data_structure.image.accumulators.Saver.__init__ (
    self,
    str_description,
    folder_name,
    data_type = None )
```

Initialize coherence pipeline item.

#### Parameters

<code>str_description</code>	String identifier for item
<code>folder_name</code>	Name to save hdf fils
<code>data_type</code>	Data type to save data as (None defaults to input data type)

### 6.49.3 Member Function Documentation

#### 6.49.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

##### Returns

String listing all current parameters

#### 6.49.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

##### Returns

String containing the item description and current parameters for filter.

#### 6.49.3.3 `perturbParams()`

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.49.3.4 `process()`

```
def skdiscovery.data_structure.image.accumulators.Saver.process (
    self,
    obj_data )
```

Save images to hdf files.

## Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

**6.49.3.5 resetParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

**6.49.4 Member Data Documentation****6.49.4.1 ap\_paramList**

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramList [inherited]

**6.49.4.2 ap\_paramNames**

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramNames [inherited]

**6.49.4.3 data\_type**

skdiscovery.data\_structure.image.accumulators.Saver.data\_type

**6.49.4.4 folder\_name**

skdiscovery.data\_structure.image.accumulators.Saver.folder\_name

#### 6.49.4.5 str\_description

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

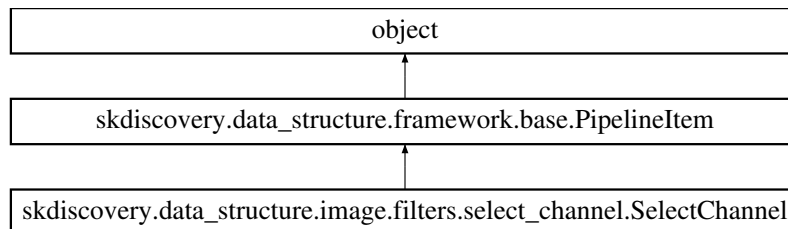
The documentation for this class was generated from the following file:

- [data\\_structure/image/accumulators/saver.py](#)

## 6.50 skdiscovery.data\_structure.image.filters.SelectChannel Class Reference

Select a specific channel out of a 3 dimensional image.

Inheritance diagram for `skdiscovery.data_structure.image.filters.SelectChannel`:



### Public Member Functions

- `def __init__ (self, str\_description, channel, channel_index=0)`  
*Initialize [SelectChannel](#) item.*
- `def process (self, obj_data)`  
*Process an image data wrapper.*
- `def perturbParams (self)`  
*choose other random value for all parameters*
- `def resetParams (self)`  
*set all parameters to initial value*
- `def __str__ (self)`  
*String represntation of object.*
- `def getMetadata (self)`  
*Retrieve metadata about filter.*

### Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.50.1 Detailed Description

Select a specific channel out of a 3 dimensional image.

### 6.50.2 Constructor & Destructor Documentation

#### 6.50.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.image.filters.SelectChannel.__init__ (
    self,
    str_description,
    channel,
    channel_index = 0 )
```

Initialize [SelectChannel](#) item.

#### Parameters

<i>str_description</i>	String description of item
<i>channel</i>	Channel to select
<i>channel_index</i>	Which index (or dimension) the channel is on

### 6.50.3 Member Function Documentation

#### 6.50.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all currenter parameters

### 6.50.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.50.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.50.3.4 process()

```
def skdiscovery.data_structure.image.filters.SelectChannel.process (
    self,
    obj_data )
```

Process an image data wrapper.

#### Parameters

<i>obj_data</i>	Image data wrapper
-----------------	--------------------

### 6.50.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.50.4 Member Data Documentation



## 6.50.4.1 ap\_paramList

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramList [inherited]

## 6.50.4.2 ap\_paramNames

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramNames [inherited]

## 6.50.4.3 str\_description

skdiscovery.data\_structure.framework.PipelineItem.str\_description [inherited]

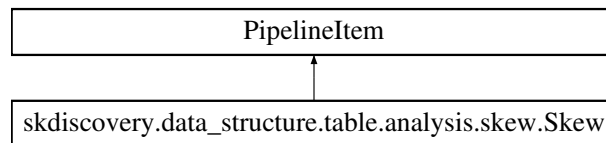
The documentation for this class was generated from the following file:

- data\_structure/image/filters/[select\\_channel.py](#)

## 6.51 skdiscovery.data\_structure.table.analysis.Skew Class Reference

Calculates the skew of table data.

Inheritance diagram for skdiscovery.data\_structure.table.analysis.Skew:



## Public Member Functions

- def [process](#) (self, obj\_data)  
Apply [Skew](#) analysis with results added to the data wrapper.

## 6.51.1 Detailed Description

Calculates the skew of table data.

## 6.51.2 Member Function Documentation

## 6.51.2.1 process()

```
def skdiscovery.data_structure.table.analysis.Skew.process (
    self,
    obj_data )
```

Apply [Skew](#) analysis with results added to the data wrapper.

## Parameters

<code>obj_data</code>	Data wrapper
-----------------------	--------------

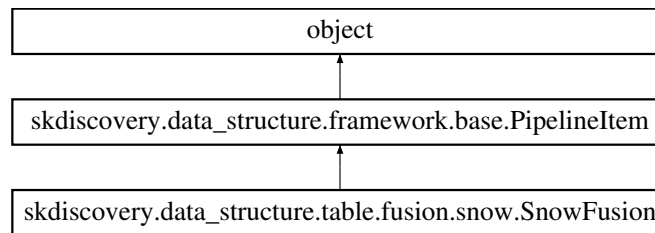
The documentation for this class was generated from the following file:

- `data_structure/table/analysis/skew.py`

## 6.52 skdiscovery.data\_structure.table.fusion.SnowFusion Class Reference

Adds snow time series data to table based on geographic coordinates.

Inheritance diagram for `skdiscovery.data_structure.table.fusion.SnowFusion`:



### Public Member Functions

- `def __init__(self, str_description, metadata, column_data_name='Snow')`  
*Initialize Snow Fusion item.*
- `def process(self, obj_data)`  
*Adds column for snow (g02156) data.*
- `def perturbParams(self)`  
*choose other random value for all parameters*
- `def resetParams(self)`  
*set all parameters to initial value*
- `def __str__(self)`  
*String representation of object.*
- `def getMetadata(self)`  
*Retrieve metadata about filter.*

### Public Attributes

- `metadata`
- `column_data_name`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.52.1 Detailed Description

Adds snow time series data to table based on geographic coordinates.

Works on table data (original data from <http://nsidc.org/data/g02156>)

### 6.52.2 Constructor & Destructor Documentation

#### 6.52.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.fusion.SnowFusion.__init__ (
    self,
    str_description,
    metadata,
    column_data_name = 'Snow' )
```

Initialize Snow Fusion item.

#### Parameters

<i>str_description</i>	String describing item
<i>metadata</i>	Metadata that contains lat,lon coordinates based on data labels
<i>column_data_name</i>	Name of column for Snow data

### 6.52.3 Member Function Documentation

#### 6.52.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all current parameters

### 6.52.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

#### Returns

String containing the item description and current parameters for filter.

### 6.52.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.52.3.4 process()

```
def skdiscovery.data_structure.table.fusion.SnowFusion.process (
    self,
    obj_data )
```

Adds column for snow (g02156) data.

#### Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

### 6.52.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.52.4 Member Data Documentation

#### 6.52.4.1 ap\_paramList

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramList [inherited]

#### 6.52.4.2 ap\_paramNames

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramNames [inherited]

#### 6.52.4.3 column\_data\_name

skdiscovery.data\_structure.table.fusion.SnowFusion.column\_data\_name

#### 6.52.4.4 metadata

skdiscovery.data\_structure.table.fusion.SnowFusion.metadata

#### 6.52.4.5 str\_description

skdiscovery.data\_structure.framework.PipelineItem.str\_description [inherited]

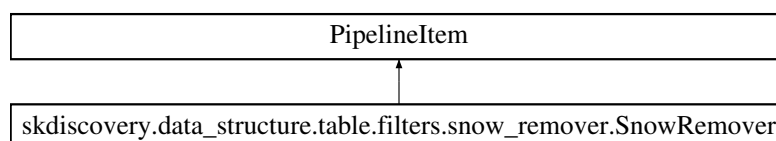
The documentation for this class was generated from the following file:

- data\_structure/table/fusion/[snow.py](#)

## 6.53 skdiscovery.data\_structure.table.filters.SnowRemover Class Reference

Removes data with snow errors.

Inheritance diagram for skdiscovery.data\_structure.table.filters.SnowRemover:



## Public Member Functions

- `def __init__ (self, str_description, ap_paramList=[AutoParam(1.5)], column_name='dN', snow_column='Snow')`  
*Initialize snow remover for use on table data.*
- `def process (self, obj_data)`  
*Removes table data with large snow errors.*

## Public Attributes

- `column_name`
- `snow_column`

### 6.53.1 Detailed Description

Removes data with snow errors.

### 6.53.2 Constructor & Destructor Documentation

#### 6.53.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.SnowRemover.__init__ (
    self,
    str_description,
    ap_paramList = [AutoParam(1.5)],
    column_name = 'dN',
    snow_column = 'Snow' )
```

Initialize snow remover for use on table data.

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[sigma_clip]</i>	remove station if the stddev of snowdays is sigma_clip times greater than non-snow days, default 1.5
<i>column_name</i>	Name of column to check
<i>snow_column</i>	Name of snow column to determine snowdays/non snow days

### 6.53.3 Member Function Documentation

### 6.53.3.1 process()

```
def skdiscovery.data_structure.table.filters.SnowRemover.process (
    self,
    obj_data )
```

Removes table data with large snow errors.

#### Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

## 6.53.4 Member Data Documentation

### 6.53.4.1 column\_name

```
skdiscovery.data_structure.table.filters.SnowRemover.column_name
```

### 6.53.4.2 snow\_column

```
skdiscovery.data_structure.table.filters.SnowRemover.snow_column
```

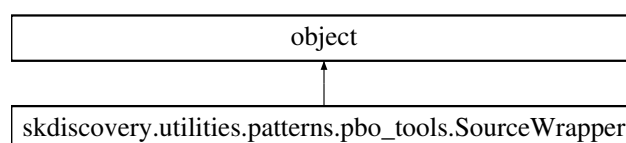
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/snow\\_remover.py](#)

## 6.54 skdiscovery.utilities.patterns.pbo\_tools.SourceWrapper Class Reference

Wrapper for using old interface with updated source interfaces.

Inheritance diagram for skdiscovery.utilities.patterns.pbo\_tools.SourceWrapper:



## Public Member Functions

- `def __init__(self, source\_method)`  
*Initialize source wrapper.*
- `def __call__(self, args)`  
*Call the source function using the old interface.*

## Public Attributes

- [source\\_method](#)

### 6.54.1 Detailed Description

Wrapper for using old interface with updated source interfaces.

### 6.54.2 Constructor & Destructor Documentation

#### 6.54.2.1 `__init__()`

```
def skdiscovery.utilities.patterns.pbo_tools.SourceWrapper.__init__ (
    self,
    source_method )
```

Initialize source wrapper.

#### Parameters

<code>source_method</code>	Source function that will be wrapped
----------------------------	--------------------------------------

### 6.54.3 Member Function Documentation

#### 6.54.3.1 `__call__()`

```
def skdiscovery.utilities.patterns.pbo_tools.SourceWrapper.__call__ (
    self,
    args )
```

Call the source function using the old interface.



## Parameters

<i>args</i>	Arguments for the wrapped source function
-------------	---

## Returns

return list of resulting deformation for each point requested point

## 6.54.4 Member Data Documentation

## 6.54.4.1 source\_method

`skdiscovery.utilities.patterns.pbo_tools.SourceWrapper.source_method`

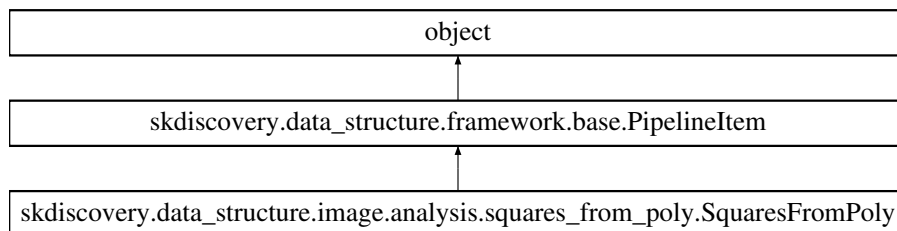
The documentation for this class was generated from the following file:

- [utilities/patterns/pbo\\_tools.py](#)

## 6.55 skdiscovery.data\_structure.image.analysis.SquaresFromPoly Class Reference

Generate shapely squares that intersect with a shapely polygon.

Inheritance diagram for `skdiscovery.data_structure.image.analysis.SquaresFromPoly`:



## Public Member Functions

- `def __init__(self, str\_description, polygon_name, size=100, stride=20, required_fraction=0.5)`  
*Create a pipeline item to generate a shapely squares from a polygon.*
- `def process(self, obj_data)`  
*Process data in an image data wrapper.*
- `def perturbParams(self)`  
*choose other random value for all parameters*
- `def resetParams(self)`  
*set all parameters to initial value*
- `def __str__(self)`  
*String representation of object.*
- `def getMetadata(self)`  
*Retrieve metadata about filter.*

## Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.55.1 Detailed Description

Generate shapely squares that intersect with a shapely polygon.

### 6.55.2 Constructor & Destructor Documentation

#### 6.55.2.1 `__init__()`

```
def skdiscovery.data_structure.image.analysis.SquaresFromPoly.__init__ (
    self,
    str_description,
    polygon_name,
    size = 100,
    stride = 20,
    required_fraction = 0.5 )
```

Create a pipeline item to generate a shapely squares from a polygon.

#### Parameters

<i>str_description</i>	String description of pipeline item
<i>polygon_name</i>	Name of polygon pipeline item
<i>size</i>	Length of a side of the shapely squares that will be generated
<i>stride</i>	Distance between squares
<i>required_fraction</i>	Fraction of overlap between polygon and square

### 6.55.3 Member Function Documentation

#### 6.55.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

**Returns**

String listing all current parameters

**6.55.3.2 getMetadata()**

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

**Returns**

String containing the item description and current parameters for filter.

**6.55.3.3 perturbParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

**6.55.3.4 process()**

```
def skdiscovery.data_structure.image.analysis.SquaresFromPoly.process (
    self,
    obj_data )
```

Process data in an image data wrapper.

**Parameters**

<i>obj_data</i>	Image data wrapper
-----------------	--------------------

**6.55.3.5 resetParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.55.4 Member Data Documentation

### 6.55.4.1 `ap_paramList`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList` [inherited]

### 6.55.4.2 `ap_paramNames`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames` [inherited]

### 6.55.4.3 `str_description`

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

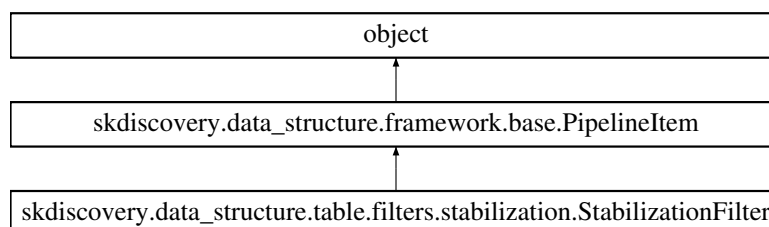
The documentation for this class was generated from the following file:

- `data_structure/image/analysis/squares_from_poly.py`

## 6.56 `skdiscovery.data_structure.table.filters.StabilizationFilter` Class Reference

This filter transforms GPS stations in a region to a local reference frame.

Inheritance diagram for `skdiscovery.data_structure.table.filters.StabilizationFilter`:



## Public Member Functions

- def [process](#) (self, obj\_data)  
*Apply stabilization filter to data set.*
- def [perturbParams](#) (self)  
*choose other random value for all parameters*
- def [resetParams](#) (self)  
*set all parameters to initial value*
- def [\\_\\_str\\_\\_](#) (self)  
*String represntation of object.*
- def [getMetadata](#) (self)  
*Retrieve metadata about filter.*

## Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.56.1 Detailed Description

This filter transforms GPS stations in a region to a local reference frame.

### 6.56.2 Member Function Documentation

#### 6.56.2.1 [\\_\\_str\\_\\_\(\)](#)

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

#### Returns

String listing all current parameters

#### 6.56.2.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

##### Returns

String containing the item description and current parameters for filter.

#### 6.56.2.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.56.2.4 process()

```
def skdiscovery.data_structure.table.filters.StabilizationFilter.process (
    self,
    obj_data )
```

Apply stabilization filter to data set.

##### Parameters

<i>obj_data</i>	Table data wrapper.
-----------------	---------------------

#### 6.56.2.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.56.3 Member Data Documentation

## 6.56.3.1 ap\_paramList

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramList [inherited]

## 6.56.3.2 ap\_paramNames

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramNames [inherited]

## 6.56.3.3 str\_description

skdiscovery.data\_structure.framework.PipelineItem.str\_description [inherited]

The documentation for this class was generated from the following file:

- data\_structure/table/filters/[stabilization.py](#)

## 6.57 skdiscovery.data\_structure.framework.StageContainer Class Reference

Container to hold a stage for the DiscoveryPipeline.

## Public Member Functions

- def `__init__` (self, [obj\\_content](#), obj\_runmethod=None, obj\_perturbmethod=None, obj\_reset=None)  
*Get the object and its run method into this conainer.*
- def [run](#) (self, obj\_data\_container)  
*Execute the obj\_content run method.*
- def [perturb](#) (self)  
*Execute the obj\_content peturb method.*
- def [reset](#) (self)  
*Execute the obj\_content reset method.*
- def [getMetadata](#) (self)  
*Retrieves the obj\_content metadata.*
- def [getObjects](#) (self)  
*Return the obj\_content in a list.*
- def [getMetadataType](#) (self)  
*Get metadata type.*
- def [getMetadataNestedTypes](#) (self)  
*Get the metadata along with container type.*
- def [getMetadataNestedGraph](#) (self)  
*Get the nested graph for the container.*

## Public Attributes

- [obj\\_content](#)
- [runmethod](#)
- [perturbmethod](#)
- [resetmethod](#)

### 6.57.1 Detailed Description

Container to hold a stage for the DiscoveryPipeline.

### 6.57.2 Constructor & Destructor Documentation

#### 6.57.2.1 `__init__()`

```
def skdiscovery.data_structure.framework.StageContainer.__init__ (
    self,
    obj_content,
    obj_runmethod = None,
    obj_perturbmethod = None,
    obj_reset = None )
```

Get the object and its run method into this conainer.

#### Parameters

<i>obj_content</i>	filter, analysis, or accumulator
<i>obj_runmethod</i>	Run method of the obj_content (default process)
<i>obj_perturbmethod</i>	Perturb method of the obj_content (default peturbParams)
<i>obj_reset</i>	Reset method of the obj_content (default resetParams)

### 6.57.3 Member Function Documentation

#### 6.57.3.1 `getMetadata()`

```
def skdiscovery.data_structure.framework.StageContainer.getMetadata (
    self )
```

Retrieves the obj\_content metadata.



**Returns**

obj\_content metadata

**6.57.3.2 getMetadataNestedGraph()**

```
def skdiscovery.data_structure.framework.StageContainer.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

**Returns**

String: Stage container subgraph

**6.57.3.3 getMetadataNestedTypes()**

```
def skdiscovery.data_structure.framework.StageContainer.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

**Returns**

string of container and metadata

**6.57.3.4 getMetadataType()**

```
def skdiscovery.data_structure.framework.StageContainer.getMetadataType (
    self )
```

Get metadata type.

**Returns**

String: container type

#### 6.57.3.5 `getObjects()`

```
def skdiscovery.data_structure.framework.StageContainer.getObjects (
    self )
```

Return the `obj_content` in a list.

##### Returns

Contained object in a list

#### 6.57.3.6 `perturb()`

```
def skdiscovery.data_structure.framework.StageContainer.perturb (
    self )
```

Execute the `obj_content` `perturb` method.

#### 6.57.3.7 `reset()`

```
def skdiscovery.data_structure.framework.StageContainer.reset (
    self )
```

Execute the `obj_content` `reset` method.

#### 6.57.3.8 `run()`

```
def skdiscovery.data_structure.framework.StageContainer.run (
    self,
    obj_data_container )
```

Execute the `obj_content` `run` method.

##### Parameters

<code>obj_data_container</code>	Data container to be passed to the held <code>obj_content</code> 's <code>run</code> method
---------------------------------	---

## 6.57.4 Member Data Documentation

### 6.57.4.1 obj\_content

`skdiscovery.data_structure.framework.StageContainer.obj_content`

### 6.57.4.2 perturbmethod

`skdiscovery.data_structure.framework.StageContainer.perturbmethod`

### 6.57.4.3 resetmethod

`skdiscovery.data_structure.framework.StageContainer.resetmethod`

### 6.57.4.4 runmethod

`skdiscovery.data_structure.framework.StageContainer.runmethod`

The documentation for this class was generated from the following file:

- `data_structure/framework/stagecontainers.py`

## 6.58 skdiscovery.data\_structure.framework.StageContainerAlternative Class Reference

Stage Container that holds a list of stage containers and randomly chooses one to use.

## Public Member Functions

- def `__init__` (self, `list_stagecontainers`)  
*Initialize the [StageContainerAlternative](#).*
- def `run` (self, `obj_data_container`)  
*Run the currently selected stage container.*
- def `perturb` (self)  
*choose one of the containers as an alternative and perturb its parameters*
- def `getMetadata` (self)  
*Return metadata from the current container.*
- def `getObjects` (self)  
*retrieve the current container as a list*
- def `reset` (self)  
*Reset the current chosen [StageContainer](#).*
- def `getMetadataType` (self)  
*Get metadata type.*
- def `getMetadataNestedTypes` (self)  
*Get the metadata along with container type.*
- def `getMetadataNestedGraph` (self)  
*Get the nested graph for the container.*

## Public Attributes

- `list_stagecontainers`
- `currentContainer`

## Static Public Attributes

- list `currentContainer` = []

### 6.58.1 Detailed Description

Stage Container that holds a list of stage containers and randomly chooses one to use.

### 6.58.2 Constructor & Destructor Documentation

#### 6.58.2.1 `__init__`()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.__init__ (
    self,
    list_stagecontainers )
```

Initialize the [StageContainerAlternative](#).

**Parameters**

<i>list_stagecontainers</i>	List of stage containers
-----------------------------	--------------------------

**6.58.3 Member Function Documentation****6.58.3.1 getMetadata()**

```
def skdiscovery.data_structure.framework.StageContainerAlternative.getMetadata (
    self )
```

Return metadata from the current container.

**Returns**

metadata from the currently selected container

**6.58.3.2 getMetadataNestedGraph()**

```
def skdiscovery.data_structure.framework.StageContainerAlternative.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

**Returns**

String: Container subgraph

**6.58.3.3 getMetadataNestedTypes()**

```
def skdiscovery.data_structure.framework.StageContainerAlternative.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

**Returns**

string of container and metadata

#### 6.58.3.4 getMetadataType()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.getMetadataType (
    self )
```

Get metadata type.

##### Returns

String: container type

#### 6.58.3.5 getObjects()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.getObjects (
    self )
```

retrieve the current container as a list

##### Returns

Current container being used as a list

#### 6.58.3.6 perturb()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.perturb (
    self )
```

choose one of the containers as an alternative and perturb its parameters

#### 6.58.3.7 reset()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.reset (
    self )
```

Reset the current chosen [StageContainer](#).

```
self.currentContainer.reset()
```

#### 6.58.3.8 run()

```
def skdiscovery.data_structure.framework.StageContainerAlternative.run (
    self,
    obj_data_container )
```

Run the currently selected stage container.

## Parameters

<i>obj_data_container</i>	Data container to be passed to the current stagecontainer
---------------------------	---

## 6.58.4 Member Data Documentation

### 6.58.4.1 currentContainer [1/2]

```
list skdiscovery.data_structure.framework.StageContainerAlternative.currentContainer = [] [static]
```

### 6.58.4.2 currentContainer [2/2]

```
skdiscovery.data_structure.framework.StageContainerAlternative.currentContainer
```

### 6.58.4.3 list\_stagecontainers

```
skdiscovery.data_structure.framework.StageContainerAlternative.list_stagecontainers
```

The documentation for this class was generated from the following file:

- data\_structure/framework/[stagecontainers.py](#)

## 6.59 skdiscovery.data\_structure.framework.StageContainerIncrementalAdd Class Reference

In each perturb call, it incrementally adds one of the filters specified in the constructor.

## Public Member Functions

- def `__init__` (self, list\_stagecontainers)  
*Initialize the container.*
- def `reset` (self)  
*Reset the container so that it will only run the first stage container again.*
- def `run` (self, obj\_data\_container)  
*Run the current list of stage containers.*
- def `perturb` (self)  
*Add another stage container to the current list of stage containers.*
- def `getMetadata` (self)  
*Return the metadata from the currently used stage containers.*
- def `getObjects` (self)  
*Retrieve objects in the current list of stage containers.*
- def `getMetadataType` (self)  
*Get metadata type.*
- def `getMetadataNestedTypes` (self)  
*Get the metadata along with container type.*
- def `getMetadataNestedGraph` (self)  
*Get the nested graph for the container.*

## Public Attributes

- `length`
- `list_AllStagecontainers`
- `currentindex`
- `list_currentContainers`

### 6.59.1 Detailed Description

In each perturb call, it incrementally adds one of the filters specified in the constructor.

### 6.59.2 Constructor & Destructor Documentation

#### 6.59.2.1 `__init__()`

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.__init__ (
    self,
    list_stagecontainers )
```

Initialize the container.



#### Parameters

<i>list_stagecontainers</i>	List of stage containers.
-----------------------------	---------------------------

### 6.59.3 Member Function Documentation

#### 6.59.3.1 getMetadata()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.getMetadata (
    self )
```

Return the metadata from the currently used stage containers.

#### Returns

List of metadata from current containers

#### 6.59.3.2 getMetadataNestedGraph()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

#### Returns

String: Container subgraph

#### 6.59.3.3 getMetadataNestedTypes()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

#### Returns

string of container and metadata

#### 6.59.3.4 getMetadataType()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.getMetadataType (  
    self )
```

Get metadata type.

##### Returns

String: container type

#### 6.59.3.5 getObjects()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.getObjects (  
    self )
```

Retrieve objects in the current list of stage containers.

##### Returns

List of current obj\_content from the current list of stage containers

#### 6.59.3.6 perturb()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.perturb (  
    self )
```

Add another stage container to the current list of stage containers.

#### 6.59.3.7 reset()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.reset (  
    self )
```

Reset the container so that it will only run the first stage container again.

### 6.59.3.8 run()

```
def skdiscovery.data_structure.framework.StageContainerIncrementalAdd.run (
    self,
    obj_data_container )
```

Run the current list of stage containers.

## 6.59.4 Member Data Documentation

### 6.59.4.1 currentindex

skdiscovery.data\_structure.framework.StageContainerIncrementalAdd.currentindex

### 6.59.4.2 length

skdiscovery.data\_structure.framework.StageContainerIncrementalAdd.length

### 6.59.4.3 list\_AllStagecontainers

skdiscovery.data\_structure.framework.StageContainerIncrementalAdd.list\_AllStagecontainers

### 6.59.4.4 list\_currentContainers

skdiscovery.data\_structure.framework.StageContainerIncrementalAdd.list\_currentContainers

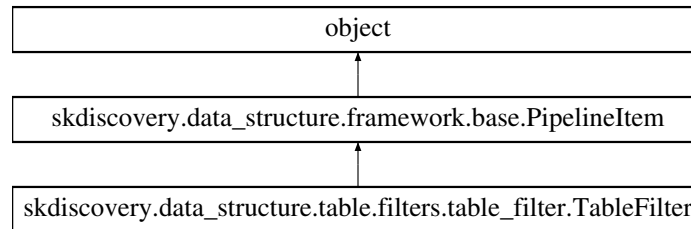
The documentation for this class was generated from the following file:

- data\_structure/framework/[stagecontainers.py](#)

## 6.60 skdiscovery.data\_structure.table.filters.TableFilter Class Reference

This class removes tables based on their label.

Inheritance diagram for skdiscovery.data\_structure.table.filters.TableFilter:



### Public Member Functions

- def `__init__` (self, `str_description`, `ap_paramList`, `invert=False`)  
*Initialize Table Filter.*
- def `process` (self, `obj_data`)  
*Apply geolocation filter to data set.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String represntation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

### Public Attributes

- `invert`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

#### 6.60.1 Detailed Description

This class removes tables based on their label.

#### 6.60.2 Constructor & Destructor Documentation

6.60.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.TableFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    invert = False )
```

Initialize Table Filter.

## Parameters

<i>str_description</i>	String describing this filter
<i>ap_paramList</i> [ <i>ap_label_list</i> ]	AutoList of table labels to remove
<i>invert</i>	Keep tables in list, and remove all others instead

## 6.60.3 Member Function Documentation

6.60.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

## Returns

String listing all current parameters

6.60.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

## Returns

String containing the item description and current parameters for filter.

### 6.60.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

### 6.60.3.4 process()

```
def skdiscovery.data_structure.table.filters.TableFilter.process (
    self,
    obj_data )
```

Apply geolocation filter to data set.

#### Parameters

<i>obj_data</i>	Table data wrapper
-----------------	--------------------

### 6.60.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.60.4 Member Data Documentation

### 6.60.4.1 ap\_paramList

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

### 6.60.4.2 ap\_paramNames

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

## 6.60.4.3 invert

```
skdiscovery.data_structure.table.filters.TableFilter.invert
```

## 6.60.4.4 str\_description

```
skdiscovery.data_structure.framework.PipelineItem.str_description [inherited]
```

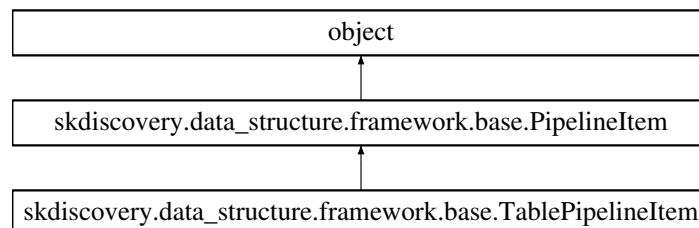
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/table\\_filter.py](#)

## 6.61 skdiscovery.data\_structure.framework.TablePipelineItem Class Reference

Pipeline item for Table data.

Inheritance diagram for skdiscovery.data\_structure.framework.TablePipelineItem:



## Public Member Functions

- `def __init__(self, str_description, ap_paramList, column_list=None, error_column_list=None)`  
*Initialize Table Pipeline item.*
- `def perturbParams(self)`  
*choose other random value for all parameters*
- `def resetParams(self)`  
*set all parameters to initial value*
- `def process(self, obj_data)`  
*The actual filter processing.*
- `def __str__(self)`  
*String representation of object.*
- `def getMetadata(self)`  
*Retrieve metadata about filter.*

## Public Attributes

- [str\\_description](#)
- [ap\\_paramList](#)
- [ap\\_paramNames](#)

### 6.61.1 Detailed Description

Pipeline item for Table data.

### 6.61.2 Constructor & Destructor Documentation

#### 6.61.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.framework.TablePipelineItem.__init__ (
    self,
    str_description,
    ap_paramList,
    column_list = None,
    error_column_list = None )
```

Initialize Table Pipeline item.

#### Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList</i>	List of AutoParams and AutoLists
<i>column_list</i>	List of columns to process
<i>error_column_list</i>	List of the associated error columns

### 6.61.3 Member Function Documentation

#### 6.61.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.



**Returns**

String listing all current parameters

**6.61.3.2 getMetadata()**

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

**Returns**

String containing the item description and current parameters for filter.

**6.61.3.3 perturbParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

**6.61.3.4 process()**

```
def skdiscovery.data_structure.framework.PipelineItem.process (
    self,
    obj_data ) [inherited]
```

The actual filter processing.

Empty in this generic filter.

```
@param obj_data: Data wrapper that will be processed
```

**6.61.3.5 resetParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

## 6.61.4 Member Data Documentation

### 6.61.4.1 `ap_paramList`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramList` [inherited]

### 6.61.4.2 `ap_paramNames`

`skdiscovery.data_structure.framework.PipelineItem.ap_paramNames` [inherited]

### 6.61.4.3 `str_description`

`skdiscovery.data_structure.framework.PipelineItem.str_description` [inherited]

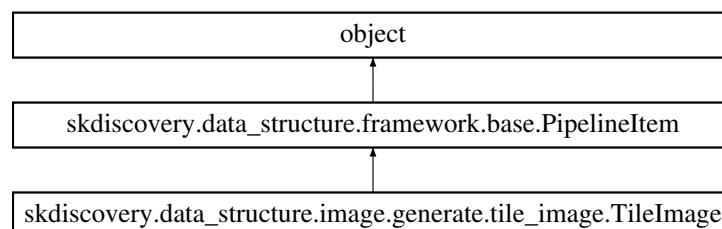
The documentation for this class was generated from the following file:

- `data_structure/framework/base.py`

## 6.62 `skdiscovery.data_structure.image.generate.TileImage` Class Reference

Create several smaller images from a larger image.

Inheritance diagram for `skdiscovery.data_structure.image.generate.TileImage`:



## Public Member Functions

- def `__init__` (self, `str_description`, `ap_paramList`, `size`, `min_deviation`=None, `min_fraction`=None, `deviation_as_percent`=False)  
*Initialize `TileImage` item.*
- def `process` (self, `obj_data`)  
*Genrate new images by tiling input images.*
- def `perturbParams` (self)  
*choose other random value for all parameters*
- def `resetParams` (self)  
*set all parameters to initial value*
- def `__str__` (self)  
*String represntation of object.*
- def `getMetadata` (self)  
*Retrieve metadata about filter.*

## Public Attributes

- `size`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.62.1 Detailed Description

Create several smaller images from a larger image.

### 6.62.2 Constructor & Destructor Documentation

#### 6.62.2.1 `__init__`()

```
def skdiscovery.data_structure.image.generate.TileImage.__init__ (
    self,
    str_description,
    ap_paramList,
    size,
    min_deviation = None,
    min_fraction = None,
    deviation_as_percent = False )
```

Initialize `TileImage` item.

## Parameters

<i>str_description</i>	String description of item
<i>ap_paramList[stride]</i>	Distance between neighboring tiles
<i>size</i>	Size of tile (length of one side of a square)
<i>min_deviation</i>	= Minimum deviation to use when determining to keep tile
<i>min_fraction</i>	Minimum fraction of pixels above min_deviation needed to keep tile
<i>deviation_as_percent</i>	Treat min_deviation as a percentage of the max value of the original image

## 6.62.3 Member Function Documentation

## 6.62.3.1 \_\_str\_\_()

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String represntation of object.

## Returns

String listing all current parameters

## 6.62.3.2 getMetadata()

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

## Returns

String containing the item description and current parameters for filter.

## 6.62.3.3 perturbParams()

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.62.3.4 process()

```
def skdiscovery.data_structure.image.generate.TileImage.process (
    self,
    obj_data )
```

Genrate new images by tiling input images.

#### Parameters

<i>obj_data</i>	Input image wrapper
-----------------	---------------------

#### 6.62.3.5 resetParams()

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

### 6.62.4 Member Data Documentation

#### 6.62.4.1 ap\_paramList

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramList [inherited]

#### 6.62.4.2 ap\_paramNames

skdiscovery.data\_structure.framework.PipelineItem.ap\_paramNames [inherited]

#### 6.62.4.3 size

skdiscovery.data\_structure.image.generate.TileImage.size

#### 6.62.4.4 str\_description

skdiscovery.data\_structure.framework.PipelineItem.str\_description [inherited]

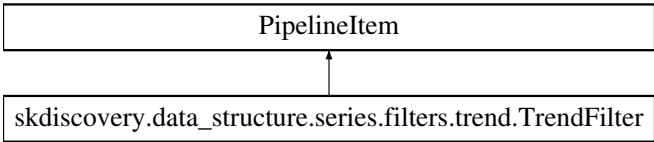
The documentation for this class was generated from the following file:

- data\_structure/image/generate/[tile\\_image.py](#)

## 6.63 skdiscovery.data\_structure.series.filters.TrendFilter Class Reference

Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.

Inheritance diagram for skdiscovery.data\_structure.series.filters.TrendFilter:



### Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList)  
*Initialize Trend Filter.*
- def `process` (self, obj\_data)  
*Apply trend filter to data set.*

### Public Attributes

- `ap_paramNames`

### 6.63.1 Detailed Description

Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.

### 6.63.2 Constructor & Destructor Documentation

#### 6.63.2.1 `__init__`()

```
def skdiscovery.data_structure.series.filters.TrendFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Trend Filter.

#### Parameters

<code>str_description</code>	String describing filter
<code>ap_paramList[list_trendTypes]</code>	List of trend types. List can contain any mix of "linear", "annual", or "semiannual".
Generated by Doxygen	The default is to remove the linear, annual, and semiannual trends

### 6.63.3 Member Function Documentation

#### 6.63.3.1 process()

```
def skdiscovery.data_structure.series.filters.TrendFilter.process (
    self,
    obj_data )
```

Apply trend filter to data set.

##### Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

### 6.63.4 Member Data Documentation

#### 6.63.4.1 ap\_paramNames

```
skdiscovery.data_structure.series.filters.TrendFilter.ap_paramNames
```

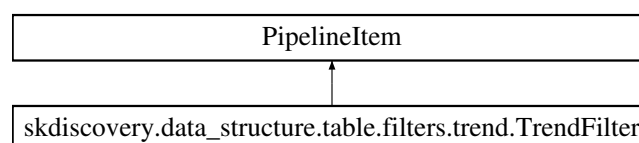
The documentation for this class was generated from the following file:

- data\_structure/series/filters/[trend.py](#)

## 6.64 skdiscovery.data\_structure.table.filters.TrendFilter Class Reference

Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.

Inheritance diagram for skdiscovery.data\_structure.table.filters.TrendFilter:





## Public Member Functions

- def `__init__` (self, str\_description, ap\_paramList, columns=None)  
*Initialize Trend Filter.*
- def `process` (self, obj\_data)  
*Apply trend filter to data set.*

## Public Attributes

- `columns`
- `ap_paramNames`

### 6.64.1 Detailed Description

Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.

Works on table data

### 6.64.2 Constructor & Destructor Documentation

#### 6.64.2.1 `__init__()`

```
def skdiscovery.data_structure.table.filters.TrendFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    columns = None )
```

Initialize Trend Filter.

#### Parameters

<code>str_description</code>	String describing filter
<code>ap_paramList[list_trendTypes]</code>	List of trend types. List can contain "linear", "annual", or "semiannual"
<code>columns</code>	List of column names to filter

### 6.64.3 Member Function Documentation

### 6.64.3.1 process()

```
def skdiscovery.data_structure.table.filters.TrendFilter.process (
    self,
    obj_data )
```

Apply trend filter to data set.

#### Parameters

<i>obj_data</i>	Input data. Changes are made in place.
-----------------	--

## 6.64.4 Member Data Documentation

### 6.64.4.1 ap\_paramNames

```
skdiscovery.data_structure.table.filters.TrendFilter.ap_paramNames
```

### 6.64.4.2 columns

```
skdiscovery.data_structure.table.filters.TrendFilter.columns
```

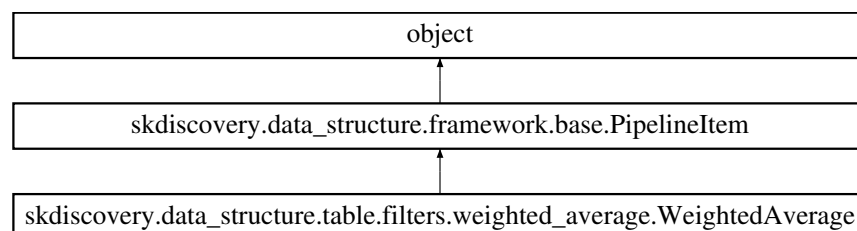
The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/trend.py](#)

## 6.65 skdiscovery.data\_structure.table.filters.WeightedAverage Class Reference

This filter performs a rolling weighted average using standard deviations as weight.

Inheritance diagram for `skdiscovery.data_structure.table.filters.WeightedAverage`:



## Public Member Functions

- `def __init__ (self, str_description, ap_paramList, column_names, std_dev_column_names=None, propagate_↵ uncertainties=False)`  
*Initializes a [WeightedAverage](#) object.*
- `def process (self, obj_data)`  
*Apply the moving (weighted) average filter to a table data wrapper.n.*
- `def perturbParams (self)`  
*choose other random value for all parameters*
- `def resetParams (self)`  
*set all parameters to initial value*
- `def __str__ (self)`  
*String representation of object.*
- `def getMetadata (self)`  
*Retrieve metadata about filter.*

## Public Attributes

- `column_names`
- `std_dev_column_names`
- `propagate_uncertainties`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

### 6.65.1 Detailed Description

This filter performs a rolling weighted average using standard deviations as weight.

### 6.65.2 Constructor & Destructor Documentation

#### 6.65.2.1 \_\_init\_\_()

```
def skdiscovery.data_structure.table.filters.WeightedAverage.__init__ (  
    self,  
    str_description,  
    ap_paramList,  
    column_names,  
    std_dev_column_names = None,  
    propagate_uncertainties = False )
```

Initializes a [WeightedAverage](#) object.

## Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[window]</i>	Window to use for computing rolling weighted average
<i>column_names</i>	Names of columns to apply the weighted average
<i>std_dev_column_names</i>	Names of columns of the standard deviations. If none a regular mean is computed.
<i>propagate_uncertainties</i>	Propagate uncertainties assuming uncorrelated errors

## 6.65.3 Member Function Documentation

6.65.3.1 `__str__()`

```
def skdiscovery.data_structure.framework.PipelineItem.__str__ (
    self ) [inherited]
```

String representation of object.

## Returns

String listing all current parameters

6.65.3.2 `getMetadata()`

```
def skdiscovery.data_structure.framework.PipelineItem.getMetadata (
    self ) [inherited]
```

Retrieve metadata about filter.

## Returns

String containing the item description and current parameters for filter.

6.65.3.3 `perturbParams()`

```
def skdiscovery.data_structure.framework.PipelineItem.perturbParams (
    self ) [inherited]
```

choose other random value for all parameters

#### 6.65.3.4 process()

```
def skdiscovery.data_structure.table.filters.WeightedAverage.process (
    self,
    obj_data )
```

Apply the moving (weighted) average filter to a table data wrapper.n.

Changes are made in place.

**Parameters**

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

**6.65.3.5 resetParams()**

```
def skdiscovery.data_structure.framework.PipelineItem.resetParams (
    self ) [inherited]
```

set all parameters to initial value

**6.65.4 Member Data Documentation****6.65.4.1 ap\_paramList**

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramList [inherited]
```

**6.65.4.2 ap\_paramNames**

```
skdiscovery.data_structure.framework.PipelineItem.ap_paramNames [inherited]
```

**6.65.4.3 column\_names**

```
skdiscovery.data_structure.table.filters.WeightedAverage.column_names
```

**6.65.4.4 propagate\_uncertainties**

```
skdiscovery.data_structure.table.filters.WeightedAverage.propagate_uncertainties
```

**6.65.4.5 std\_dev\_column\_names**

```
skdiscovery.data_structure.table.filters.WeightedAverage.std_dev_column_names
```

**6.65.4.6 str\_description**

```
skdiscovery.data_structure.framework.PipelineItem.str_description [inherited]
```

The documentation for this class was generated from the following file:

- [data\\_structure/table/filters/weighted\\_average.py](#)

## Chapter 7

# File Documentation

### 7.1 data\_structure/framework/base.py File Reference

#### Classes

- class [skdiscovery.data\\_structure.framework.PipelineItem](#)  
*The general class used to create pipeline items.*
- class [skdiscovery.data\\_structure.framework.TablePipelineItem](#)  
*Pipeline item for Table data.*

#### Namespaces

- [skdiscovery.data\\_structure.framework.base](#)

### 7.2 data\_structure/framework/config.py File Reference

#### Namespaces

- [skdiscovery.data\\_structure.framework.config](#)

#### Functions

- def [skdiscovery.data\\_structure.framework.config.getConfig](#) ()  
*Retrieve skdiscovery configuration.*
- def [skdiscovery.data\\_structure.framework.config.writeConfigValue](#) (section, key, value)  
*Write config to disk.*
- def [skdiscovery.data\\_structure.framework.config.getConfigValue](#) (section, key)  
*Retrieve a value from the config file.*
- def [skdiscovery.data\\_structure.framework.config.getDispyPassword](#) ()  
*Get dispy password.*
- def [skdiscovery.data\\_structure.framework.config.getHostName](#) ()  
*Get Host name for displaying link to dispy status.*

## 7.3 data\_structure/framework/discoverypipeline.py File Reference

### Classes

- class [skdiscovery.data\\_structure.framework.DiscoveryPipeline](#)  
*Pipeline for running the analysis.*

### Namespaces

- [skdiscovery.data\\_structure.framework.discoverypipeline](#)

## 7.4 data\_structure/framework/stagecontainers.py File Reference

### Classes

- class [skdiscovery.data\\_structure.framework.StageContainer](#)  
*Container to hold a stage for the DiscoveryPipeline.*
- class [skdiscovery.data\\_structure.framework.StageContainerAlternative](#)  
*Stage Container that holds a list of stage containers and randomly chooses one to use.*
- class [skdiscovery.data\\_structure.framework.StageContainerIncrementalAdd](#)  
*In each perturb call, it incrementally adds one of the filters specified in the constructor.*

### Namespaces

- [skdiscovery.data\\_structure.framework.stagecontainers](#)

## 7.5 data\_structure/generic/accumulators/data.py File Reference

### Classes

- class [skdiscovery.data\\_structure.generic.accumulators.DataAccumulator](#)  
*Stores a copy of the data in its current state in the pipeline.*

### Namespaces

- [skdiscovery.data\\_structure.generic.accumulators.data](#)



## 7.6 data\_structure/generic/accumulators/gpshplotter.py File Reference

### Classes

- class [skdiscovery.data\\_structure.generic.accumulators.GPSHPlotter](#)  
*Plots results from General\_Component\_Analysis, for the GPS horizontal or vertical components.*

### Namespaces

- [skdiscovery.data\\_structure.generic.accumulators.gpshplotter](#)

## 7.7 data\_structure/generic/accumulators/hcluster.py File Reference

### Classes

- class [skdiscovery.data\\_structure.generic.accumulators.HCluster](#)  
*Hierarchical Clustering function that produces a cluster map of the distance matrix.*

### Namespaces

- [skdiscovery.data\\_structure.generic.accumulators.hcluster](#)

## 7.8 data\_structure/image/accumulators/saver.py File Reference

### Classes

- class [skdiscovery.data\\_structure.image.accumulators.Saver](#)  
*Write images out to a hdf5 file.*

### Namespaces

- [skdiscovery.data\\_structure.image.accumulators.saver](#)

## 7.9 data\_structure/image/analysis/squares\_from\_poly.py File Reference

### Classes

- class [skdiscovery.data\\_structure.image.analysis.SquaresFromPoly](#)  
*Generate shapely squares that intersect with a shapely polygon.*

## Namespaces

- [skdiscovery.data\\_structure.image.analysis.squares\\_from\\_poly](#)

## 7.10 data\_structure/image/filters/select\_channel.py File Reference

### Classes

- class [skdiscovery.data\\_structure.image.filters.SelectChannel](#)  
*Select a specific channel out of a 3 dimensional image.*

## Namespaces

- [skdiscovery.data\\_structure.image.filters.select\\_channel](#)

## 7.11 data\_structure/image/generate/rotate\_image.py File Reference

### Classes

- class [skdiscovery.data\\_structure.image.generate.RotateImage](#)  
*Create new images by rotating 90, 180, and 270 degrees.*

## Namespaces

- [skdiscovery.data\\_structure.image.generate.rotate\\_image](#)

## 7.12 data\_structure/image/generate/tile\_image.py File Reference

### Classes

- class [skdiscovery.data\\_structure.image.generate.TileImage](#)  
*Create several smaller images from a larger image.*

## Namespaces

- [skdiscovery.data\\_structure.image.generate.tile\\_image](#)

## 7.13 data\_structure/series/accumulators/plotter.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.accumulators.Plotter](#)  
*Make a plot of series data.*

### Namespaces

- [skdiscovery.data\\_structure.series.accumulators.plotter](#)

## 7.14 data\_structure/table/accumulators/plotter.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.accumulators.Plotter](#)  
*Make a plot of table data.*

### Namespaces

- [skdiscovery.data\\_structure.table.accumulators.plotter](#)

## 7.15 data\_structure/series/analysis/correlate.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.analysis.Correlate](#)  
*Computes the correlation for series data.*

### Namespaces

- [skdiscovery.data\\_structure.series.analysis.correlate](#)

## 7.16 data\_structure/table/analysis/correlate.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.Correlate](#)  
*Computes the correlation for table data and stores the result as a matrix.*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.correlate](#)

## 7.17 data\_structure/series/analysis/gca.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.analysis.General\\_Component\\_Analysis](#)  
*Performs either ICA or PCA analysis on series data.*

## Namespaces

- [skdiscovery.data\\_structure.series.analysis.gca](#)

## 7.18 data\_structure/table/analysis/gca.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.General\\_Component\\_Analysis](#)  
*Performs a general component analysis on table data.*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.gca](#)

## 7.19 data\_structure/series/analysis/mogi.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.analysis.Mogi\\_Inversion](#)  
*Perform a Mogi source inversion on a set of gps series data.*

## Namespaces

- [skdiscovery.data\\_structure.series.analysis.mogi](#)

## 7.20 data\_structure/table/analysis/mogi.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.Mogi\\_Inversion](#)  
*Perform a mogi source inversion on a set of gps table data.*

### Namespaces

- [skdiscovery.data\\_structure.table.analysis.mogi](#)

## 7.21 data\_structure/series/filters/dataremove.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.DataRemover](#)  
*Sets specified series data to NaN.*

### Namespaces

- [skdiscovery.data\\_structure.series.filters.dataremove](#)

## 7.22 data\_structure/table/filters/dataremove.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.DataRemover](#)  
*Sets specified table data to NaN.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.dataremove](#)

## 7.23 data\_structure/series/filters/hyperbolictan.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.HTanFilter](#)  
*Filter to subtract arctan fit from data.*

## Namespaces

- [skdiscovery.data\\_structure.series.filters.hyperbolictan](#)

## 7.24 data\_structure/table/filters/hyperbolictan.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.HTanFilter](#)  
*Filter to subtract an arctan fit from data.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.hyperbolictan](#)

## 7.25 data\_structure/series/filters/interpolate.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.InterpolateFilter](#)  
*Interpolate missing values on series data.*

## Namespaces

- [skdiscovery.data\\_structure.series.filters.interpolate](#)

## 7.26 data\_structure/table/filters/interpolate.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.InterpolateFilter](#)  
*Interpolate missing values on table data.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.interpolate](#)

## 7.27 data\_structure/series/filters/kalman.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.KalmanFilter](#)  
*Runs a forward and backward Kalman Smoother with a FOGM state on series data.*

### Namespaces

- [skdiscovery.data\\_structure.series.filters.kalman](#)

## 7.28 data\_structure/table/filters/kalman.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.KalmanFilter](#)  
*Runs a forward and backward Kalman Smoother with a FOGM state on table data.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.kalman](#)

## 7.29 data\_structure/series/filters/lowpass.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.LowPassFilter](#)  
*A FIR Remez (Parks-McLellan) designed low pass filter for series data.*

### Namespaces

- [skdiscovery.data\\_structure.series.filters.lowpass](#)

## 7.30 data\_structure/table/filters/lowpass.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.LowPassFilter](#)  
*A remez low pass filter for table data.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.lowpass](#)

## 7.31 data\_structure/series/filters/median.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.MedianFilter](#)  
*A Median filter for series data.*

## Namespaces

- [skdiscovery.data\\_structure.series.filters.median](#)

## 7.32 data\_structure/table/filters/median.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.MedianFilter](#)  
*A Median filter for table data.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.median](#)

## 7.33 data\_structure/series/filters/offset\_detrend.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.OffsetDetrend](#)  
*Trend filter that fits a stepwise function to linearly detrended series data.*

## Namespaces

- [skdiscovery.data\\_structure.series.filters.offset\\_detrend](#)



## 7.34 data\_structure/table/filters/offset\_detrend.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.OffsetDetrend](#)  
*Trend filter that fits a stepwise function to linearly detrended table data.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.offset\\_detrend](#)

## 7.35 data\_structure/series/filters/trend.py File Reference

### Classes

- class [skdiscovery.data\\_structure.series.filters.TrendFilter](#)  
*Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.*

### Namespaces

- [skdiscovery.data\\_structure.series.filters.trend](#)

## 7.36 data\_structure/table/filters/trend.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.TrendFilter](#)  
*Trend Filter that removes linear and sinusoidal (annual, semi-annual) trends on series data.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.trend](#)

## 7.37 data\_structure/table/analysis/dbscan.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.DBScan](#)  
*Runs [DBScan](#) on table data.*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.dbscan](#)

## 7.38 data\_structure/table/analysis/midas.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.MIDAS](#)  
*In Development A basic **MIDAS** trend estimator*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.midas](#)

## 7.39 data\_structure/table/analysis/outlier.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.Outlier](#)  
*Computes  $(data / mad(data))$  for outlier detection.*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.outlier](#)

## 7.40 data\_structure/table/analysis/rotate\_pca.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.RotatePCA](#)  
*\*\*\* In Development \*\*\* Class for rotating PCA to seperate superimposed signals*

## Namespaces

- [skdiscovery.data\\_structure.table.analysis.rotate\\_pca](#)

## 7.41 data\_structure/table/analysis/skew.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.analysis.Skew](#)  
*Calculates the skew of table data.*

### Namespaces

- [skdiscovery.data\\_structure.table.analysis.skew](#)

## 7.42 data\_structure/table/filters/antenna\_offset.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.AntennaOffset](#)  
*Applies corrections to fix offsets in PBO GPS data induced by antenna changes.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.antenna\\_offset](#)

## 7.43 data\_structure/table/filters/calibrate\_py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.CalibrateGRACE](#)  
*Calibrate Grace Data.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.calibrate\\_grace](#)

## 7.44 data\_structure/table/filters/calibrate\_mascon.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.CalibrateGRACEMascon](#)  
*Calibrate Grace Data.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.calibrate\\_mascon](#)

## 7.45 data\_structure/table/filters/combine\_columns.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.CombineColumns](#)  
*Create a new column by selecting data from a column.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.combine\\_columns](#)

## 7.46 data\_structure/table/filters/geolocation.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.GeoLocationFilter](#)  
*Removes objects not located in a specified region.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.geolocation](#)

## 7.47 data\_structure/table/filters/normalize.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.NormalizeFilter](#)  
*Normalize data using median filter.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.normalize](#)

## 7.48 data\_structure/table/filters/propagate\_nans.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.PropagateNaNs](#)  
*Propagates NaN's from one column to other columns.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.propagate\\_nans](#)

## 7.49 data\_structure/table/filters/resample.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.Resample](#)  
*Resample data.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.resample](#)

## 7.50 data\_structure/table/filters/snow\_remover.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.SnowRemover](#)  
*Removes data with snow errors.*

### Namespaces

- [skdiscovery.data\\_structure.table.filters.snow\\_remover](#)

## 7.51 data\_structure/table/filters/stabilization.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.StabilizationFilter](#)  
*This filter transforms GPS stations in a region to a local reference frame.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.stabilization](#)

## 7.52 data\_structure/table/filters/table\_filter.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.TableFilter](#)

*This class removes tables based on their label.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.table\\_filter](#)

## 7.53 data\_structure/table/filters/weighted\_average.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.filters.WeightedAverage](#)

*This filter performs a rolling weighted average using standard deviations as weight.*

## Namespaces

- [skdiscovery.data\\_structure.table.filters.weighted\\_average](#)

## 7.54 data\_structure/table/fusion/grace.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.fusion.GraceFusion](#)

*Fuses GRACE equivalent water depth time series.*

## Namespaces

- [skdiscovery.data\\_structure.table.fusion.grace](#)

## 7.55 data\_structure/table/fusion/snow.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.fusion.SnowFusion](#)  
*Adds snow time series data to table based on geographic coordinates.*

### Namespaces

- [skdiscovery.data\\_structure.table.fusion.snow](#)

## 7.56 data\_structure/table/generators/catalog\_generator.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.generators.CatalogGenerator](#)  
*In Development Generates galaxy catalogs for use in DiscoveryPipeline*

### Namespaces

- [skdiscovery.data\\_structure.table.generators.catalog\\_generator](#)

## 7.57 data\_structure/table/generators/data\_generator.py File Reference

### Classes

- class [skdiscovery.data\\_structure.table.generators.DataGenerator](#)  
*In Class for generating random data.*

### Namespaces

- [skdiscovery.data\\_structure.table.generators.data\\_generator](#)

## 7.58 utilities/cloud/amazon\_control.py File Reference

### Namespaces

- [skdiscovery.utilities.cloud.amazon\\_control](#)

## Functions

- def `skdiscovery.utilities.cloud.amazon_control.init` (in\_aws\_access\_key, in\_aws\_secret, in\_aws\_region, in\_aws\_security\_group, in\_aws\_key\_name, in\_pem\_file)  
*The underlying functionality for the Amazon GUI, the user should not need to directly interface with this function.*
- def `skdiscovery.utilities.cloud.amazon_control.closeDispyScheduler` ()  
*Close the Dispy Scheduler.*
- def `skdiscovery.utilities.cloud.amazon_control.startDispyScheduler` ()  
*Start the Dispy Scheduler.*
- def `skdiscovery.utilities.cloud.amazon_control.generateInfo` (instance)  
*Read metadata from an Amazon instance.*
- def `skdiscovery.utilities.cloud.amazon_control.updateStatus` ()  
*Update status information in amazon\_list.*
- def `skdiscovery.utilities.cloud.amazon_control.setNumInstances` (new\_total\_instances, instance\_type, image\_id)  
*Change the number of running instances.*
- def `skdiscovery.utilities.cloud.amazon_control.updateIPAddress` (instance\_info)  
*Update ip address of instance info.*
- def `skdiscovery.utilities.cloud.amazon_control.goodConnection` (instance, port)  
*Check if an amazon instance has a port open.*
- def `skdiscovery.utilities.cloud.amazon_control.createTunnels` ()  
*Create reverse ssh tunnels to all instances.*
- def `skdiscovery.utilities.cloud.amazon_control.startDispyNode` ()  
*Start dispy on each Amazon instance.*
- def `skdiscovery.utilities.cloud.amazon_control.resetInstances` ()  
*Reboot Amazon instances.*
- def `skdiscovery.utilities.cloud.amazon_control.reset` ()  
*Close and clear Amazon List.*
- def `skdiscovery.utilities.cloud.amazon_control.close` ()  
*Shutdown all instances, close dispy scheduler and clear Amazon list.*
- def `skdiscovery.utilities.cloud.amazon_control.clearAmazonList` ()  
*Shutdown connection tunnels to Amazon instances and clear amazon list.*

## Variables

- `skdiscovery.utilities.cloud.amazon_control.aws_access_key` = None
- `skdiscovery.utilities.cloud.amazon_control.aws_secret` = None
- `skdiscovery.utilities.cloud.amazon_control.aws_region` = None
- `skdiscovery.utilities.cloud.amazon_control.aws_security_group` = None
- `skdiscovery.utilities.cloud.amazon_control.aws_key_name` = None
- `skdiscovery.utilities.cloud.amazon_control.pem_file` = None
- `skdiscovery.utilities.cloud.amazon_control.ec2_res` = None
- `skdiscovery.utilities.cloud.amazon_control.ec2_client` = None
- list `skdiscovery.utilities.cloud.amazon_control.amazon_list` = []
- `skdiscovery.utilities.cloud.amazon_control.scheduler` = None
- `skdiscovery.utilities.cloud.amazon_control.popen` = None



## 7.59 utilities/cloud/amazon\_gui.py File Reference

### Namespaces

- [skdiscovery.utilities.cloud.amazon\\_gui](#)

### Functions

- def [skdiscovery.utilities.cloud.amazon\\_gui.init](#) ()  
*Initialize GUI for controlling Amazon instances.*
- def [skdiscovery.utilities.cloud.amazon\\_gui.drawGUI](#) ()  
*Draw the GUI on the screen.*
- def [skdiscovery.utilities.cloud.amazon\\_gui.changeButtonState](#) (enabled=True)  
*Enable or disable the buttons and slider in the GUI.*
- def [skdiscovery.utilities.cloud.amazon\\_gui.checkValidValues](#) ()  
*Check if Amazon information is valid.*

### Variables

- [skdiscovery.utilities.cloud.amazon\\_gui.widget\\_dict](#) = OrderedDict()
- list [skdiscovery.utilities.cloud.amazon\\_gui.disable\\_list](#) = ['initialize\_button', 'cache\_button', 'restore\_button']
- list [skdiscovery.utilities.cloud.amazon\\_gui.initialized\\_disabled\\_list](#) = ['new\_num\_instances\_widget', 'execute\_↔instances\_button']
- list [skdiscovery.utilities.cloud.amazon\\_gui.key\\_value\\_list](#)
- bool [skdiscovery.utilities.cloud.amazon\\_gui.initialized](#) = False

## 7.60 utilities/cloud/ssh\_reverse.py File Reference

### Classes

- class [skdiscovery.utilities.cloud.ssh\\_reverse.ReverseTunnel](#)  
*Create a reverse ssh tunnel.*

### Namespaces

- [skdiscovery.utilities.cloud.ssh\\_reverse](#)

### Functions

- def [skdiscovery.utilities.cloud.ssh\\_reverse.print\\_verbose](#) (s, verbose=False)  
*Print statement if verbose is True.*
- def [skdiscovery.utilities.cloud.ssh\\_reverse.handler](#) (chan, host, port, verbose=False)  
*Handler is responsible for sending and receiving data through ssh tunnel.*
- def [skdiscovery.utilities.cloud.ssh\\_reverse.reverse\\_forward\\_tunnel](#) (server\_port, remote\_host, remote\_port, transport, check=30, verbose=False)  
*Creates a reverse ssh tunnel.*

## 7.61 utilities/patterns/astro\_tools.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.astro\\_tools](#)

### Functions

- def [skdiscovery.utilities.patterns.astro\\_tools.z\\_to\\_v](#) (z)  
*Convert redshift to km/s assuming shift is due to velocity using special relativity.*
- def [skdiscovery.utilities.patterns.astro\\_tools.v\\_to\\_z](#) (v)  
*Convert km/s to redshift assuming all are using special relativity.*
- def [skdiscovery.utilities.patterns.astro\\_tools.angular\\_separation](#) (ra1, dec1, ra2, dec2)  
*Angular separation between two objects via the haversine formula.*
- def [skdiscovery.utilities.patterns.astro\\_tools.move\\_point](#) (ra, dec, ang\_dist, bearing)  
*Move a point along a great circle at a particular bearing.*
- def [skdiscovery.utilities.patterns.astro\\_tools.abs\\_mag](#) (app\_mag, z)  
*Get the absolute magnitude from apparent magnitude.*
- def [skdiscovery.utilities.patterns.astro\\_tools.app\\_mag](#) (abs\_mag, z)  
*Get the apparent magnitude from absolute magnitude.*
- def [skdiscovery.utilities.patterns.astro\\_tools.nfw](#) (R, norm\_constant, Rs, Rcore)  
*2D Navarro-Frenk-White surface radial profile probability density*
- def [skdiscovery.utilities.patterns.astro\\_tools.lf](#) (x, A, mstar, alpha)  
*Schechter function.*
- def [skdiscovery.utilities.patterns.astro\\_tools.dlf](#) (x, A, m1, a1, m2, a2)  
*double Schechter function.*
- def [skdiscovery.utilities.patterns.astro\\_tools.cdf\\_dlf](#) (x, A, m1, a1, m2, a2, start=-26)  
*Cumulative Schechter function.*
- def [skdiscovery.utilities.patterns.astro\\_tools.inv\\_cdf\\_dlf](#) (p, A, m1, a1, m2, a2, start=-26, end=-15)  
*Inverse Cumulative Schechter function.*

## 7.62 utilities/patterns/atec\_tools.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.atec\\_tools](#)

## Functions

- def [skdiscovery.utilities.patterns.atec\\_tools.geocalc](#) (lat1, lon1, lat2, lon2)
- def [skdiscovery.utilities.patterns.atec\\_tools.get\\_lp\\_tec](#) (tvec, vtec\_est, window\_length=481, polyorder=3)  
*get\_lp\_tec returns a low pass version of the vertical tec at the same time spacing as vtec\_est (that is, at the times given by tvec).*
- def [skdiscovery.utilities.patterns.atec\\_tools.getRawStitch](#) (DOYs, llat, ulat, llon, rlon, year=2016)
- def [skdiscovery.utilities.patterns.atec\\_tools.fixTECOffset](#) (siteprnTEC, doyN, dchk=3, dcut=.25, mjump=1)
- def [skdiscovery.utilities.patterns.atec\\_tools.findTECEvents](#) (rawdata, dayNum, hrEvent, pwin=200, nstd=10, thrstd=.75, verbose=False, fixOffset=False)
- def [skdiscovery.utilities.patterns.atec\\_tools.plotTECres](#) (pidx, resbuf, hrEvent, pwin=200)
- def [skdiscovery.utilities.patterns.atec\\_tools.makeMap](#) (lat\_0, lon\_0, dbuffer=5, projection='gnom', resolution='i')
- def [skdiscovery.utilities.patterns.atec\\_tools.findPRNs](#) (raw\_tec, eventHr, doyN, lat\_0, lon\_0, latWin=5, lonWin=5, nThreshold=1000)
- def [skdiscovery.utilities.patterns.atec\\_tools.genDTecs](#) (aprn, raw\_tec, doyN)
- def [skdiscovery.utilities.patterns.atec\\_tools.plotPRNd](#) (raw\_tec, dtecDat, eventHr, doyN, lat\_0, lon\_0, m, fsize=(10, 10), clim=.1, ms=5)
- def [skdiscovery.utilities.patterns.atec\\_tools.plotTracks](#) (prns, asite, raw\_tec, eventHr, doyN, lat\_0, lon\_0, m, fsize=(10, 10), ms=[15])
- def [skdiscovery.utilities.patterns.atec\\_tools.genHodochron](#) (raw\_data, aprn, doyN, lat\_0, lon\_0)
- def [skdiscovery.utilities.patterns.atec\\_tools.plotHodochron](#) (genRes, eventTime, propTime=None, ylim=[-1500, clim=.1, figsize=(12, 5), ms=5, nDir=True, fntsize=10)

## 7.63 utilities/patterns/general\_tools.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.general\\_tools](#)

## Functions

- def [skdiscovery.utilities.patterns.general\\_tools.getPCAComponents](#) (pca\_results)  
*Retrieve PCA components from PCA results.*
- def [skdiscovery.utilities.patterns.general\\_tools.rotate](#) (col\_vectors, az, ay, ax)  
*Rotate col vectors in three dimensions.*
- def [skdiscovery.utilities.patterns.general\\_tools.translate](#) (col\_vectors, delta\_x, delta\_y, delta\_z)  
*Translate col vectors by x, y, and z.*
- def [skdiscovery.utilities.patterns.general\\_tools.formatColorbarLabels](#) (colorbar, pad=29)  
*Adjust the labels on a colorbar so they are right aligned.*

## 7.64 utilities/patterns/image\_tools.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.image\\_tools](#)

## Functions

- def [skdiscovery.utilities.patterns.image\\_tools.buildMatchedPoints](#) (in\_matches, query\_kp, train\_kp)  
*Get postions of matched points.*
- def [skdiscovery.utilities.patterns.image\\_tools.scaleImage](#) (input\_data, vmin=None, vmax=None)  
*Scale image values to be within 0 and 255.*
- def [skdiscovery.utilities.patterns.image\\_tools.divideIntoSquares](#) (image, size, stride)  
*Create many patches from an image.*
- def [skdiscovery.utilities.patterns.image\\_tools.generateSquaresAroundPoly](#) (poly, size=100, stride=20)  
*Generate that may touch a shapely polygon.*

## 7.65 utilities/patterns/kalman\_smoother.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.kalman\\_smoother](#)

### Functions

- def [skdiscovery.utilities.patterns.kalman\\_smoother.KalmanFilter](#) (in\_data, t, sigma\_sq, R, Pinit, x0=0, invert=False, clipping=5)  
*Runs the kalman filter on data.*
- def [skdiscovery.utilities.patterns.kalman\\_smoother.FitFOGMParameters](#) (data, Pinit=100, R=1, method='brute', x0=0, clipping=5)  
*Find best FOGM parameters for a given data set.*
- def [skdiscovery.utilities.patterns.kalman\\_smoother.IterativeGridSearch](#) (f, args, intervals, max\_iter=50, tol=0.1, bounds=None, prev\_minimum=None, verbose=False)  
*Find the minimum of f using an iterative grid search with 3 points per dimension.*
- def [skdiscovery.utilities.patterns.kalman\\_smoother.KalmanSmoother](#) (in\_data, Pinit=1e6, Restimate=1, clipping=5, method='simple', t=None, sigma\_sq=None, R=1, verbose=False, max\_clip\_iter=10)  
*Smoother based on a forward and a backward kalman filter.*
- def [skdiscovery.utilities.patterns.kalman\\_smoother.FOGM](#) (size, t, sigma\_sq, R)  
*Generates data from a First Order Gaussian-Markov process.*

## 7.66 utilities/patterns/pbo\_tools.py File Reference

### Classes

- class [skdiscovery.utilities.patterns.pbo\\_tools.SourceWrapper](#)  
*Wrapper for using old interface with updated source interfaces.*

### Namespaces

- [skdiscovery.utilities.patterns.pbo\\_tools](#)

## Functions

- def [skdiscovery.utilities.patterns.pbo\\_tools.getLength](#) (position\_y, position\_x)  
*Get the length of the input position y and position x data.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.compute\\_distances](#) (position\_y, position\_x, source\_y, source\_x, latlon=True)  
*Compute the y and x distance between the observation location and the source location.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.mogi](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, latlon=True)  
*Compute the surface deformation due to changes in a mogi source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.finite\\_sphere](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, alpha\_rad, latlon=True)  
*Compute the surface deformation due to changes in a finite sphere source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.closed\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)  
*Compute the surface deformation due to changes in a closed pipe source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.constant\\_open\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)  
*Compute the surface deformation due to changes in a constant width open pipe source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.rising\\_open\\_pipe](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, pipe\_delta, latlon=True)  
*Compute the surface deformation due to changes in a rising width amplitude open pipe source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.sill](#) (position\_y, position\_x, source\_y, source\_x, source\_depth, amplitude, latlon=True)  
*Compute the surface deformation due to changes in a sill-like source.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.dirEigenvectors](#) (coord\_list, pca\_comps, pdir='H')  
*Takes eigenvectors (north and east) and forces them to point "outward".*
- def [skdiscovery.utilities.patterns.pbo\\_tools.datetimeToNumber](#) (in\_time)  
*Converts input pandas Timestamp or pandas DatetimeIndex to unix time.*
- def [skdiscovery.utilities.patterns.pbo\\_tools.MogiVectors](#) (mogi\_res, station\_lat\_list, station\_lon\_list, flag3D=False)  
*Creates a set of Mogi vectors for plotting.*

## 7.67 utilities/patterns/polygon\_utils.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.polygon\\_utils](#)

### Functions

- def [skdiscovery.utilities.patterns.polygon\\_utils.shoelaceArea](#) (in\_vertices)  
*Determine the area of a polygon using the shoelace method.*
- def [skdiscovery.utilities.patterns.polygon\\_utils.parseBasemapShape](#) (aquifers, aquifers\_info)  
*Create shapely polygons from shapefile read in with basemap.*
- def [skdiscovery.utilities.patterns.polygon\\_utils.nearestEdgeDistance](#) (x, y, poly)  
*Determine the distance to the closest edge of a polygon.*

- def [skdiscovery.utilities.patterns.polygon\\_utils.findPolygon](#) (in\_data, in\_point)  
*Find the polygon that a point resides in.*
- def [skdiscovery.utilities.patterns.polygon\\_utils.getInfo](#) (row, key, fill, polygon\_data)  
*Retrieve information from polygon data:*
- def [skdiscovery.utilities.patterns.polygon\\_utils.findClosestPolygonDistance](#) (x, y, polygon\_data)  
*Find the distance to the closest polygon.*

## 7.68 utilities/patterns/random\_walks.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.random\\_walks](#)

### Functions

- def [skdiscovery.utilities.patterns.random\\_walks.uniform\\_walk](#) (pos, grid, step\_size=None)  
*A uniform random walk function.*
- def [skdiscovery.utilities.patterns.random\\_walks.gaussian\\_walk](#) (pos, grid, step\_size=None)  
*A gaussian random walk function.*
- def [skdiscovery.utilities.patterns.random\\_walks.keep\\_in\\_bound](#) (pos, grid)  
*Function for truncating and bounding the random walk to within the defined grid.*

## 7.69 utilities/patterns/trend\_tools.py File Reference

### Namespaces

- [skdiscovery.utilities.patterns.trend\\_tools](#)

### Functions

- def [skdiscovery.utilities.patterns.trend\\_tools.getTrend](#) (xdata)  
*The getTrend function applies the signal.detrend function.*
- def [skdiscovery.utilities.patterns.trend\\_tools.sinuFits](#) (xdata, fitN=2, rmve=1)  
*The sinuFits function fits annual and semi-annual sinusoid trends.*
- def [skdiscovery.utilities.patterns.trend\\_tools.interpNaN](#) (data)  
*Interpolate data using a linear interpolation.*
- def [skdiscovery.utilities.patterns.trend\\_tools.medianFilter](#) (data, window, interpolate=True)  
*A median filter.*
- def [skdiscovery.utilities.patterns.trend\\_tools.normalize](#) (in\_data)

## 7.70 utilities/planetary/ellipse\_uncertainty.py File Reference

### Namespaces

- [skdiscovery.utilities.planetary.ellipse\\_uncertainty](#)

### Functions

- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.coordinates\\_coding](#) (ob)  
*Function definitions.*
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.create\\_path\\_from\\_coordinates](#) (xy\_outer\_ring, xy\_inner\_← rings=[])
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_path](#) (center\_longitude, center\_latitude, a, b, azimuth, planet\_radius, number\_of\_nodes=100, basemap=None)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.transform\\_to\\_pixel\\_coordinates](#) (x, y, xmin, xmax, ymin, ymax, width, height)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_path\\_bounding\\_box](#) (ellipse\_path, lon\_← min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_path\\_and\\_bounding\\_box](#) (center\_← longitude, center\_latitude, a, b, azimuth, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height, planet\_radius, number\_of\_nodes=100)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_raster\\_ellipse](#) (favorability\_map\_array, rad\_← center\_longitude, rad\_center\_latitude, rad\_longitudes, rad\_latitudes, planet\_radius, a, b, azimuth, ellipse\_slice)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_coordinates](#) (rad\_center\_longitude, rad\_← center\_latitude, a, b, azimuth, planet\_radius, number\_of\_nodes=100)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.min\\_list](#) (list\_a)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.max\\_list](#) (list\_a)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_extremities](#) (ellipse\_path\_longitudes, ellipse\_path\_latitudes)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_bounding\\_box](#) (ellipse\_extremities, lon\_← min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.transform\\_to\\_pixel\\_coordinates\\_math](#) (x, y, xmin, xmax, ymin, ymax, width, height)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_ellipse\\_and\\_bounding\\_box](#) (center\_longitude, center\_latitude, a, b, azimuth, lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height, planet\_radius, number\_of\_nodes=100)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.get\\_favorability\\_inside\\_ellipse](#) (favorability\_map\_array, rad\_center\_longitude, rad\_center\_latitude, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, a, b, azimuth, slice\_i, slice\_j)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_number\\_of\\_ellipse\\_nodes](#) (latitude, min\_← number\_of\_nodes=100, max\_number\_of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_landing\\_ellipse\\_uncertainty](#) (raster\_rawfavorability\_← \_array, i, j, rad\_longitude\_array, rad\_latitude\_array, a, b, azimuth, min\_number\_of\_nodes=100, max\_number\_← of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75, raster\_lon\_min=-180, raster\_lon\_max=180, raster\_← lat\_min=-90, raster\_lat\_max=90, planet\_radius=3389.50)
- [def skdiscovery.utilities.planetary.ellipse\\_uncertainty.compute\\_landing\\_ellipse\\_uncertainties](#) (raster\_rawfavorability\_← \_array, ii, jj, rad\_longitude\_array, rad\_latitude\_array, a, b, azimuth, min\_number\_of\_nodes=100, max\_number\_← of\_nodes=500, sigmoid\_midlatitude=85, steepness=0.75, raster\_lon\_min=-180, raster\_lon\_max=180, raster\_← lat\_min=-90, raster\_lat\_max=90, planet\_radius=3389.50)

## 7.71 utilities/planetary/fast\_marching.py File Reference

### Classes

- class [skdiscovery.utilities.planetary.fast\\_marching.PriorityQueue](#)

*Function definitions.*

### Namespaces

- [skdiscovery.utilities.planetary.fast\\_marching](#)

### Functions

- def [skdiscovery.utilities.planetary.fast\\_marching.get\\_four\\_neighborhood](#) (j, i, raster\_height, raster\_width, gap=1, is\_entire\_planet\_mapped=True)
- def [skdiscovery.utilities.planetary.fast\\_marching.haversine\\_distance\\_math](#) (longitude\_1, latitude\_1, longitude\_2, latitude\_2, radius)
- def [skdiscovery.utilities.planetary.fast\\_marching.get\\_quadratic\\_coefficients](#) (current\_cell\_j, current\_cell\_i, time\_array, alive\_cells, velocity\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [skdiscovery.utilities.planetary.fast\\_marching.solve\\_quadratic\\_equation](#) (a, b, c)
- def [skdiscovery.utilities.planetary.fast\\_marching.compute\\_time](#) (current\_cell\_j, current\_cell\_i, time\_array, alive\_cells, velocity\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [skdiscovery.utilities.planetary.fast\\_marching.run\\_fast\\_marching](#) (initiation\_array, velocity\_array, longitude\_array, latitude\_array, planet\_radius, stopping\_time=None, is\_entire\_planet\_mapped=True, turn\_inf\_to\_nan=True)

## 7.72 utilities/planetary/fuzzy\_logic.py File Reference

### Namespaces

- [skdiscovery.utilities.planetary.fuzzy\\_logic](#)

### Functions

- def [skdiscovery.utilities.planetary.fuzzy\\_logic.trapezoidal\\_function](#) (raster\_array, x\_start\_rise, x\_start\_plateau, x\_end\_plateau, x\_end\_slope, bottom\_value=0.2, plateau\_value=1, nan\_value=0.1)
- Function definitions.*
- def [skdiscovery.utilities.planetary.fuzzy\\_logic.union](#) (args)
  - def [skdiscovery.utilities.planetary.fuzzy\\_logic.intersection](#) (args)
  - def [skdiscovery.utilities.planetary.fuzzy\\_logic.complement](#) (raster\_array\_a)
  - def [skdiscovery.utilities.planetary.fuzzy\\_logic.algebraic\\_product](#) (args)
  - def [skdiscovery.utilities.planetary.fuzzy\\_logic.algebraic\\_sum](#) (args)
  - def [skdiscovery.utilities.planetary.fuzzy\\_logic.gamma\\_operation](#) (gamma, args)



## 7.73 utilities/planetary/geographical\_computation.py File Reference

### Namespaces

- [skdiscovery.utilities.planetary.geographical\\_computation](#)

### Functions

- [def skdiscovery.utilities.planetary.geographical\\_computation.haversine\\_distance\\_math](#) (longitude\_1, latitude\_1, longitude\_2, latitude\_2, radius)
- [def skdiscovery.utilities.planetary.geographical\\_computation.nvector\\_from\\_lonlat](#) (longitude\_1, latitude\_1)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_great\\_circle\\_nvector](#) (nvector\_1, bearing, distance, planet\_radius)
- [def skdiscovery.utilities.planetary.geographical\\_computation.lonlat\\_from\\_nvector](#) (nvector\_1)
- [def skdiscovery.utilities.planetary.geographical\\_computation.mod](#) (y, x)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_great\\_circle\\_distance\\_and\\_bearing](#) (rad\_longitude\_1, rad\_latitude\_1, rad\_longitude\_2, rad\_latitude\_2, planet\_radius)
- [def skdiscovery.utilities.planetary.geographical\\_computation.nvector\\_from\\_lonlat\\_math](#) (rad\_longitude\_1, rad\_latitude\_1)
- [def skdiscovery.utilities.planetary.geographical\\_computation.cross](#) (vector\_a, vector\_b)
- [def skdiscovery.utilities.planetary.geographical\\_computation.scalar\\_division](#) (vector\_a, scalar)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_great\\_circle\\_nvector\\_math](#) (nvector\_1, bearing, distance, planet\_radius)
- [def skdiscovery.utilities.planetary.geographical\\_computation.lonlat\\_from\\_nvector\\_math](#) (nvector\_1)
- [def skdiscovery.utilities.planetary.geographical\\_computation.mod\\_math](#) (y, x)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_great\\_circle\\_distance\\_and\\_bearing\\_math](#) (rad\_longitude\_1, rad\_latitude\_1, rad\_longitude\_2, rad\_latitude\_2, planet\_radius)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_longitude\\_and\\_latitude\\_maps](#) (lon\_min, lon\_max, lat\_min, lat\_max, raster\_width, raster\_height)
- [def skdiscovery.utilities.planetary.geographical\\_computation.compute\\_surface\\_area](#) (raster\_longitude\_array, raster\_latitude\_array, lon\_min, lon\_max, lat\_min, lat\_max, planet\_radius)

### Variables

- [skdiscovery.utilities.planetary.geographical\\_computation.nopython](#)

*Function definitions.*

## 7.74 utilities/planetary/map\_util.py File Reference

### Classes

- class [skdiscovery.utilities.planetary.map\\_util.Planet](#)  
*A class for storing variables about a planetary body.*
- class [skdiscovery.utilities.planetary.map\\_util.GlobalCoords](#)  
*Converts from pixel coordinates to projected coordinates.*

## Namespaces

- [skdiscovery.utilities.planetary.map\\_util](#)

## Functions

- def [skdiscovery.utilities.planetary.map\\_util.sanitize\\_latlon](#) (lat\_lon\_tuple, ppd=1, start\_from\_90N=False)  
*Wraps around latitude & longitudes, including interpretation of points past the poles.*
- def [skdiscovery.utilities.planetary.map\\_util.trim\\_map](#) (array, ppd, nswe, lat\_npole=90, lon\_offset=0)  
*Returns a copy of a map/array trimmed to the given N, S, W, E extents.*
- def [skdiscovery.utilities.planetary.map\\_util.calc\\_slopes](#) (topo\_array, ppd, planet, scaled=True, nswe="global", lon\_offset=0, lat\_npole=90)  
*Calculate a slope map from a topographic dataset.*
- def [skdiscovery.utilities.planetary.map\\_util.wgs84\\_distance](#) (point1, point2, planet=Planet("wgs84"), miles=False)  
*Vincenty distance adapted from public domain vincenty package.*
- def [skdiscovery.utilities.planetary.map\\_util.global\\_coords](#) (x\_in, y\_in, coeffs)  
*Transform pixel coordinates into projected coords using affine transformation coefficients.*
- def [skdiscovery.utilities.planetary.map\\_util.gps\\_to\\_pixel](#) (gpsmethod, gps\_coord, bounds)  
*Function for finding the pixel coordinate associated with a gps coordinate.*

## 7.75 utilities/planetary/morphometry.py File Reference

## Namespaces

- [skdiscovery.utilities.planetary.morphometry](#)

## Functions

- def [skdiscovery.utilities.planetary.morphometry.add\\_symmetric\\_border](#) (raster\_array, border\_size=1)
- def [skdiscovery.utilities.planetary.morphometry.add\\_planet\\_border](#) (raster\_array, border\_size=1)
- def [skdiscovery.utilities.planetary.morphometry.compute\\_gradient](#) (j, i, raster\_array, longitude\_array, latitude\_array, planet\_radius, axis=1)
- def [skdiscovery.utilities.planetary.morphometry.compute\\_horne\\_slope](#) (raster\_array, longitude\_array, latitude\_array, planet\_radius, is\_entire\_planet\_mapped=True)
- def [skdiscovery.utilities.planetary.morphometry.compute\\_absolute\\_standard\\_deviation\\_filter](#) (raster\_array, window\_size=3, is\_entire\_planet\_mapped=True)

## Variables

- [skdiscovery.utilities.planetary.morphometry.nopython](#)

*Function definitions.*

## 7.76 utilities/planetary/raster\_management.py File Reference

### Classes

- class [skdiscovery.utilities.planetary.raster\\_management.DiscreteColormap](#)

### Namespaces

- [skdiscovery.utilities.planetary.raster\\_management](#)

### Functions

- def [skdiscovery.utilities.planetary.raster\\_management.open\\_raster](#) (gdal\_raster\_path, read\_only=True)  
*Function definitions.*
- def [skdiscovery.utilities.planetary.raster\\_management.get\\_raster\\_array](#) (gdal\_raster, remove\_ndv=True)
- def [skdiscovery.utilities.planetary.raster\\_management.get\\_raster\\_extent](#) (gdal\_raster)
- def [skdiscovery.utilities.planetary.raster\\_management.print\\_raster\\_info](#) (gdal\_raster)
- def [skdiscovery.utilities.planetary.raster\\_management.define\\_geotransform](#) (xmin, xmax, ymin, ymax, raster\_x↵\_size, raster\_y\_size)
- def [skdiscovery.utilities.planetary.raster\\_management.add\\_raster\\_to\\_map](#) (basemap, raster\_array, raster\_↵name, min\_longitude=-180, max\_longitude=180, min\_latitude=-90, max\_latitude=90, colormap='viridis', add\_↵colorbar=True, zorder=1, use\_latlon=True, use\_pcolormesh=True)
- def [skdiscovery.utilities.planetary.raster\\_management.create\\_raster\\_from\\_array](#) (raster\_array, geotransform, pro-↵jection, file\_type='MEM', file\_path="", data\_type=gdal.GDT\_Float64, no\_data\_value=-99999., scale=1., offset=0., options=[])
- def [skdiscovery.utilities.planetary.raster\\_management.transform\\_to\\_i\\_coordinate](#) (x, xmin, xmax, width)
- def [skdiscovery.utilities.planetary.raster\\_management.recenter\\_raster\\_array](#) (raster\_array, old\_central\_meridian, new\_central\_meridian, old\_lon\_min, old\_lon\_max)
- def [skdiscovery.utilities.planetary.raster\\_management.recenter\\_raster](#) (raster, old\_central\_meridian, new\_↵central\_meridian, old\_lon\_min, old\_lon\_max, file\_type='MEM', file\_path="")

## 7.77 utilities/planetary/traverse\_emulation.py File Reference

### Namespaces

- [skdiscovery.utilities.planetary.traverse\\_emulation](#)

## Functions

- def [skdiscovery.utilities.planetary.traverse\\_emulation.get\\_target\\_types\\_at\\_cells](#) (target\_arrays)  
*Function definitions.*
- def [skdiscovery.utilities.planetary.traverse\\_emulation.identify\\_neighbors](#) (cells, target\_types\_at\_cells, target\_arrays, time\_limit=math.inf)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.compute\\_neighborhoods](#) (neighbors, target\_types\_at\_cells, time\_limit)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.extract\\_threshold\\_targets](#) (neighborhoods, target\_types\_at\_cells, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_groups\_per\_priority, time\_limit)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.compute\\_path\\_rank](#) (traverse\_path, scenarios\_visited\_groups\_per\_priorities, scenarios\_path\_duration, max\_path\_length, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_priorities, scenarios\_groups\_per\_priority, high\_resolution\_arrays, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, group\_weights, number\_weight, data\_weight, sinuosity\_weight, duration\_weight)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.are\\_all\\_high\\_priority\\_in\\_path](#) (traverse\_path, scenarios\_groups\_per\_priority, scenarios\_target\_priorities, scenarios\_target\_groups)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.check\\_path\\_validity](#) (traverse\_path, new\_target, max\_path\_duration)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.compute\\_traverse\\_paths](#) (threshold\_targets, neighborhoods, target\_types\_at\_cells, max\_path\_length, scenarios\_target\_priorities, scenarios\_target\_groups, scenarios\_priorities, scenarios\_groups\_per\_priority, high\_resolution\_arrays, rad\_longitude\_array, rad\_latitude\_array, planet\_radius, group\_weights, number\_weight, data\_weight, sinuosity\_weight, duration\_weight)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.save\\_paths\\_to\\_csv\\_file](#) (file\_path, paths\_dict)
- def [skdiscovery.utilities.planetary.traverse\\_emulation.read\\_paths\\_from\\_csv\\_file](#) (file\_path)

## 7.78 utilities/planetary/vector\_management.py File Reference

### Namespaces

- [skdiscovery.utilities.planetary.vector\\_management](#)

### Functions

- def [skdiscovery.utilities.planetary.vector\\_management.open\\_shapefile](#) (shapefile\_path, writeable=False)  
*Function definitions.*
- def [skdiscovery.utilities.planetary.vector\\_management.get\\_latitude\\_longitude\\_from\\_csv\\_file](#) (csv\_file\_location, longitude\_column\_index=0, latitude\_column\_index=1, other\_data\_column\_indexes=[])
- def [skdiscovery.utilities.planetary.vector\\_management.print\\_shapefile\\_field\\_names](#) (shapefile)
- def [skdiscovery.utilities.planetary.vector\\_management.get\\_field\\_values](#) (shapefile, field\_name)
- def [skdiscovery.utilities.planetary.vector\\_management.print\\_shapefile\\_unique\\_field\\_values](#) (shapefile, field\_name)
- def [skdiscovery.utilities.planetary.vector\\_management.shape\\_coding](#) (ob)
- def [skdiscovery.utilities.planetary.vector\\_management.create\\_path\\_from\\_shape](#) (shape)
- def [skdiscovery.utilities.planetary.vector\\_management.get\\_geometry\\_coordinates](#) (geometry, xy\_outer\_path, xy\_inner\_paths, basemap=None)
- def [skdiscovery.utilities.planetary.vector\\_management.build\\_shape\\_from\\_geometry](#) (geometry, basemap=None)

- def [skdiscovery.utilities.planetary.vector\\_management.add\\_shape\\_to\\_map](#) (axes, shape, legend\_label, facecolor='#cccccc', alpha=1., hatch=None, edgecolor='#999999', linewidth=0.25, linestyle='-')
- def [skdiscovery.utilities.planetary.vector\\_management.add\\_geometry\\_to\\_map](#) (axes, basemap, geometry, legend\_label, facecolor='#cccccc', alpha=1., hatch=None, edgecolor='#999999', linewidth=0.25, linestyle='-')
- def [skdiscovery.utilities.planetary.vector\\_management.add\\_vector\\_to\\_map](#) (axes, basemap, shapefile, field\_name, random\_colors=False, facecolor='#08519c', alpha=1., hatch=None, edgecolor='#252525', linewidth=0.25, linestyle='-')
- def [skdiscovery.utilities.planetary.vector\\_management.add\\_path\\_to\\_map](#) (axes, path, legend\_label, facecolor='#cccccc', alpha=1., edgecolor='#999999', linestyle='-', linewidth=0.25, zorder=1)
- def [skdiscovery.utilities.planetary.vector\\_management.filter\\_shapefile](#) (shapefile, field\_name, field\_filter\_values, file\_type='Memory', file\_path="", geom\_type=None)
- def [skdiscovery.utilities.planetary.vector\\_management.get\\_shapefile\\_borders](#) (shapefile, file\_type='Memory', file\_path="", geom\_type=ogr.wkbLineString)
- def [skdiscovery.utilities.planetary.vector\\_management.buffer\\_shapefile](#) (shapefile, buffer\_distance, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [skdiscovery.utilities.planetary.vector\\_management.clip\\_shapefile](#) (shapefile, polygon\_clip, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [skdiscovery.utilities.planetary.vector\\_management.union\\_shapefiles](#) (shapefile\_1, shapefile\_2, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [skdiscovery.utilities.planetary.vector\\_management.intersect\\_shapefiles](#) (shapefile\_1, shapefile\_2, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [skdiscovery.utilities.planetary.vector\\_management.get\\_intersected\\_features\\_from\\_shapefile](#) (input\_shapefile, method\_shapefile, look\_for\_intersection=True, file\_type='Memory', file\_path="")
- def [skdiscovery.utilities.planetary.vector\\_management.modify\\_shapefile\\_extent](#) (shapefile, x\_min, x\_max, y\_min, y\_max, new\_x\_min, new\_x\_max, new\_y\_min, new\_y\_max, file\_type='Memory', file\_path="", geom\_type=ogr.wkbPolygon)
- def [skdiscovery.utilities.planetary.vector\\_management.rasterize\\_geometries](#) (shapes, data\_type, raster\_x\_size, raster\_y\_size, geotransform, spatial\_reference, fill\_value=0, background\_value=1, no\_data\_value=-99999, scale=1, offset=0, all\_touched=False, file\_type='MEM', file\_path="", number\_of\_bands=1)
- def [skdiscovery.utilities.planetary.vector\\_management.rasterize\\_shapefile](#) (shapefile, field\_name, data\_type, raster\_x\_size, raster\_y\_size, geotransform, projection, fill\_value=0, background\_value=1, no\_data\_value=-99999, scale=1, offset=0, file\_type='MEM', file\_path="", number\_of\_bands=1)

## 7.79 visualization/emd\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.emd\\_plot](#)

### Functions

- def [skdiscovery.visualization.emd\\_plot.calc\\_imfs](#) (rawData, nbsym=False)  
*IMF calculation function, streamlined and quieted.*
- def [skdiscovery.visualization.emd\\_plot.calc\\_imfs\\_sum](#) (imfs, highNum=2, high=True, residual=False)  
*IMF summation helper function.*
- def [skdiscovery.visualization.emd\\_plot.plot\\_imfs](#) (rawData, imfs, toPlot=[], mainTitle='IMFs', show=True, figsize=(12, 10))  
*Plots raw data and IMFs in a subplot grid (n Imfs [rows] x 1 [col])*

- def [skdiscovery.visualization.emd\\_plot.plot\\_imfs\\_split](#) (rawData, imfs, highNum=2, residual=False, mainTitle='Raw data', collage=False, show=True)  
*Plots raw data and summed IMFs based on HF/LF cut, can optionally plot the residual separately from LF.*
- def [skdiscovery.visualization.emd\\_plot.plot\\_imfs\\_split\\_comp](#) (rawData, imfs, highNums=[2, residual=False, plotRaw=True, mainTitle='Raw data', collage=False, show=True)  
*Like plot\_imfs\_split, plots raw data and summed IMFs based on two HF/LF cuts.*
- def [skdiscovery.visualization.emd\\_plot.plot\\_imfs\\_noise](#) (imfs, guessType='high', noiseNum=2, collage=False, show=True)  
*Plots assumed noise from IMF summation in a histogram, with overlaid graphs of fit probability distributions to check if assumption can be validated.*
- def [skdiscovery.visualization.emd\\_plot.run\\_plotImfs](#) (inData, imfs=None, nbsym=False, toPlot=[], mainTitle='IMFs', show=True, figsize=(12, 10))  
*Wrapper for plot\_imfs.*
- def [skdiscovery.visualization.emd\\_plot.run\\_plotImfsSplit](#) (inData, imfs=None, nbsym=False, highNum=2, residual=False, mainTitle='Raw data', collage=False, show=True)  
*Wrapper for plot\_imfs\_split.*
- def [skdiscovery.visualization.emd\\_plot.run\\_plotImfsSplitComp](#) (inData, imfs=None, nbsym=False, highNums=[2, residual=False, plotRaw=True, mainTitle='Raw data', collage=False, show=True)  
*Wrapper for plot\_imfs\_split\_comp.*
- def [skdiscovery.visualization.emd\\_plot.run\\_plotImfsNoise](#) (inData, imfs=None, nbsym=False, noiseNum=2, guessType='high', show=True)  
*Wrapper for plot\_imfs\_noise.*
- def [skdiscovery.visualization.emd\\_plot.run\\_plotImfsSplitNoise](#) (inData, imfs=None, nbsym=False, highNum=2, residual=False, mainTitle='Raw data', noiseNum=2, guessType='high', show=False)  
*Wrapper for both plot\_imfs\_split and plot\_imfs\_noise.*

## 7.80 visualization/fourier\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.fourier\\_plot](#)

### Functions

- def [skdiscovery.visualization.fourier\\_plot.calc\\_DFT](#) (t, y)  
*Calculates discrete Fourier transform using np.fft.fft.*
- def [skdiscovery.visualization.fourier\\_plot.plot\\_DFT](#) (tIndex, yData, collage=False, show=True, supitle="", hori=True)  
*Plots input data and Fourier transformed coefficients in a subplot grid.*
- def [skdiscovery.visualization.fourier\\_plot.run\\_plotDFT](#) (inData, inIndex=None, collage=False, show=True, supitle="", hori=True)  
*Wrapper for plot\_DFT.*

## 7.81 visualization/linear\_decomposition\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.linear\\_decomposition\\_plot](#)

### Functions

- def [skdiscovery.visualization.linear\\_decomposition\\_plot.lin\\_trend](#) (inData)  
*Calculates a linear polynomial fit and evaluates.*
- def [skdiscovery.visualization.linear\\_decomposition\\_plot.calc\\_lin\\_interp](#) (inData, iterStep=100)  
*Calculates a piecewise linear interpolated fit for some data.*
- def [skdiscovery.visualization.linear\\_decomposition\\_plot.plot\\_lin\\_trend](#) (inData, plotIndex=None, show=True)  
*Plots a linear linear trend against its source data.*
- def [skdiscovery.visualization.linear\\_decomposition\\_plot.plot\\_lin\\_interp](#) (inData, interps=None, plotIndex=None, iterSteps=[100], pRange=[], mainTitle='Piecewise Decomposition', plotReal=True, show=True)  
*Plots linear interpolation against its source data.*
- def [skdiscovery.visualization.linear\\_decomposition\\_plot.plot\\_lin\\_slope](#) (inData, interps=None, plotIndex=None, mainTitle='Piecewise Decomposition and Slopes', iterSteps=[100], pRange=[], plotReal=True, show=True)  
*Plots raw data, linear interpolated data, and interpolated slope.*

## 7.82 visualization/multi\_ca\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.multi\\_ca\\_plot](#)

### Functions

- def [skdiscovery.visualization.multiCaPlot](#) (pipeline, mogiFlag=False, offset=.15, direction='H', pca\_comp=0, scaleFactor=2.5, map\_res='i')  
*The multiCaPlot function generates a geographic eigenvector plot of several pipeline runs.*

## 7.83 visualization/multi\_dist.py File Reference

### Namespaces

- [skdiscovery.visualization.multi\\_dist](#)

## Functions

- def [skdiscovery.visualization.calc\\_distance\\_map](#) (pipeline, ap\_name, ca\_name, ca\_type, plotFlag=True, hist←  
ldx=False, fontsize=10)  
*Calculates distances/similarities between pipeline runs.*

## 7.84 visualization/spherical\_voronoi.py File Reference

### Namespaces

- [skdiscovery.visualization.spherical\\_voronoi](#)

### Functions

- def [skdiscovery.visualization.spherical\\_voronoi.sphericalToXYZ](#) (lat, lon, radius=1)  
*Convert spherical coordinates to x,y,z.*
- def [skdiscovery.visualization.spherical\\_voronoi.xyzToSpherical](#) (x, y, z)  
*Convert x,y,z to spherical coordinates.*
- def [skdiscovery.visualization.spherical\\_voronoi.find\\_match](#) (region\_index, region\_list)  
*Find neighboring regions.*
- def [skdiscovery.visualization.spherical\\_voronoi.getVoronoiCollection](#) (data, lat\_name, lon\_name, bmap=None, v\_name=None, full\_sphere=False, max\_v=.3, min\_v=-0.3, cmap=matplotlib.cm.get\_cmap('jet'), test\_point=None, proj1=None, proj2=None, kwargs)  
*Perform a Spherical Voronoi Tessellation on the input data.*

## 7.85 visualization/spiral\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.spiral\\_plot](#)

### Functions

- def [skdiscovery.visualization.spiral\\_plot.plot\\_spiral](#) (plotData, plotIndex, T, mainTitle='Spiral plot', bar←  
Label='Amplitude', plotTS=False, show=True)  
*Plots data in a spiral pattern via a polar plot.*
- def [skdiscovery.visualization.spiral\\_plot.run\\_spiral](#) (inData, period, inIndex=None, mainTitle='Spiral plot', bar←  
Label='Amplitude', plotTS=False, show=True)  
*Wrapper for plot\_spiral.*
- def [skdiscovery.visualization.spiral\\_plot.run\\_spiralInteractive](#) (inData, period, pParams=[], inIndex=None, main←  
Title='Spiral plot', barLabel='Amplitude', plotTS=False)  
*Wrapper for plot\_spiral that is interactive when used in Jupyter notebooks.*



## 7.86 visualization/vis\_utils.py File Reference

### Namespaces

- [skdiscovery.visualization.vis\\_utils](#)

### Functions

- def [skdiscovery.visualization.vis\\_utils.lin\\_trend](#) (inData, toReturn='eval')
- def [skdiscovery.visualization.vis\\_utils.index\\_scale](#) (toScale, endRange=[])
- def [skdiscovery.visualization.vis\\_utils.block\\_output](#) ()
- def [skdiscovery.visualization.vis\\_utils.enable\\_output](#) ()
- def [skdiscovery.visualization.vis\\_utils.mod\\_data](#) (inData, inIndex=None, makeType=None)  
*modifies data for run\_spiral so that plotted data is uniform*

### Variables

- list [skdiscovery.visualization.vis\\_utils.types](#) = [int, float, complex, np.float32, np.float64, np.int32, np.int64, np.complex64, np.complex128,]
- dictionary [skdiscovery.visualization.vis\\_utils.coldict](#) = {0 : 'C0', 1 : 'C1', 2 : 'C2', 3 : 'C3', 4 : 'C4', 5 : 'C5', 6 : 'C6', 7 : 'C7', 8 : '#92C7Ed', 9 : '#FFBB80', 10 : '#9BE49B', 11 : '#EB9393', 12 : '#C0A6D8', 13 : '#D2B3AC', 14 : '#E995D0', 15 : '#BFBFBF'}

## 7.87 visualization/wavelets\_plot.py File Reference

### Namespaces

- [skdiscovery.visualization.wavelets\\_plot](#)

### Functions

- def [skdiscovery.visualization.wavelets\\_plot.calc\\_wp\\_deconstruct](#) (calcData, wavelet=None)  
*simple function to calculate a wavelet deconstruction*
- def [skdiscovery.visualization.wavelets\\_plot.calc\\_wp\\_reconstruct](#) (deconPacket=None, calcData=None, wavelet=None, reconNodes=[])
- def [skdiscovery.visualization.wavelets\\_plot.plot\\_wp\\_deconstruct](#) (deconPacket, deconNodes=[], mainTitle='Wavelet Deconstruction', plotRaw=True, show=True)
- def [skdiscovery.visualization.wavelets\\_plot.plot\\_wp\\_showall](#) (deconPacket, deconNodes=[], mainTitle='Individual Wavelet Nodes', plotRaw=True, show=True)
- def [skdiscovery.visualization.wavelets\\_plot.plot\\_wp\\_reconstruct](#) (reconPacket, calcData, mainTitle='Wavelet Reconstruction', plotRaw=True, show=True)
- def [skdiscovery.visualization.wavelets\\_plot.run\\_plotWPDecon](#) (inData, wavelet=None, deconNodes=[], mainTitle='Wavelet Deconstruction', plotRaw=True, show=True)
- def [skdiscovery.visualization.wavelets\\_plot.run\\_plotWPRecon](#) (inData, wavelet=None, reconNodes=[], mainTitle='Individual Wavelet Nodes', plotRaw=True, show=True)
- def [skdiscovery.visualization.wavelets\\_plot.run\\_plotWPShowall](#) (inData, wavelet=None, deconNodes=[], mainTitle='Wavelet Reconstruction', plotRaw=True, show=True)



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