

Scikit MIT Haystack Data Analysis Pipeline Toolkit

Generated by Doxygen 1.8.13

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Chapter 5

Namespace Documentation

5.1 skdiscovery Namespace Reference

Namespaces

- [framework](#)
- [generic](#)
- [series](#)
- [table](#)
- [utilities](#)
- [visualization](#)

5.2 skdiscovery.framework Namespace Reference

Namespaces

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

5.3 skdiscovery.framework.base Namespace Reference

Classes

- class [PipelineItem](#)

The general class used to create pipeline items.

5.4 skdiscovery.framework.discoverypipeline Namespace Reference

Classes

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

5.5 skdiscovery.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.

5.6 skdiscovery.generic Namespace Reference

Namespaces

- [accumulators](#)

5.7 skdiscovery.generic.accumulators Namespace Reference

Namespaces

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

5.8 skdiscovery.generic.accumulators.data Namespace Reference

Classes

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

5.9 skdiscovery.generic.accumulators.gpshplotter Namespace Reference

Classes

- class [GPShPlotter](#)
Plots results from General_Component_Analysis, for the GPS horizontal or vertical components.

5.10 skdiscovery.generic.accumulators.hcluster Namespace Reference

Classes

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

5.11 skdiscovery.series Namespace Reference

Namespaces

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

5.12 skdiscovery.series.accumulators Namespace Reference

Namespaces

- [plotter](#)

5.13 skdiscovery.series.accumulators.plotter Namespace Reference

Classes

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

5.14 skdiscovery.series.analysis Namespace Reference

Namespaces

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

5.15 skdiscovery.series.analysis.correlate Namespace Reference

Classes

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

5.16 skdiscovery.series.analysis.gca Namespace Reference

Classes

- class [General_Component_Analysis](#)
Performs either ICA or PCA analysis on series data.

5.17 skdiscovery.series.analysis.mogi Namespace Reference

Classes

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

Functions

- def [MogiVectors](#) (mogi_res, station_lat_list, station_lon_list, flag3D=False)
Creates a set of Mogi vectors for plotting.

5.17.1 Function Documentation

5.17.1.1 MogiVectors()

```
def skdiscovery.series.analysis.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

5.18 skdiscovery.series.filters Namespace Reference

Namespaces

- [dataremove](#)
- [hyperbolictan](#)
- [interpolate](#)
- [kalman](#)
- [lowpass](#)
- [median](#)
- [offset_detrend](#)
- [trend](#)

5.19 skdiscovery.series.filters.dataremove Namespace Reference

Classes

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

5.20 skdiscovery.series.filters.hyperbolictan Namespace Reference

Classes

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

5.21 skdiscovery.series.filters.interpolate Namespace Reference

Classes

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

5.22 skdiscovery.series.filters.kalman Namespace Reference

Classes

- class [KalmanFilter](#)
Runs a Kalman Smoother on series data.

5.23 skdiscovery.series.filters.lowpass Namespace Reference

Classes

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

5.24 skdiscovery.series.filters.median Namespace Reference

Classes

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

5.25 skdiscovery.series.filters.offset_detrend Namespace Reference

Classes

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

5.26 skdiscovery.series.filters.trend Namespace Reference

Classes

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

5.27 skdiscovery.table Namespace Reference

Namespaces

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

5.28 skdiscovery.table.accumulators Namespace Reference

Namespaces

- [plotter](#)

5.29 skdiscovery.table.accumulators.plotter Namespace Reference

Classes

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

5.30 skdiscovery.table.analysis Namespace Reference

Namespaces

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

5.31 skdiscovery.table.analysis.correlate Namespace Reference

Classes

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

5.32 skdiscovery.table.analysis.dbscan Namespace Reference

Classes

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

5.33 skdiscovery.table.analysis.gca Namespace Reference

Classes

- class [General_Component_Analysis](#)
Performs a general component analysis on table data.

5.34 skdiscovery.table.analysis.midas Namespace Reference

Classes

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

5.35 skdiscovery.table.analysis.mogi Namespace Reference

Classes

- class [Mogi_Inversion](#)
Perform a mogi source inversion on a set of gps table data.

Functions

- def [MogiVectors](#) (mogi_res, station_lat_list, station_lon_list, flag3D=False)
Creates a set of mogi vectors for plotting.

5.35.1 Function Documentation

5.35.1.1 MogiVectors()

```
def skdiscovery.table.analysis.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
<i>station_lat_list</i>	List of station latitudes
<i>station_lon_list</i>	List of station longitudes
<i>flag3D</i>	Make vectors 3 dimensional, defaults to False (2D)

5.36 skdiscovery.table.analysis.outlier Namespace Reference

Classes

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

5.37 skdiscovery.table.analysis.skew Namespace Reference

Classes

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

5.38 skdiscovery.table.filters Namespace Reference

Namespaces

- [antenna_offset](#)
- [calibrate_grace](#)
- [combine_columns](#)
- [dataremover](#)
- [geolocation](#)
- [hyperbolictan](#)
- [interpolate](#)
- [kalman](#)
- [lowpass](#)
- [median](#)
- [offset_detrend](#)
- [propagate_nans](#)
- [snow_removal](#)
- [stabilization](#)
- [table_filter](#)
- [trend](#)
- [weighted_average](#)

5.39 skdiscovery.table.filters.antenna_offset Namespace Reference

Classes

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

5.40 skdiscovery.table.filters.calibrate_grace Namespace Reference

Classes

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

5.41 skdiscovery.table.filters.combine_columns Namespace Reference

Classes

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

5.42 skdiscovery.table.filters.dataremover Namespace Reference

Classes

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

5.43 skdiscovery.table.filters.geolocation Namespace Reference

Classes

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

5.44 skdiscovery.table.filters.hyperbolictan Namespace Reference

Classes

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

5.45 skdiscovery.table.filters.interpolate Namespace Reference

Classes

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

5.46 skdiscovery.table.filters.kalman Namespace Reference

Classes

- class [KalmanFilter](#)
Runs a Kalman Smoother on table data.

5.47 skdiscovery.table.filters.lowpass Namespace Reference

Classes

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

5.48 skdiscovery.table.filters.median Namespace Reference

Classes

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

5.49 skdiscovery.table.filters.offset_detrend Namespace Reference

Classes

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

5.50 skdiscovery.table.filters.propagate_nans Namespace Reference

Classes

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

5.51 skdiscovery.table.filters.snow_remover Namespace Reference

Classes

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

5.52 skdiscovery.table.filters.stabilization Namespace Reference

Classes

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

5.53 skdiscovery.table.filters.table_filter Namespace Reference

Classes

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

5.54 skdiscovery.table.filters.trend Namespace Reference

Classes

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

5.55 skdiscovery.table.filters.weighted_average Namespace Reference

Classes

- class [WeightedAverage](#)
This filter performs a rolling weighted average using standard deviations as weight.

5.56 skdiscovery.table.fusion Namespace Reference

Namespaces

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

5.57 skdiscovery.table.fusion.grace Namespace Reference

Classes

- class [GraceFusion](#)

Fuses GRACE equivalent water depth time series.

5.58 skdiscovery.table.fusion.snow Namespace Reference

Classes

- class [SnowFusion](#)

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

5.59 skdiscovery.table.generators Namespace Reference

Namespaces

- [catalog_generator](#)
- [data_generator](#)

5.60 skdiscovery.table.generators.catalog_generator Namespace Reference

Classes

- class [CatalogGenerator](#)

In Generates galaxy catalogs for use in DiscoveryPipeline.

5.61 skdiscovery.table.generators.data_generator Namespace Reference

Classes

- class [DataGenerator](#)

In Class for generating random data.

5.62 skdiscovery.utilities Namespace Reference

Namespaces

- [amazon_control](#)
- [amazon_gui](#)
- [astro_tools](#)
- [config](#)
- [kalman_smoother](#)
- [pbo_tools](#)
- [random_walks](#)
- [spherical_voronoi](#)
- [ssh_reverse](#)
- [trendTools](#)

5.63 skdiscovery.utilities.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 [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

5.63.1 Function Documentation

5.63.1.1 `clearAmazonList()`

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

Shutdown connection tunnels to Amazon instances and clear amazon list.

5.63.1.2 `close()`

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

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

5.63.1.3 `closeDispyScheduler()`

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

Close the Dispy Scheduler.

5.63.1.4 createTunnels()

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

Create reverse ssh tunnels to all instances.

5.63.1.5 generateInfo()

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

Read metadata from an Amazon instance.

Returns

metadata for Amazon instance

5.63.1.6 init()

```
def skdiscovery.utilities.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

5.63.1.7 reset()

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

Close and clear Amazon List.

5.63.1.8 resetInstances()

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

Reboot Amazon instances.

5.63.1.9 setNumInstances()

```
def skdiscovery.utilities.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)

5.63.1.10 startDispyNode()

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

Start dispy on each Amazon instance.

5.63.1.11 startDispyScheduler()

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

Start the Dispy Scheduler.

5.63.1.12 `updateStatus()`

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

Update status information in `amazon_list`.

5.63.2 Variable Documentation

5.63.2.1 `amazon_list`

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

5.63.2.2 `aws_access_key`

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

5.63.2.3 `aws_key_name`

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

5.63.2.4 `aws_region`

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

5.63.2.5 `aws_secret`

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

5.63.2.6 aws_security_group

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

5.63.2.7 ec2_client

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

5.63.2.8 ec2_res

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

5.63.2.9 pem_file

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

5.63.2.10 popen

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

5.63.2.11 scheduler

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

5.64 skdiscovery.utilities.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`
- list `key_value_list`

5.64.1 Function Documentation

5.64.1.1 `changeButtonState()`

```
def skdiscovery.utilities.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.
----------------	---------------------------------

5.64.1.2 `checkValidValues()`

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

Check if Amazon information is valid.

Returns

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

5.64.1.3 `drawGUI()`

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

Draw the GUI on the screen.

5.64.1.4 init()

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

Initialize GUI for controlling Amazon instances.

5.64.2 Variable Documentation

5.64.2.1 disable_list

```
list skdiscovery.utilities.amazon_gui.disable_list
```

Initial value:

```
1 = ['execute_instances_button', 'initialize_button', 'cache_button', 'restore_button',  
2   'new_num_instances_widget']
```

5.64.2.2 key_value_list

```
list skdiscovery.utilities.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']
```

5.64.2.3 widget_dict

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

5.65 skdiscovery.utilities.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.

5.65.1 Function Documentation

5.65.1.1 [abs_mag\(\)](#)

```
def skdiscovery.utilities.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

5.65.1.2 angular_separation()

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

Angular separation between two objects via the haversine formula.

All inputs are in degrees.

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

Formula is 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

5.65.1.3 app_mag()

```
def skdiscovery.utilities.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*

5.65.1.4 cdf_dlf()

```
def skdiscovery.utilities.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*

5.65.1.5 dlf()

```
def skdiscovery.utilities.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

5.65.1.6 inv_cdf_dlf()

```

def skdiscovery.utilities.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

5.65.1.7 lf()

```
def skdiscovery.utilities.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

5.65.1.8 move_point()

```
def skdiscovery.utilities.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

5.65.1.9 nfw()

```
def skdiscovery.utilities.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

5.65.1.10 v_to_z()

```
def skdiscovery.utilities.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

5.65.1.11 z_to_v()

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

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

Parameters

z	Redshift
---	----------

Returns

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

5.66 skdiscovery.utilities.config Namespace Reference**Functions**

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

5.66.1 Function Documentation**5.66.1.1 getConfig()**

```
def skdiscovery.utilities.config.getConfig ( )
```

Retrieve skdiscovery configuration.

Returns

skdiscovery configparser

5.66.1.2 getDispyPassword()

```
def skdiscovery.utilities.config.getDispyPassword ( )
```

Get dispy password.

Returns

dispy password

5.66.1.3 getHostName()

```
def skdiscovery.utilities.config.getHostName ( )
```

Get Host name for displaying link to dispy status.

Returns

Hostname

5.66.1.4 writeConfigValue()

```
def skdiscovery.utilities.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

5.67 skdiscovery.utilities.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 [FitFOGMPParameters](#) (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.

5.67.1 Function Documentation

5.67.1.1 FitFOGMPParameters()

```
def skdiscovery.utilities.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

5.67.1.2 FOGM()

```
def skdiscovery.utilities.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

5.67.1.3 IterativeGridSearch()

```
def skdiscovery.utilities.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.

5.67.1.4 KalmanFilter()

```
def skdiscovery.utilities.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

5.67.1.5 KalmanSmoother()

```
def skdiscovery.utilities.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

5.68 skdiscovery.utilities.pbo_tools Namespace Reference

Functions

- def [mogi](#) (xdata, lat, lon, source_depth, amplitude)
Compute the surface deformation due to changes in a mogi source.
- def [finite_sphere](#) (xdata, lat, lon, source_depth, amplitude, alpha_rad)
Compute the surface deformation due to changes in a finite sphere source.
- def [closed_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta)
Compute the surface deformation due to changes in a closed pipe source.
- def [constant_open_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta)
Compute the surface deformation due to changes in a constant width open pipe source.
- def [rising_open_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta, open_pipe_top)
Compute the surface deformation due to changes in a rising width amplitude open pipe source.
- def [sill](#) (xdata, lat, lon, source_depth, amplitude)

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.

5.68.1 Function Documentation

5.68.1.1 closed_pipe()

```
def skdiscovery.utilities.pbo_tools.closed_pipe (
    xdata,
    lat,
    lon,
    source_depth,
    amplitude,
    pipe_delta )
```

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>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<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

Returns

list of resulting deformation for each point in xdata

5.68.1.2 constant_open_pipe()

```
def skdiscovery.utilities.pbo_tools.constant_open_pipe (
    xdata,
```

```
lat,  
lon,  
source_depth,  
amplitude,  
pipe_delta )
```

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>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<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

Returns

list of resulting deformation for each point in xdata

5.68.1.3 datetimeToNumber()

```
def skdiscovery.utilities.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

5.68.1.4 dirEigenvectors()

```
def skdiscovery.utilities.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 orientated corresponding eigenvector latitude component
ev_lon_list: the properly orientated corresponding eigenvector longitude component
direction scale factor (1 for no flip, or -1 for flip)

5.68.1.5 finite_sphere()

```
def skdiscovery.utilities.pbo_tools.finite_sphere (
    xdata,
    lat,
    lon,
    source_depth,
    amplitude,
    alpha_rad )
```

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>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source
<i>alpha_rad</i>	Alpha radius of the source

Returns

list of resulting deformation for each point in xdata

5.68.1.6 mogi()

```
def skdiscovery.utilities.pbo_tools.mogi (
    xdata,
    lat,
    lon,
    source_depth,
    amplitude )
```

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

Parameters

<i>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of mogi source

Returns

list of resulting deformation for each point in xdata

5.68.1.7 rising_open_pipe()

```
def skdiscovery.utilities.pbo_tools.rising_open_pipe (
    xdata,
    lat,
    lon,
    source_depth,
    amplitude,
    pipe_delta,
    open_pipe_top )
```

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>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<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

Returns

list of resulting deformation for each point in xdata

5.68.1.8 sill()

```
def skdiscovery.utilities.pbo_tools.sill (
    xdata,
    lat,
    lon,
    source_depth,
    amplitude )
```

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>xdata</i>	List of the position data with each array element containing [direction (x, y, or z), lat, lon]
<i>lat</i>	Latitude of source
<i>lon</i>	Longitude of source
<i>source_depth</i>	Depth of source
<i>amplitude</i>	Amplitude of source

Returns

list of resulting deformation for each point in xdata

5.69 skdiscovery.utilities.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.

5.69.1 Function Documentation

5.69.1.1 `gaussian_walk()`

```
def skdiscovery.utilities.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

5.69.1.2 `keep_in_bound()`

```
def skdiscovery.utilities.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

5.69.1.3 uniform_walk()

```
def skdiscovery.utilities.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

5.70 skdiscovery.utilities.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'))
Perform a Spherical Voronoi Tessellation on the input data.

5.70.1 Function Documentation

5.70.1.1 find_match()

```
def skdiscovery.utilities.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

5.70.1.2 getVoronoiCollection()

```
def skdiscovery.utilities.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') )
```

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
<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

Returns

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

5.70.1.3 sphericalToXYZ()

```
def skdiscovery.utilities.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

5.70.1.4 xyzToSpherical()

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

Convert x,y,z to spherical coordinates.

Parameters

<i>x</i>	Cartesian coordinate x
<i>y</i>	Cartesian coordinate y
<i>z</i>	Cartesian coordinate z

Returns

numpy array of latitude,longitude, and radius

5.71 skdiscovery.utilities.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.

5.71.1 Function Documentation

5.71.1.1 handler()

```
def skdiscovery.utilities.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

5.71.1.2 print_verbose()

```
def skdiscovery.utilities.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

5.71.1.3 reverse_forward_tunnel()

```
def skdiscovery.utilities.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

5.72 skdiscovery.utilities.trendTools 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)
A simple wrapper for the linear interpolation function from Numpy to fill in NaN's.
- def [medianFilter](#) (data, window, interpolate=True)
A median filter.

5.72.1 Function Documentation

5.72.1.1 `getTrend()`

```
def skdiscovery.utilities.trendTools.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

5.72.1.2 `interpNaN()`

```
def skdiscovery.utilities.trendTools.interpNaN (
    data )
```

A simple wrapper for the linear interpolation function from Numpy to fill in NaN's.

A copy of the data is made in place with endpoint NaN's extrapolated from closest non-NaN value Modified slightly from sample code at ref: <http://stackoverflow.com/questions/6518811/interpolate-nan-values-in-a-numpy-a>

Parameters

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

Returns

data after interpolation

5.72.1.3 `medianFilter()`

```
def skdiscovery.utilities.trendTools.medianFilter (
    data,
```

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

A median filter.

If interpolate is True, data will be interpolated before smoothening. 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

5.72.1.4 sinuFits()

```
def skdiscovery.utilities.trendTools.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

5.73 skdiscovery.visualization Namespace Reference

Namespaces

- [multi_ca_plot](#)
- [multi_dist](#)

5.74 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.

5.74.1 Function Documentation

5.74.1.1 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 : Map data resolution for Basemap ('c', 'i', 'h', 'f', or None)

5.75 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.

Variables

- [font](#)

5.75.1 Function Documentation

5.75.1.1 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

5.75.2 Variable Documentation

5.75.2.1 font

`skdiscovery.visualization.font`

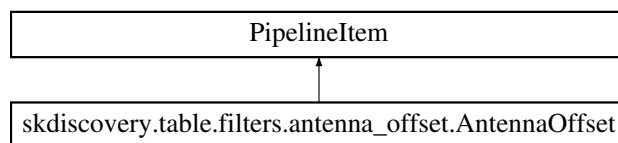
Chapter 6

Class Documentation

6.1 skdiscovery.table.filters.AntennaOffset Class Reference

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

Inheritance diagram for skdiscovery.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.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.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.table.filters.AntennaOffset.antenna_data
```

6.1.4.2 column_list

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

6.1.4.3 min_diff

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

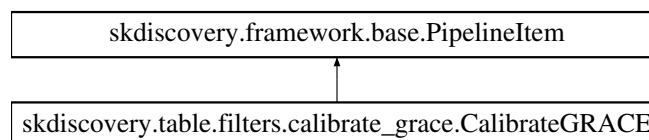
The documentation for this class was generated from the following file:

- [table/filters/antenna_offset.py](#)

6.2 skdiscovery.table.filters.CalibrateGRACE Class Reference

Calibrate Grace Data.

Inheritance diagram for skdiscovery.table.filters.CalibrateGRACE:



Public Member Functions

- `def __init__(self, str_description, ewd_column_name='EWD', round_dates=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](#)
- [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.table.filters.CalibrateGRACE.__init__ (
    self,
    str_description,
    ewd_column_name = 'EWD',
    round_dates = 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

6.2.3 Member Function Documentation

6.2.3.1 `__str__()`

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

String representation of object.

Returns

String listing all current parameters

6.2.3.2 getMetadata()

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

choose other random value for all parameters

6.2.3.4 process()

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

set all parameters to initial value

6.2.4 Member Data Documentation

6.2.4.1 ap_paramList

skdiscovery.framework.PipelineItem.ap_paramList [inherited]

6.2.4.2 ap_paramNames

skdiscovery.framework.PipelineItem.ap_paramNames [inherited]

6.2.4.3 ewd_column_name

skdiscovery.table.filters.CalibrateGRACE.ewd_column_name

6.2.4.4 round_dates

skdiscovery.table.filters.CalibrateGRACE.round_dates

6.2.4.5 str_description

skdiscovery.framework.PipelineItem.str_description [inherited]

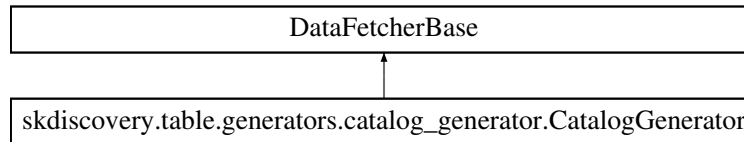
The documentation for this class was generated from the following file:

- [table/filters/calibrate_py](#)

6.3 skdiscovery.table.generators.CatalogGenerator Class Reference

In Generates galaxy catalogs for use in DiscoveryPipeline.

Inheritance diagram for skdiscovery.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

6.3.1 Detailed Description

In Generates galaxy catalogs for use in DiscoveryPipeline.

6.3.2 Constructor & Destructor Documentation

6.3.2.1 `__init__()`

```

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

Parameters

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

6.3.3 Member Function Documentation

6.3.3.1 `inverse_nfw_cumulative()`

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

inverse of radial nfw cumulative distribution

Parameters

<i>p</i>	Probability
----------	-------------

Returns

float: Radius corresponding to probability p

6.3.3.2 `nfw_cumulative()`

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

Cumulative radial NFW distribution.

Parameters

<i>R</i>	Radius
----------	--------

Returns

float: Probability of being within R

6.3.3.3 output()

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

Generates galaxy catalog.

Returns

DataWrapper: Table data wrapper of galaxy catalog

6.3.4 Member Data Documentation**6.3.4.1 background_density**

```
skdiscovery.table.generators.CatalogGenerator.background_density
```

6.3.4.2 dec1

```
skdiscovery.table.generators.CatalogGenerator.dec1
```

6.3.4.3 dec2

```
skdiscovery.table.generators.CatalogGenerator.dec2
```

6.3.4.4 ra1

```
skdiscovery.table.generators.CatalogGenerator.ra1
```

6.3.4.5 ra2

```
skdiscovery.table.generators.CatalogGenerator.ra2
```

6.3.4.6 z

```
skdiscovery.table.generators.CatalogGenerator.z
```

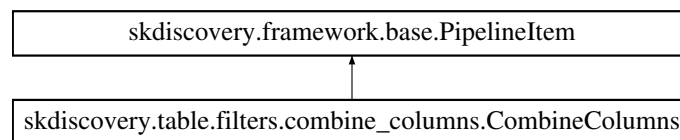
The documentation for this class was generated from the following file:

- [table/generators/catalog_generator.py](#)

6.4 skdiscovery.table.filters.CombineColumns Class Reference

Create a new column by selecting data from a column.

Inheritance diagram for skdiscovery.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](#)

6.4.1 Detailed Description

Create a new column by selecting data from a column.

Fills in any missing values using a second column

6.4.2 Constructor & Destructor Documentation

6.4.2.1 __init__()

```
def skdiscovery.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

6.4.3 Member Function Documentation

6.4.3.1 __str__()

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

String represntation of object.

Returns

String listing all current parameters

6.4.3.2 getMetadata()

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.4.3.3 perturbParams()

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

choose other random value for all parameters

6.4.3.4 process()

```
def skdiscovery.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.
-----------------	---------------------

6.4.3.5 resetParams()

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

set all parameters to initial value

6.4.4 Member Data Documentation

6.4.4.1 ap_paramList

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

6.4.4.2 ap_paramNames

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

6.4.4.3 column_1

```
skdiscovery.table.filters.CombineColumns.column_1
```

6.4.4.4 column_2

```
skdiscovery.table.filters.CombineColumns.column_2
```

6.4.4.5 new_column_name

```
skdiscovery.table.filters.CombineColumns.new_column_name
```

6.4.4.6 str_description

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

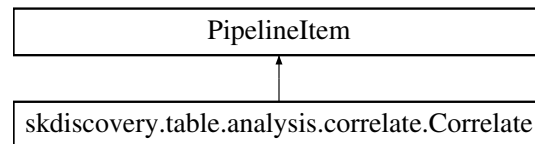
The documentation for this class was generated from the following file:

- [table/filters/combine_columns.py](#)

6.5 skdiscovery.table.analysis.Correlate Class Reference

Computes the correlation for table data and stores the result as a matrix.

Inheritance diagram for `skdiscovery.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](#)

6.5.1 Detailed Description

Computes the correlation for table data and stores the result as a matrix.

6.5.2 Constructor & Destructor Documentation

6.5.2.1 __init__()

```

def skdiscovery.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')

6.5.3 Member Function Documentation

6.5.3.1 process()

```
def skdiscovery.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
-----------------	--------------

6.5.4 Member Data Documentation

6.5.4.1 column_names

```
skdiscovery.table.analysis.Correlate.column_names
```

6.5.4.2 corr_type

```
skdiscovery.table.analysis.Correlate.corr_type
```

6.5.4.3 local_match

`skdiscovery.table.analysis.Correlate.local_match`

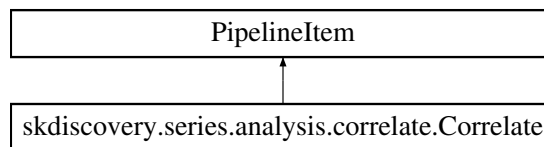
The documentation for this class was generated from the following file:

- [table/analysis/correlate.py](#)

6.6 skdiscovery.series.analysis.Correlate Class Reference

Computes the correlation for series data.

Inheritance diagram for `skdiscovery.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`

6.6.1 Detailed Description

Computes the correlation for series data.

Stores the result as a matrix

6.6.2 Constructor & Destructor Documentation

6.6.2.1 __init__()

```
def skdiscovery.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

6.6.3 Member Function Documentation

6.6.3.1 process()

```
def skdiscovery.series.analysis.Correlate.process (  
    self,  
    obj_data )
```

Computes the correlation between all the time series.

The results are stored in `obj_data`

Parameters

<i>obj_data</i>	Data wrapper for correlating
-----------------	------------------------------

6.6.4 Member Data Documentation

6.6.4.1 column_names

```
skdiscovery.series.analysis.Correlate.column_names
```

6.6.4.2 labels

```
skdiscovery.series.analysis.Correlate.labels
```

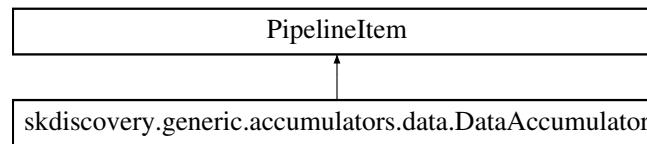
The documentation for this class was generated from the following file:

- series/analysis/[correlate.py](#)

6.7 skdiscovery.generic.accumulators.DataAccumulator Class Reference

Stores a copy of the data in its current state in the pipeline.

Inheritance diagram for skdiscovery.generic.accumulators.DataAccumulator:



Public Member Functions

- def `process` (self, obj_data)
Store a copy of the data in the object wrapper results.

6.7.1 Detailed Description

Stores a copy of the data in its current state in the pipeline.

6.7.2 Member Function Documentation

6.7.2.1 process()

```
def skdiscovery.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
-----------------------	---------------------------

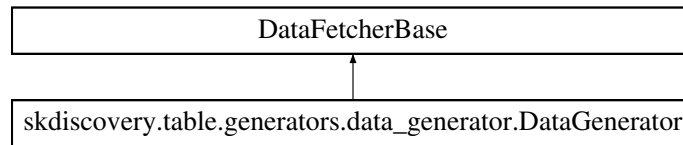
The documentation for this class was generated from the following file:

- generic/accumulators/[data.py](#)

6.8 skdiscovery.table.generators.DataGenerator Class Reference

In Class for generating random data.

Inheritance diagram for skdiscovery.table.generators.DataGenerator:



Public Member Functions

- `def __init__(self, length, args, seed=None, final_function=None)`
Initialize Random data generator.
- `def output(self)`

Public Attributes

- `length`
- `seed`
- `args`
- `final_function`

6.8.1 Detailed Description

In Class for generating random data.

6.8.2 Constructor & Destructor Documentation

6.8.2.1 __init__()

```

def skdiscovery.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

6.8.3 Member Function Documentation**6.8.3.1 output()**

```
def skdiscovery.table.generators.DataGenerator.output (
    self )
```

6.8.4 Member Data Documentation**6.8.4.1 args**

```
skdiscovery.table.generators.DataGenerator.args
```

6.8.4.2 final_function

```
skdiscovery.table.generators.DataGenerator.final_function
```

6.8.4.3 length

```
skdiscovery.table.generators.DataGenerator.length
```

6.8.4.4 seed

```
skdiscovery.table.generators.DataGenerator.seed
```

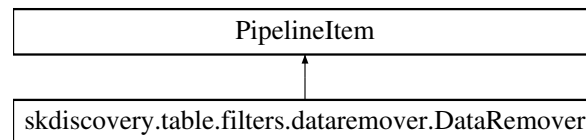
The documentation for this class was generated from the following file:

- table/generators/[data_generator.py](#)

6.9 skdiscovery.table.filters.DataRemover Class Reference

Sets specified table data to NaN.

Inheritance diagram for skdiscovery.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](#)

6.9.1 Detailed Description

Sets specified table data to NaN.

6.9.2 Constructor & Destructor Documentation

6.9.2.1 `__init__()`

```
def skdiscovery.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)

6.9.3 Member Function Documentation

6.9.3.1 `process()`

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

NaN's data from DataWrapper.

Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

6.9.4 Member Data Documentation

6.9.4.1 `column_names`

```
skdiscovery.table.filters.DataRemover.column_names
```

6.9.4.2 end

```
skdiscovery.table.filters.DataRemover.end
```

6.9.4.3 labels

```
skdiscovery.table.filters.DataRemover.labels
```

6.9.4.4 start

```
skdiscovery.table.filters.DataRemover.start
```

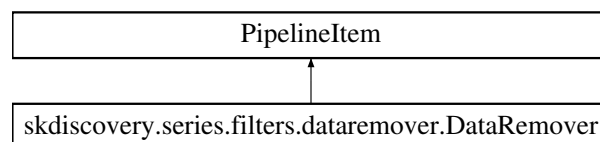
The documentation for this class was generated from the following file:

- table/filters/[dataremover.py](#)

6.10 skdiscovery.series.filters.DataRemover Class Reference

Sets specified series data to NaN.

Inheritance diagram for skdiscovery.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.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.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.series.filters.DataRemover.column_names`

6.10.4.2 end

`skdiscovery.series.filters.DataRemover.end`

6.10.4.3 labels

`skdiscovery.series.filters.DataRemover.labels`

6.10.4.4 start

`skdiscovery.series.filters.DataRemover.start`

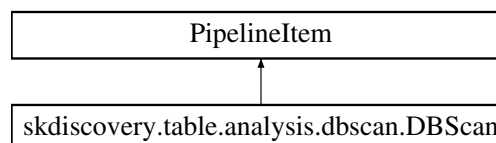
The documentation for this class was generated from the following file:

- [series/filters/dataremoover.py](#)

6.11 skdiscovery.table.analysis.DBScan Class Reference

Runs [DBScan](#) on table data.

Inheritance diagram for `skdiscovery.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](#)

6.11.1 Detailed Description

Runs [DBScan](#) on table data.

Adds cluster information column to data

6.11.2 Constructor & Destructor Documentation

6.11.2.1 `__init__()`

```
def skdiscovery.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

6.11.3 Member Function Documentation

6.11.3.1 process()

```
def skdiscovery.table.analysis.DBScan.process (
    self,
    obj_data )
```

Run [DBScan](#) on data.

Stores result in data wrapper

```
@param obj_data: Data wrapper to be processed
```

6.11.4 Member Data Documentation

6.11.4.1 column_names

```
skdiscovery.table.analysis.DBScan.column_names
```

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

- [table/analysis/dbscan.py](#)

6.12 skdiscovery.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_data=False, num_cores=1, amazon=False, 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](#)

6.12.1 Detailed Description

Pipeline for running the analysis.

6.12.2 Constructor & Destructor Documentation

6.12.2.1 `__init__()`

```
def skdiscovery.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

6.12.3 Member Function Documentation

6.12.3.1 `__str__()`

```
def skdiscovery.DiscoveryPipeline.__str__ (
    self )
```

String representation of the pipeline.

Returns

String of current metadata of pipeline containers.

6.12.3.2 `getMetadata()`

```
def skdiscovery.DiscoveryPipeline.getMetadata (
    self )
```

Retrieve Metadata from stage containers.

Returns

list of metadata for the current run

6.12.3.3 `getMetadataHistory()`

```
def skdiscovery.DiscoveryPipeline.getMetadataHistory (
    self )
```

Get the metadata for each run in the pipeline.

Returns

list of metadata configurations for all runs

6.12.3.4 `getMetadataNestedGraph()`

```
def skdiscovery.DiscoveryPipeline.getMetadataNestedGraph (
    self )
```

Retrieve the metadata nested graph.

Returns

String: Metadata nested graph

6.12.3.5 `getMetadataNestedTypes()`

```
def skdiscovery.DiscoveryPipeline.getMetadataNestedTypes (
    self )
```

Get the Metadata Nested Types.

Returns

String: Metadata Nested types

6.12.3.6 `getResults()`

```
def skdiscovery.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

6.12.3.7 perturb()

```
def skdiscovery.DiscoveryPipeline.perturb (
    self )
```

Perturb the paramters in the stage containers.

6.12.3.8 perturbData()

```
def skdiscovery.DiscoveryPipeline.perturbData (
    self )
```

Perturb the input data.

6.12.3.9 plotPipelineInstance()

```
def skdiscovery.DiscoveryPipeline.plotPipelineInstance (
    self )
```

Plot current instance of pipeline stages with metadata.

Returns

iPython display object

6.12.3.10 plotPipelineStructure()

```
def skdiscovery.DiscoveryPipeline.plotPipelineStructure (
    self )
```

Plot pipeline structure.

Returns

iPython display object

6.12.3.11 reset()

```
def skdiscovery.DiscoveryPipeline.reset (
    self )
```

Reset the stage containers to their default values and clear previous runs.

6.12.3.12 resultIter()

```
def skdiscovery.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

6.12.3.13 run()

```
def skdiscovery.DiscoveryPipeline.run (
    self,
    num_runs = 1,
    perturb_data = False,
    num_cores = 1,
    amazon = False,
    verbose = False )
```

Run the pipeline.

Parameters

<i>num_runs</i>	Number of times to run the pipeline
<i>perturb_data</i>	Boolean flag. If running the pipeline multiple times then perturb the data instead of the pipeline
<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>amazon</i>	Offload the pipeline on amazon
<i>verbose</i>	Display the pipeline for each run

6.12.4 Member Data Documentation

6.12.4.1 data_fetcher

`skdiscovery.DiscoveryPipeline.data_fetcher`

6.12.4.2 RA_results

`skdiscovery.DiscoveryPipeline.RA_results`

6.12.4.3 stage_containers

`skdiscovery.DiscoveryPipeline.stage_containers`

6.12.4.4 stageConfigurationHistory

`skdiscovery.DiscoveryPipeline.stageConfigurationHistory`

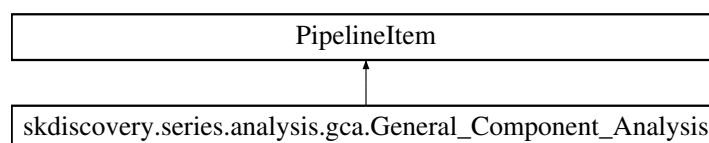
The documentation for this class was generated from the following file:

- framework/[discoverypipeline.py](#)

6.13 skdiscovery.series.analysis.General_Component_Analysis Class Reference

Performs either ICA or PCA analysis on series data.

Inheritance diagram for `skdiscovery.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`

6.13.1 Detailed Description

Performs either ICA or PCA analysis on series data.

6.13.2 Constructor & Destructor Documentation

6.13.2.1 __init__()

```
def skdiscovery.series.analysis.General_Component_Analysis.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Analysis object.

Parameters

<code>str_description</code>	String description of analysis
<code>ap_paramList[num_components]</code>	Number of components
<code>ap_paramList[component_type]</code>	Type of component analysis (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>ap_paramList[labels]</code>	Optional list of label names

6.13.3 Member Function Documentation

6.13.3.1 process()

```
def skdiscovery.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
-----------------	----------------------------------

6.13.4 Member Data Documentation

6.13.4.1 ap_paramList

```
skdiscovery.series.analysis.General_Component_Analysis.ap_paramList
```

6.13.4.2 ap_paramNames

```
skdiscovery.series.analysis.General_Component_Analysis.ap_paramNames
```

6.13.4.3 results

```
skdiscovery.series.analysis.General_Component_Analysis.results
```

6.13.4.4 str_description

`skdiscovery.series.analysis.General_Component_Analysis.str_description`

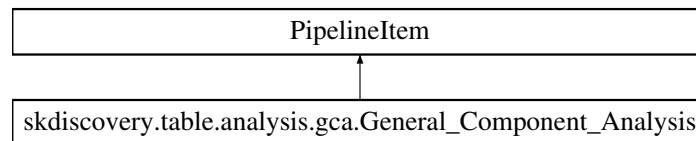
The documentation for this class was generated from the following file:

- [series/analysis/gca.py](#)

6.14 skdiscovery.table.analysis.General_Component_Analysis Class Reference

Performs a general component analysis on table data.

Inheritance diagram for `skdiscovery.table.analysis.General_Component_Analysis`:



Public Member Functions

- `def __init__(self, str_description, ap_paramList, n_components, column_names)`
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`
- `results`

6.14.1 Detailed Description

Performs a general component analysis on table data.

Currently, the two built-in types of analysis are either ICA or PCA.

6.14.2 Constructor & Destructor Documentation

6.14.2.1 `__init__()`

```
def skdiscovery.table.analysis.General_Component_Analysis.__init__ (
    self,
    str_description,
    ap_paramList,
    n_components,
    column_names )
```

Initialize Analysis object.

Parameters

<i>str_description</i>	String description of analysis
<i>ap_paramList[component_type]</i>	Type of 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>n_components</i>	Number of components to compute
<i>column_names</i>	Columns names to use

6.14.3 Member Function Documentation

6.14.3.1 `process()`

```
def skdiscovery.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
-----------------	--------------

6.14.4 Member Data Documentation

6.14.4.1 `ap_paramList`

`skdiscovery.table.analysis.General_Component_Analysis.ap_paramList`

6.14.4.2 `ap_paramNames`

`skdiscovery.table.analysis.General_Component_Analysis.ap_paramNames`

6.14.4.3 `column_names`

`skdiscovery.table.analysis.General_Component_Analysis.column_names`

6.14.4.4 `n_components`

`skdiscovery.table.analysis.General_Component_Analysis.n_components`

6.14.4.5 `results`

`skdiscovery.table.analysis.General_Component_Analysis.results`

6.14.4.6 `str_description`

`skdiscovery.table.analysis.General_Component_Analysis.str_description`

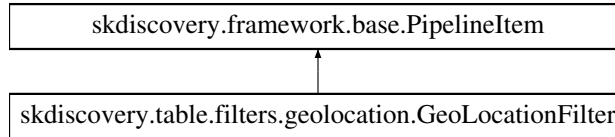
The documentation for this class was generated from the following file:

- [table/analysis/gca.py](#)

6.15 skdiscovery.table.filters.GeoLocationFilter Class Reference

Removes objects not located in a specified region.

Inheritance diagram for skdiscovery.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`

6.15.1 Detailed Description

Removes objects not located in a specified region.

6.15.2 Constructor & Destructor Documentation

6.15.2.1 __init__()

```

def skdiscovery.table.filters.GeoLocationFilter.__init__ (
    self,
    str_description,
    ap_paramList )
  
```

Initialize GeolocationFilter.

Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[ap_lat]</i>	Latitude coordinate
<i>ap_paramList[ap_lon]</i>	Longitude coordinate
<i>ap_paramList[ap_radius]</i>	cut objects whose distance from lat/lon is greater than ap_radius

6.15.3 Member Function Documentation

6.15.3.1 __str__()

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

String representation of object.

Returns

String listing all current parameters

6.15.3.2 getMetadata()

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.15.3.3 perturbParams()

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

choose other random value for all parameters

6.15.3.4 process()

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

Apply geolocation filter to data set.

Parameters

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

6.15.3.5 resetParams()

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

set all parameters to initial value

6.15.4 Member Data Documentation

6.15.4.1 ap_paramList

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

6.15.4.2 ap_paramNames

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

6.15.4.3 str_description

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

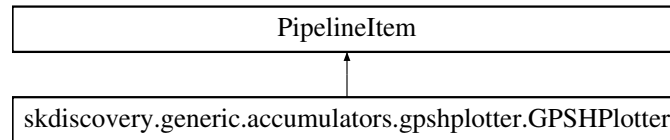
The documentation for this class was generated from the following file:

- [table/filters/geolocation.py](#)

6.16 skdiscovery.generic.accumulators.GPSHPlotter Class Reference

Plots results from General_Component_Analysis, for the GPS horizontal or vertical components.

Inheritance diagram for skdiscovery.generic.accumulators.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 GPHSHPlotter.
- `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`

6.16.1 Detailed Description

Plots results from General_Component_Analysis, for the GPS horizontal or vertical components.

6.16.2 Constructor & Destructor Documentation

6.16.2.1 `__init__()`

```
def skdiscovery.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

6.16.3 Member Function Documentation

6.16.3.1 `process()`

```
def skdiscovery.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
-----------------	---

6.16.4 Member Data Documentation

6.16.4.1 comp_name

`skdiscovery.generic.accumulators.GPSHPlotter.comp_name`

6.16.4.2 dir_sign

`skdiscovery.generic.accumulators.GPSHPlotter.dir_sign`

6.16.4.3 errorE

`skdiscovery.generic.accumulators.GPSHPlotter.errorE`

6.16.4.4 KF_tau

`skdiscovery.generic.accumulators.GPSHPlotter.KF_tau`

6.16.4.5 mogi_name

`skdiscovery.generic.accumulators.GPSHPlotter.mogi_name`

6.16.4.6 offset

`skdiscovery.generic.accumulators.GPSHPlotter.offset`

6.16.4.7 `pca_comp`

```
skdiscovery.generic.accumulators.GPSHPlotter.pca_comp
```

6.16.4.8 `pca_dir`

```
skdiscovery.generic.accumulators.GPSHPlotter.pca_dir
```

6.16.4.9 `scaleFactor`

```
skdiscovery.generic.accumulators.GPSHPlotter.scaleFactor
```

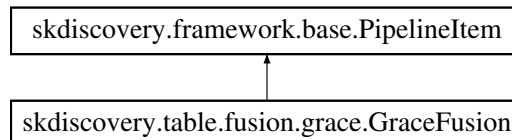
The documentation for this class was generated from the following file:

- [generic/accumulators/gpshplotter.py](#)

6.17 `skdiscovery.table.fusion.GraceFusion` Class Reference

Fuses GRACE equivalent water depth time series.

Inheritance diagram for `skdiscovery.table.fusion.GraceFusion`:



Public Member Functions

- `def __init__(self, str_description, metadata, column_data_name='Grace', column_error_name='Grace_←
Uncertainty', gldas="Off")`
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](#)
- [gldas](#)
- [str_description](#)
- [ap_paramList](#)
- [ap_paramNames](#)

6.17.1 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/>)

6.17.2 Constructor & Destructor Documentation

6.17.2.1 __init__()

```
def skdiscovery.table.fusion.GraceFusion.__init__ (
    self,
    str_description,
    metadata,
    column_data_name = 'Grace',
    column_error_name = 'Grace_Uncertainty',
    gldas = "Off" )
```

Initialize Grace 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 GRACE data
<i>column_error_name</i>	Grace Uncertainty column name
<i>gldas</i>	Indicating use of the global land data assimilation water model

6.17.3 Member Function Documentation

6.17.3.1 __str__()

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

String represntation of object.

Returns

String listing all current parameters

6.17.3.2 getMetadata()

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

choose other random value for all parameters

6.17.3.4 process()

```
def skdiscovery.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
-----------------	--

6.17.3.5 resetParams()

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

set all parameters to initial value

6.17.4 Member Data Documentation

6.17.4.1 ap_paramList

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

6.17.4.2 ap_paramNames

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

6.17.4.3 column_data_name

```
skdiscovery.table.fusion.GraceFusion.column_data_name
```

6.17.4.4 column_error_name

```
skdiscovery.table.fusion.GraceFusion.column_error_name
```

6.17.4.5 gldas

```
skdiscovery.table.fusion.GraceFusion.gldas
```

6.17.4.6 metadata

```
skdiscovery.table.fusion.GraceFusion.metadata
```

6.17.4.7 str_description

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

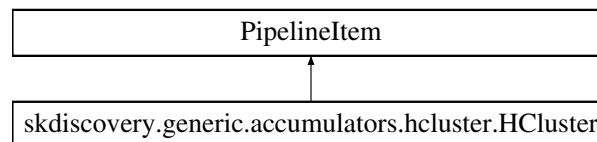
The documentation for this class was generated from the following file:

- [table/fusion/grace.py](#)

6.18 skdiscovery.generic.accumulators.HCluster Class Reference

Hierarchical Clustering function that produces a cluster map of the distance matrix.

Inheritance diagram for skdiscovery.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](#)

6.18.1 Detailed Description

Hierarchical Clustering function that produces a cluster map of the distance matrix.

6.18.2 Constructor & Destructor Documentation

6.18.2.1 `__init__()`

```
def skdiscovery.generic.accumulators.HCluster.__init__ (
    self,
    str_description,
    obj_name )
```

Initialize [HCluster](#).

Parameters

<i>str_description</i>	String describing accumulator
<i>obj_name</i>	Name of distance matrix parameter in the <i>obj_data</i> results

6.18.3 Member Function Documentation

6.18.3.1 `process()`

```
def skdiscovery.generic.accumulators.HCluster.process (
    self,
    obj_data )
```

Produces a cluster map and stores the linkage results.

Parameters

<i>obj_data</i>	Data wrapper
-----------------	--------------

6.18.4 Member Data Documentation

6.18.4.1 `obj_name`

```
skdiscovery.generic.accumulators.HCluster.obj_name
```

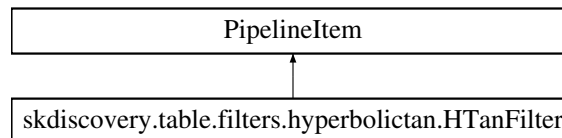
The documentation for this class was generated from the following file:

- [generic/accumulators/hcluster.py](#)

6.19 skdiscovery.table.filters.HTanFilter Class Reference

Filter to subtract an arctan fit from data.

Inheritance diagram for skdiscovery.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`

6.19.1 Detailed Description

Filter to subtract an arctan fit from data.

6.19.2 Constructor & Destructor Documentation

6.19.2.1 `__init__()`

```
def skdiscovery.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
<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 arctangent 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)

6.19.3 Member Function Documentation

6.19.3.1 `process()`

```
def skdiscovery.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.
-----------------	--

6.19.4 Member Data Documentation**6.19.4.1 a**

`skdiscovery.table.filters.HTanFilter.a`

6.19.4.2 c

`skdiscovery.table.filters.HTanFilter.c`

6.19.4.3 column_names

`skdiscovery.table.filters.HTanFilter.column_names`

6.19.4.4 end

`skdiscovery.table.filters.HTanFilter.end`

6.19.4.5 end_time_limit

`skdiscovery.table.filters.HTanFilter.end_time_limit`

6.19.4.6 labels

`skdiscovery.table.filters.HTanFilter.labels`

6.19.4.7 offset

`skdiscovery.table.filters.HTanFilter.offset`

6.19.4.8 slope

`skdiscovery.table.filters.HTanFilter.slope`

6.19.4.9 start

`skdiscovery.table.filters.HTanFilter.start`

6.19.4.10 start_time_limit

`skdiscovery.table.filters.HTanFilter.start_time_limit`

6.19.4.11 t0

`skdiscovery.table.filters.HTanFilter.t0`

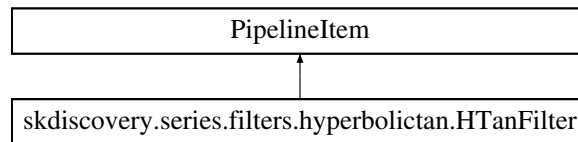
The documentation for this class was generated from the following file:

- [table/filters/hyperbolictan.py](#)

6.20 skdiscovery.series.filters.HTanFilter Class Reference

Filter to subtract arctan fit from data.

Inheritance diagram for skdiscovery.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`

6.20.1 Detailed Description

Filter to subtract arctan fit from data.

[DEPRECATED] [will be removed]

6.20.2 Constructor & Destructor Documentation

6.20.2.1 `__init__()`

```
def skdiscovery.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 arctangent 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)

6.20.3 Member Function Documentation

6.20.3.1 `process()`

```
def skdiscovery.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.
-----------------	--

6.20.4 Member Data Documentation**6.20.4.1 a**

`skdiscovery.series.filters.HTanFilter.a`

6.20.4.2 c

`skdiscovery.series.filters.HTanFilter.c`

6.20.4.3 column_names

`skdiscovery.series.filters.HTanFilter.column_names`

6.20.4.4 end

`skdiscovery.series.filters.HTanFilter.end`

6.20.4.5 end_time_limit

`skdiscovery.series.filters.HTanFilter.end_time_limit`

6.20.4.6 labels

`skdiscovery.series.filters.HTanFilter.labels`

6.20.4.7 offset

`skdiscovery.series.filters.HTanFilter.offset`

6.20.4.8 slope

`skdiscovery.series.filters.HTanFilter.slope`

6.20.4.9 start

`skdiscovery.series.filters.HTanFilter.start`

6.20.4.10 start_time_limit

`skdiscovery.series.filters.HTanFilter.start_time_limit`

6.20.4.11 t0

`skdiscovery.series.filters.HTanFilter.t0`

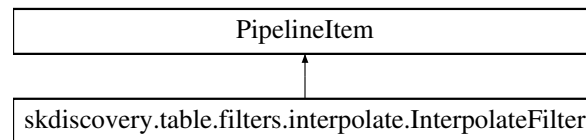
The documentation for this class was generated from the following file:

- [series/filters/hyperbolic_tan.py](#)

6.21 skdiscovery.table.filters.InterpolateFilter Class Reference

Interpolate missing values on table data.

Inheritance diagram for skdiscovery.table.filters.InterpolateFilter:



Public Member Functions

- def [process](#) (self, obj_data)
Interpolate missing data in obj_data DataWrapper.

6.21.1 Detailed Description

Interpolate missing values on table data.

6.21.2 Member Function Documentation

6.21.2.1 process()

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

Interpolate missing data in obj_data DataWrapper.

Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

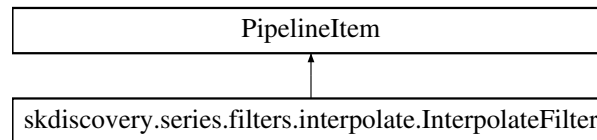
The documentation for this class was generated from the following file:

- [table/filters/interpolate.py](#)

6.22 skdiscovery.series.filters.InterpolateFilter Class Reference

Interpolate missing values on series data.

Inheritance diagram for skdiscovery.series.filters.InterpolateFilter:



Public Member Functions

- def [process](#) (self, obj_data)
Interpolate missing data in obj_data DataWrapper.

6.22.1 Detailed Description

Interpolate missing values on series data.

6.22.2 Member Function Documentation

6.22.2.1 process()

```
def skdiscovery.series.filters.InterpolateFilter.process (
    self,
    obj_data )
```

Interpolate missing data in obj_data DataWrapper.

Parameters

<i>obj_data</i>	Input DataWrapper, will be modified in place
-----------------	--

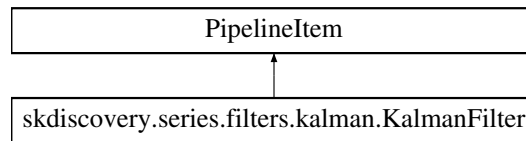
The documentation for this class was generated from the following file:

- series/filters/[interpolate.py](#)

6.23 skdiscovery.series.filters.KalmanFilter Class Reference

Runs a Kalman Smoother on series data.

Inheritance diagram for skdiscovery.series.filters.KalmanFilter:



Public Member Functions

- `def __init__ (self, str_description, ap_paramList, uncertainty_clip=5)`
Initialize [KalmanFilter](#).
- `def process (self, obj_data)`
Apply kalman smoother to data set.

Public Attributes

- [uncertainty_clip](#)
- [ap_paramNames](#)

6.23.1 Detailed Description

Runs a Kalman Smoother on series data.

For more information see: Ji, K. H. 2011, PhD thesis, MIT.

6.23.2 Constructor & Destructor Documentation

6.23.2.1 __init__()

```
def skdiscovery.series.filters.KalmanFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    uncertainty_clip = 5 )
```

Initialize [KalmanFilter](#).

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>

6.23.3 Member Function Documentation

6.23.3.1 process()

```
def skdiscovery.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.
-----------------	---

6.23.4 Member Data Documentation

6.23.4.1 ap_paramNames

```
skdiscovery.series.filters.KalmanFilter.ap_paramNames
```

6.23.4.2 uncertainty_clip

```
skdiscovery.series.filters.KalmanFilter.uncertainty_clip
```

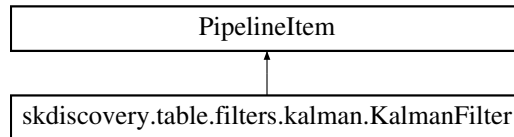
The documentation for this class was generated from the following file:

- [series/filters/kalman.py](#)

6.24 skdiscovery.table.filters.KalmanFilter Class Reference

Runs a Kalman Smoother on table data.

Inheritance diagram for skdiscovery.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 [KalmanFilter](#).
- `def process (self, obj_data)`
Apply kalman smoother to data set.

Public Attributes

- [uncertainty_clip](#)
- [ap_paramNames](#)
- [column_names](#)
- [error_column_names](#)
- [fillna](#)

6.24.1 Detailed Description

Runs a Kalman Smoother on table data.

For more information see: Ji, K. H. 2011, PhD thesis, MIT.

6.24.2 Constructor & Destructor Documentation

6.24.2.1 __init__()

```

def skdiscovery.table.filters.KalmanFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    uncertainty_clip = 5,
    column_names = None,
    error_column_names = None,
    fillna = True )
  
```

Initialize [KalmanFilter](#).

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>
<i>column_names</i>	List of column names to smooth (using <code>None</code> will apply to all columns)
<i>error_column_names</i>	List of error column names to smooth (using <code>None</code> will use default error columns)
<i>fillna</i>	Fill in missing values

6.24.3 Member Function Documentation

6.24.3.1 process()

```
def skdiscovery.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.
-----------------	--

6.24.4 Member Data Documentation

6.24.4.1 ap_paramNames

```
skdiscovery.table.filters.KalmanFilter.ap_paramNames
```

6.24.4.2 column_names

```
skdiscovery.table.filters.KalmanFilter.column_names
```

6.24.4.3 error_column_names

```
skdiscovery.table.filters.KalmanFilter.error_column_names
```

6.24.4.4 fillna

```
skdiscovery.table.filters.KalmanFilter.fillna
```

6.24.4.5 uncertainty_clip

```
skdiscovery.table.filters.KalmanFilter.uncertainty_clip
```

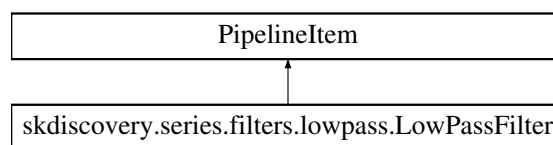
The documentation for this class was generated from the following file:

- [table/filters/kalman.py](#)

6.25 skdiscovery.series.filters.LowPassFilter Class Reference

A FIR Remez (Parks-McLellan) designed low pass filter for series data.

Inheritance diagram for skdiscovery.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](#)

6.25.1 Detailed Description

A FIR Remez (Parks-McLellan) designed low pass filter for series data.

6.25.2 Constructor & Destructor Documentation

6.25.2.1 `__init__()`

```
def skdiscovery.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

6.25.3 Member Function Documentation

6.25.3.1 `process()`

```
def skdiscovery.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
-----------------	----------------------

6.25.4 Member Data Documentation

6.25.4.1 ap_paramNames

`skdiscovery.series.filters.LowPassFilter.ap_paramNames`

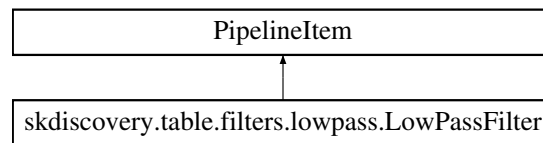
The documentation for this class was generated from the following file:

- [series/filters/lowpass.py](#)

6.26 skdiscovery.table.filters.LowPassFilter Class Reference

A remez low pass filter for table data.

Inheritance diagram for `skdiscovery.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](#)

6.26.1 Detailed Description

A remez low pass filter for table data.

6.26.2 Constructor & Destructor Documentation

6.26.2.1 __init__()

```
def skdiscovery.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[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

6.26.3 Member Function Documentation

6.26.3.1 process()

```
def skdiscovery.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.
-----------------	--

6.26.4 Member Data Documentation

6.26.4.1 ap_paramNames

```
skdiscovery.table.filters.LowPassFilter.ap_paramNames
```

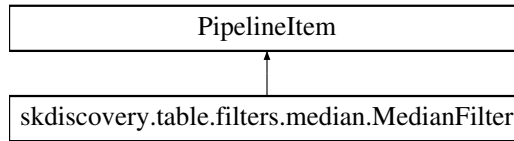
The documentation for this class was generated from the following file:

- [table/filters/lowpass.py](#)

6.27 skdiscovery.table.filters.MedianFilter Class Reference

A Median filter for table data.

Inheritance diagram for skdiscovery.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`

6.27.1 Detailed Description

A Median filter for table data.

6.27.2 Constructor & Destructor Documentation

6.27.2.1 __init__()

```

def skdiscovery.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

6.27.3 Member Function Documentation**6.27.3.1 process()**

```
def skdiscovery.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.
-----------------	---

6.27.4 Member Data Documentation**6.27.4.1 ap_paramNames**

```
skdiscovery.table.filters.MedianFilter.ap_paramNames
```

6.27.4.2 interpolate

```
skdiscovery.table.filters.MedianFilter.interpolate
```

6.27.4.3 min_periods

```
skdiscovery.table.filters.MedianFilter.min_periods
```

6.27.4.4 regular_period

```
skdiscovery.table.filters.MedianFilter.regular_period
```

6.27.4.5 subtract

```
skdiscovery.table.filters.MedianFilter.subtract
```

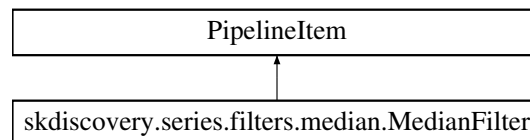
The documentation for this class was generated from the following file:

- [table/filters/median.py](#)

6.28 skdiscovery.series.filters.MedianFilter Class Reference

A Median filter for series data.

Inheritance diagram for skdiscovery.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](#)

6.28.1 Detailed Description

A Median filter for series data.

6.28.2 Constructor & Destructor Documentation

6.28.2.1 `__init__()`

```
def skdiscovery.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</i> [<i>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

6.28.3 Member Function Documentation

6.28.3.1 `process()`

```
def skdiscovery.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.
-----------------	---

6.28.4 Member Data Documentation

6.28.4.1 ap_paramNames

`skdiscovery.series.filters.MedianFilter.ap_paramNames`

6.28.4.2 interpolate

`skdiscovery.series.filters.MedianFilter.interpolate`

6.28.4.3 subtract

`skdiscovery.series.filters.MedianFilter.subtract`

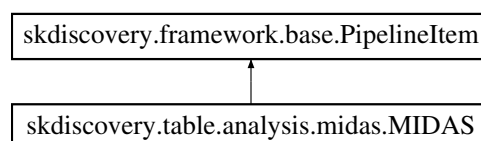
The documentation for this class was generated from the following file:

- [series/filters/median.py](#)

6.29 skdiscovery.table.analysis.MIDAS Class Reference

In A basic [MIDAS](#) trend estimator.

Inheritance diagram for `skdiscovery.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`

6.29.1 Detailed Description

In A basic MIDAS trend estimator.

See <http://onlinelibrary.wiley.com/doi/10.1002/2015JB012552/full>

6.29.2 Constructor & Destructor Documentation

6.29.2.1 __init__()

```
def skdiscovery.table.analysis.MIDAS.__init__ (
    self,
    str_description,
    column_names = None )
```

Initiatlize the MIDAS filtering item.

Parameters

<code>str_description</code>	String description of filter
<code>column_names</code>	List of column names to analyze

6.29.3 Member Function Documentation

6.29.3.1 `__str__()`

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

String representation of object.

Returns

String listing all current parameters

6.29.3.2 `getMetadata()`

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.29.3.3 `perturbParams()`

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

choose other random value for all parameters

6.29.3.4 `process()`

```
def skdiscovery.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
-----------------	--------------

6.29.3.5 resetParams()

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

set all parameters to initial value

6.29.4 Member Data Documentation**6.29.4.1 ap_paramList**

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

6.29.4.2 ap_paramNames

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

6.29.4.3 column_names

```
skdiscovery.table.analysis.MIDAS.column_names
```

6.29.4.4 str_description

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

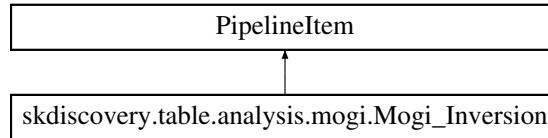
The documentation for this class was generated from the following file:

- [table/analysis/midas.py](#)

6.30 skdiscovery.table.analysis.Mogi_Inversion Class Reference

Perform a mogi source inversion on a set of gps table data.

Inheritance diagram for skdiscovery.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](#)

6.30.1 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').

6.30.2 Constructor & Destructor Documentation

6.30.2.1 __init__()

```

def skdiscovery.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

6.30.3 Member Function Documentation

6.30.3.1 FitPCA()

```
def skdiscovery.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

6.30.3.2 FitTimeSeries()

```
def skdiscovery.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

6.30.3.3 process()

```
def skdiscovery.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 (meters³)

Parameters

<i>obj_data</i>	
-----------------	--

6.30.4 Member Data Documentation

6.30.4.1 ap_paramNames

```
skdiscovery.table.analysis.Mogi_Inversion.ap_paramNames
```

6.30.4.2 column_names

```
skdiscovery.table.analysis.Mogi_Inversion.column_names
```

6.30.4.3 `pca_name`

`skdiscovery.table.analysis.Mogi_Inversion.pca_name`

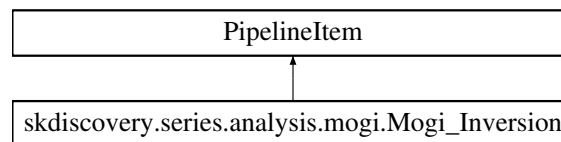
The documentation for this class was generated from the following file:

- [table/analysis/mogi.py](#)

6.31 `skdiscovery.series.analysis.Mogi_Inversion` Class Reference

Perform a Mogi source inversion on a set of gps series data.

Inheritance diagram for `skdiscovery.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](#)

6.31.1 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').

6.31.2 Constructor & Destructor Documentation

6.31.2.1 __init__()

```
def skdiscovery.series.analysis.Mogi_Inversion.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Mogi analysis item.

Parameters

<i>str_description</i>	Description of the item
<i>ap_paramList[h_pca_name]</i>	Name of the pca computed by General_Component_Analysis. Gets start and end date from the PCA fit.
<i>ap_paramList[source_type]</i>	Type of magma chamber source model to use (mogi [default],finite_sphere,closed_pipe,constant_open_pipe,rising_open_pipe,sill)

6.31.3 Member Function Documentation

6.31.3.1 FitPCA()

```
def skdiscovery.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]

6.31.3.2 FitTimeSeries()

```
def skdiscovery.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>	[t_0 , c]

Returns

Amplitude of fit

6.31.3.3 process()

```
def skdiscovery.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 (meters³) `res[4]` = extra parameters (depends on mogi fit type)

Parameters

<i>obj_data</i>	Data object containing the results from the PCA stage
-----------------	---

6.31.4 Member Data Documentation

6.31.4.1 ap_paramNames

skdiscovery.series.analysis.Mogi_Inversion.ap_paramNames

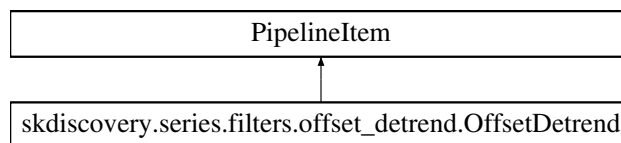
The documentation for this class was generated from the following file:

- series/analysis/mogi.py

6.32 skdiscovery.series.filters.OffsetDetrend Class Reference

Trend filter that fits a stepwise function to linearly detrended series data.

Inheritance diagram for skdiscovery.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

6.32.1 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.

6.32.2 Constructor & Destructor Documentation

6.32.2.1 `__init__()`

```
def skdiscovery.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

6.32.3 Member Function Documentation

6.32.3.1 `process()`

```
def skdiscovery.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.
-----------------	--

6.32.4 Member Data Documentation

6.32.4.1 ap_paramNames

`skdiscovery.series.filters.OffsetDetrend.ap_paramNames`

6.32.4.2 column_names

`skdiscovery.series.filters.OffsetDetrend.column_names`

6.32.4.3 labels

`skdiscovery.series.filters.OffsetDetrend.labels`

6.32.4.4 time_interval

`skdiscovery.series.filters.OffsetDetrend.time_interval`

6.32.4.5 time_point

`skdiscovery.series.filters.OffsetDetrend.time_point`

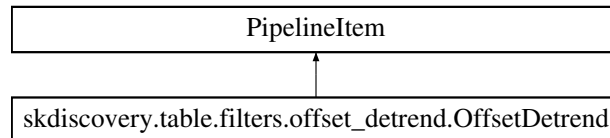
The documentation for this class was generated from the following file:

- [series/filters/offset_detrend.py](#)

6.33 skdiscovery.table.filters.OffsetDetrend Class Reference

Trend filter that fits a stepwise function to linearly detrended table data.

Inheritance diagram for skdiscovery.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`

6.33.1 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.

6.33.2 Constructor & Destructor Documentation

6.33.2.1 `__init__()`

```
def skdiscovery.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

6.33.3 Member Function Documentation**6.33.3.1 process()**

```
def skdiscovery.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.
-----------------	--

6.33.4 Member Data Documentation**6.33.4.1 ap_paramNames**

```
skdiscovery.table.filters.OffsetDetrend.ap_paramNames
```

6.33.4.2 column_names

```
skdiscovery.table.filters.OffsetDetrend.column_names
```

6.33.4.3 labels

```
skdiscovery.table.filters.OffsetDetrend.labels
```

6.33.4.4 time_interval

```
skdiscovery.table.filters.OffsetDetrend.time_interval
```

6.33.4.5 time_point

```
skdiscovery.table.filters.OffsetDetrend.time_point
```

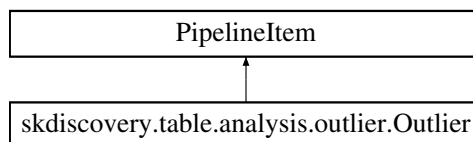
The documentation for this class was generated from the following file:

- [table/filters/offset_detrend.py](#)

6.34 skdiscovery.table.analysis.Outlier Class Reference

Computes $(data / mad(data))$ for outlier detection.

Inheritance diagram for skdiscovery.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](#)

6.34.1 Detailed Description

Computes $(data / mad(data))$ for outlier detection.

Creates a new column for the result

6.34.2 Constructor & Destructor Documentation

6.34.2.1 `__init__()`

```
def skdiscovery.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

6.34.3 Member Function Documentation

6.34.3.1 `process()`

```
def skdiscovery.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
-----------------	--------------------------

6.34.4 Member Data Documentation

6.34.4.1 columns

`skdiscovery.table.analysis.Outlier.columns`

6.34.4.2 name_prefix

`skdiscovery.table.analysis.Outlier.name_prefix`

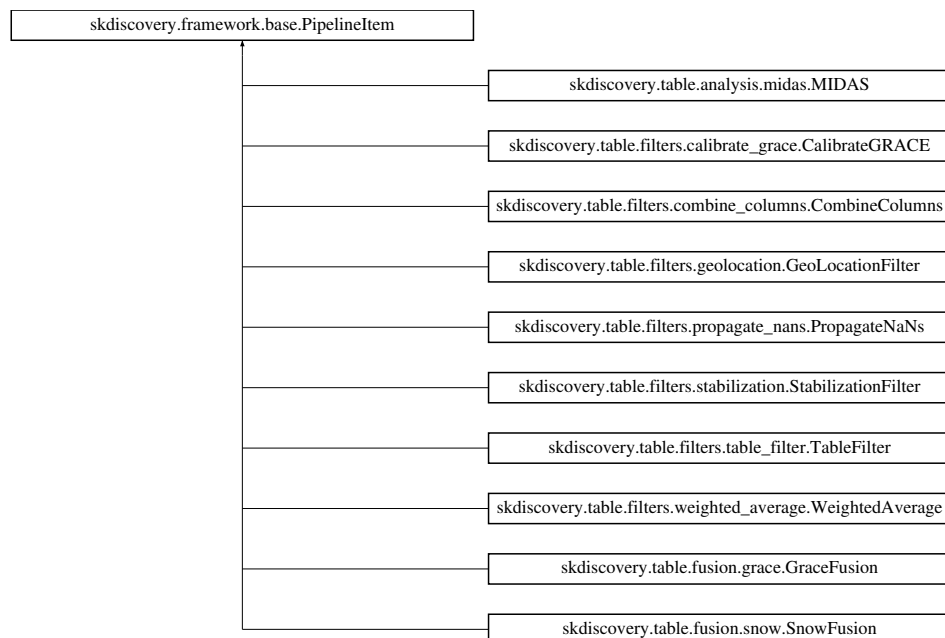
The documentation for this class was generated from the following file:

- [table/analysis/outlier.py](#)

6.35 skdiscovery.framework.PipelineItem Class Reference

The general class used to create pipeline items.

Inheritance diagram for `skdiscovery.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`

6.35.1 Detailed Description

The general class used to create pipeline items.

6.35.2 Constructor & Destructor Documentation

6.35.2.1 `__init__()`

```
def skdiscovery.framework.PipelineItem.__init__ (
    self,
    str_description,
    ap_paramList = [] )
```

Initialize an object.

Parameters

<code>str_description</code>	String description of filter
<code>ap_paramList</code>	List of AutoParam parameters.

6.35.3 Member Function Documentation

6.35.3.1 __str__()

```
def skdiscovery.framework.PipelineItem.__str__ (
    self )
```

String representation of object.

Returns

String listing all current parameters

6.35.3.2 getMetadata()

```
def skdiscovery.framework.PipelineItem.getMetadata (
    self )
```

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.35.3.3 perturbParams()

```
def skdiscovery.framework.PipelineItem.perturbParams (
    self )
```

choose other random value for all parameters

6.35.3.4 process()

```
def skdiscovery.framework.PipelineItem.process (
    self,
    obj_data )
```

The actual filter processing.

Empty in this generic filter.

@param obj_data: Data wrapper that will be processed

6.35.3.5 resetParams()

```
def skdiscovery.framework.PipelineItem.resetParams (
    self )
```

set all parameters to initial value

6.35.4 Member Data Documentation

6.35.4.1 ap_paramList

```
skdiscovery.framework.PipelineItem.ap_paramList
```

6.35.4.2 ap_paramNames

```
skdiscovery.framework.PipelineItem.ap_paramNames
```

6.35.4.3 str_description

```
skdiscovery.framework.PipelineItem.str_description
```

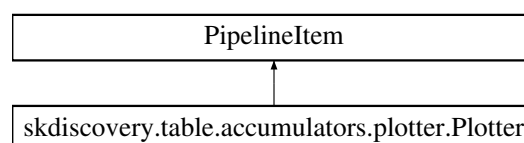
The documentation for this class was generated from the following file:

- framework/[base.py](#)

6.36 skdiscovery.table.accumulators.Plotter Class Reference

Make a plot of table data.

Inheritance diagram for skdiscovery.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_

Public Attributes

- `xlim`
- `ylim`
- `kwargs`
- `num_columns`
- `height`
- `width`
- `column_names`
- `annotate_column`
- `annotate_data`
- `error_column_names`
- `columns_together`

6.36.1 Detailed Description

Make a plot of table data.

6.36.2 Constructor & Destructor Documentation

6.36.2.1 __init__()

```
def skdiscovery.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

6.36.3 Member Function Documentation

6.36.3.1 process()

```
def skdiscovery.table.accumulators.Plotter.process (
    self,
    obj_data )
```

Plot each column in obj_

Parameters

<i>obj_data</i>	Data Wrapper
-----------------	--------------

6.36.4 Member Data Documentation

6.36.4.1 annotate_column

```
skdiscovery.table.accumulators.Plotter.annotate_column
```

6.36.4.2 annotate_data

skdiscovery.table.accumulators.Plotter.annotate_data

6.36.4.3 column_names

skdiscovery.table.accumulators.Plotter.column_names

6.36.4.4 columns_together

skdiscovery.table.accumulators.Plotter.columns_together

6.36.4.5 error_column_names

skdiscovery.table.accumulators.Plotter.error_column_names

6.36.4.6 height

skdiscovery.table.accumulators.Plotter.height

6.36.4.7 kwargs

skdiscovery.table.accumulators.Plotter.kwargs

6.36.4.8 num_columns

skdiscovery.table.accumulators.Plotter.num_columns

6.36.4.9 width

```
skdiscovery.table.accumulators.Plotter.width
```

6.36.4.10 xlim

```
skdiscovery.table.accumulators.Plotter.xlim
```

6.36.4.11 ylim

```
skdiscovery.table.accumulators.Plotter.ylim
```

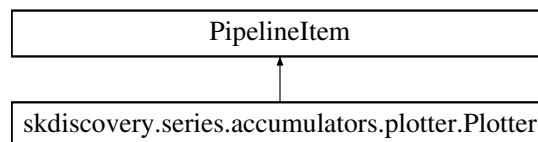
The documentation for this class was generated from the following file:

- [table/accumulators/plotter.py](#)

6.37 skdiscovery.series.accumulators.Plotter Class Reference

Make a plot of series data.

Inheritance diagram for `skdiscovery.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_data`

Public Attributes

- [kwargs](#)
- [num_columns](#)
- [errorbars](#)
- [height](#)
- [width](#)

6.37.1 Detailed Description

Make a plot of series data.

6.37.2 Constructor & Destructor Documentation

6.37.2.1 `__init__()`

```
def skdiscovery.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

6.37.3 Member Function Documentation

6.37.3.1 `process()`

```
def skdiscovery.series.accumulators.Plotter.process (
    self,
    obj_data )
```

Plot each column in obj_

Parameters

<i>obj_data</i>	Data Wrapper
-----------------	--------------

6.37.4 Member Data Documentation**6.37.4.1 errorbars**

`skdiscovery.series.accumulators.Plotter.errorbars`

6.37.4.2 height

`skdiscovery.series.accumulators.Plotter.height`

6.37.4.3 kwargs

`skdiscovery.series.accumulators.Plotter.kwargs`

6.37.4.4 num_columns

`skdiscovery.series.accumulators.Plotter.num_columns`

6.37.4.5 width

`skdiscovery.series.accumulators.Plotter.width`

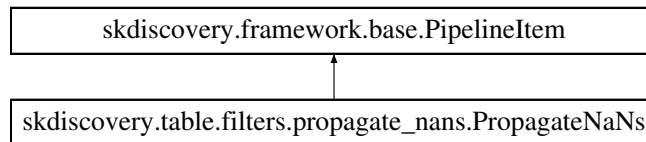
The documentation for this class was generated from the following file:

- [series/accumulators/plotter.py](#)

6.38 skdiscovery.table.filters.PropagateNaNs Class Reference

Propagates NaN's from one column to other columns.

Inheritance diagram for skdiscovery.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`

6.38.1 Detailed Description

Propagates NaN's from one column to other columns.

6.38.2 Constructor & Destructor Documentation

6.38.2.1 `__init__()`

```
def skdiscovery.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

6.38.3 Member Function Documentation

6.38.3.1 `__str__()`

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

String representation of object.

Returns

String listing all current parameters

6.38.3.2 `getMetadata()`

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.38.3.3 perturbParams()

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

choose other random value for all parameters

6.38.3.4 process()

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

[PropagateNaNs](#) on table data wrapper.

Parameters

<i>obj_data</i>	Input table data wrapper
-----------------	--------------------------

6.38.3.5 resetParams()

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

set all parameters to initial value

6.38.4 Member Data Documentation

6.38.4.1 ap_paramList

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

6.38.4.2 ap_paramNames

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

6.38.4.3 nan_column

`skdiscovery.table.filters.PropagateNaNs.nan_column`

6.38.4.4 str_description

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

6.38.4.5 target_columns

`skdiscovery.table.filters.PropagateNaNs.target_columns`

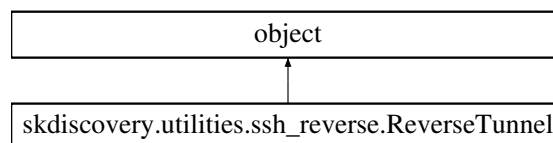
The documentation for this class was generated from the following file:

- [table/filters/propagate_nans.py](#)

6.39 skdiscovery.utilities.ssh_reverse.ReverseTunnel Class Reference

Create a reverse ssh tunnel.

Inheritance diagram for `skdiscovery.utilities.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](#)

6.39.1 Detailed Description

Create a reverse ssh tunnel.

6.39.2 Constructor & Destructor Documentation

6.39.2.1 `__init__()`

```
def skdiscovery.utilities.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

6.39.2.2 `__del__()`

```
def skdiscovery.utilities.ssh_reverse.ReverseTunnel.__del__ (
    self )
```

Deconstructor.

6.39.3 Member Function Documentation

6.39.3.1 `create_reverse_tunnel()`

```
def skdiscovery.utilities.ssh_reverse.ReverseTunnel.create_reverse_tunnel (
    self )
```

Create the reverse tunnel.

6.39.4 Member Data Documentation

6.39.4.1 `check`

```
skdiscovery.utilities.ssh_reverse.ReverseTunnel.check
```

6.39.4.2 `child_threads`

```
skdiscovery.utilities.ssh_reverse.ReverseTunnel.child_threads
```

6.39.4.3 `event`

```
skdiscovery.utilities.ssh_reverse.ReverseTunnel.event
```


6.39.4.4 key_filename

skdiscovery.utilities.ssh_reverse.ReverseTunnel.key_filename

6.39.4.5 remote_host

skdiscovery.utilities.ssh_reverse.ReverseTunnel.remote_host

6.39.4.6 remote_port

skdiscovery.utilities.ssh_reverse.ReverseTunnel.remote_port

6.39.4.7 server_address

skdiscovery.utilities.ssh_reverse.ReverseTunnel.server_address

6.39.4.8 server_port

skdiscovery.utilities.ssh_reverse.ReverseTunnel.server_port

6.39.4.9 ssh

skdiscovery.utilities.ssh_reverse.ReverseTunnel.ssh

6.39.4.10 username

skdiscovery.utilities.ssh_reverse.ReverseTunnel.username

6.39.4.11 verbose

`skdiscovery.utilities.ssh_reverse.ReverseTunnel.verbose`

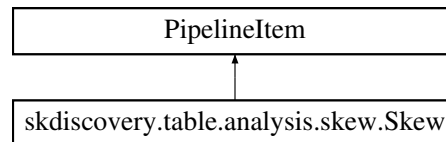
The documentation for this class was generated from the following file:

- [utilities/ssh_reverse.py](#)

6.40 skdiscovery.table.analysis.Skew Class Reference

Calculates the skew of table data.

Inheritance diagram for `skdiscovery.table.analysis.Skew`:



Public Member Functions

- `def process (self, obj_data)`
Apply [Skew](#) analysis with results added to the data wrapper.

6.40.1 Detailed Description

Calculates the skew of table data.

6.40.2 Member Function Documentation

6.40.2.1 process()

```
def skdiscovery.table.analysis.Skew.process (
    self,
    obj_data )
```

Apply [Skew](#) analysis with results added to the data wrapper.

Parameters

<code>obj_data</code>	Data wrapper
-----------------------	--------------

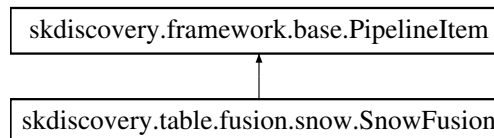
The documentation for this class was generated from the following file:

- [table/analysis/skew.py](#)

6.41 skdiscovery.table.fusion.SnowFusion Class Reference

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

Inheritance diagram for `skdiscovery.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`

6.41.1 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>)

6.41.2 Constructor & Destructor Documentation

6.41.2.1 `__init__()`

```
def skdiscovery.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

6.41.3 Member Function Documentation

6.41.3.1 `__str__()`

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

String represntation of object.

Returns

String listing all current parameters

6.41.3.2 getMetadata()

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.41.3.3 perturbParams()

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

choose other random value for all parameters

6.41.3.4 process()

```
def skdiscovery.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
-----------------	--

6.41.3.5 resetParams()

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

set all parameters to initial value

6.41.4 Member Data Documentation

6.41.4.1 `ap_paramList`

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

6.41.4.2 `ap_paramNames`

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

6.41.4.3 `column_data_name`

`skdiscovery.table.fusion.SnowFusion.column_data_name`

6.41.4.4 `metadata`

`skdiscovery.table.fusion.SnowFusion.metadata`

6.41.4.5 `str_description`

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

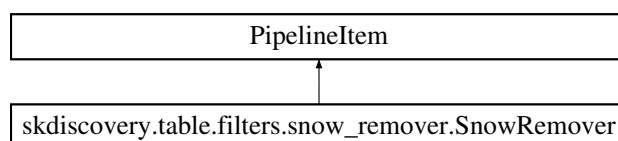
The documentation for this class was generated from the following file:

- `table/fusion/snow.py`

6.42 `skdiscovery.table.filters.SnowRemover` Class Reference

Removes data with snow errors.

Inheritance diagram for `skdiscovery.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`

6.42.1 Detailed Description

Removes data with snow errors.

6.42.2 Constructor & Destructor Documentation

6.42.2.1 `__init__()`

```
def skdiscovery.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

<code>str_description</code>	String describing filter
<code>ap_paramList[sigma_clip]</code>	remove station if the stddev of snowdays is sigma_clip times greater than non-snow days, default 1.5
<code>column_name</code>	Name of column to check
<code>snow_column</code>	Name of snow column to determine snowdays/non snow days

6.42.3 Member Function Documentation

6.42.3.1 process()

```
def skdiscovery.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
-----------------	--

6.42.4 Member Data Documentation

6.42.4.1 column_name

```
skdiscovery.table.filters.SnowRemover.column_name
```

6.42.4.2 snow_column

```
skdiscovery.table.filters.SnowRemover.snow_column
```

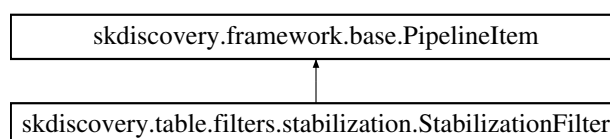
The documentation for this class was generated from the following file:

- [table/filters/snow_remover.py](#)

6.43 skdiscovery.table.filters.StabilizationFilter Class Reference

This filter transforms GPS stations in a region to a local reference frame.

Inheritance diagram for skdiscovery.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](#)

6.43.1 Detailed Description

This filter transforms GPS stations in a region to a local reference frame.

6.43.2 Member Function Documentation

6.43.2.1 [__str__\(\)](#)

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

String represntation of object.

Returns

String listing all currenter parameters

6.43.2.2 getMetadata()

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.43.2.3 perturbParams()

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

choose other random value for all parameters

6.43.2.4 process()

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

Apply stabilization filter to data set.

Parameters

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

6.43.2.5 resetParams()

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

set all parameters to initial value

6.43.3 Member Data Documentation

6.43.3.1 ap_paramList

skdiscovery.framework.PipelineItem.ap_paramList [inherited]

6.43.3.2 ap_paramNames

skdiscovery.framework.PipelineItem.ap_paramNames [inherited]

6.43.3.3 str_description

skdiscovery.framework.PipelineItem.str_description [inherited]

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

- [table/filters/stabilization.py](#)

6.44 skdiscovery.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](#)

6.44.1 Detailed Description

Container to hold a stage for the DiscoveryPipeline.

6.44.2 Constructor & Destructor Documentation

6.44.2.1 `__init__()`

```
def skdiscovery.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)

6.44.3 Member Function Documentation

6.44.3.1 `getMetadata()`

```
def skdiscovery.framework.StageContainer.getMetadata (
    self )
```

Retrieves the obj_content metadata.

Returns

obj_content metadata

6.44.3.2 getMetadataNestedGraph()

```
def skdiscovery.framework.StageContainer.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

Returns

String: Stage container subgraph

6.44.3.3 getMetadataNestedTypes()

```
def skdiscovery.framework.StageContainer.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

Returns

string of container and metadata

6.44.3.4 getMetadataType()

```
def skdiscovery.framework.StageContainer.getMetadataType (
    self )
```

Get metadata type.

Returns

String: container type

6.44.3.5 `getObjects()`

```
def skdiscovery.framework.StageContainer.getObjects (
    self )
```

Return the `obj_content` in a list.

Returns

Contained object in a list

6.44.3.6 `perturb()`

```
def skdiscovery.framework.StageContainer.perturb (
    self )
```

Execute the `obj_content` `perturb` method.

6.44.3.7 `reset()`

```
def skdiscovery.framework.StageContainer.reset (
    self )
```

Execute the `obj_content` `reset` method.

6.44.3.8 `run()`

```
def skdiscovery.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
---------------------------------	---

6.44.4 Member Data Documentation

6.44.4.1 obj_content

`skdiscovery.framework.StageContainer.obj_content`

6.44.4.2 perturbmethod

`skdiscovery.framework.StageContainer.perturbmethod`

6.44.4.3 resetmethod

`skdiscovery.framework.StageContainer.resetmethod`

6.44.4.4 runmethod

`skdiscovery.framework.StageContainer.runmethod`

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

- framework/[stagecontainers.py](#)

6.45 skdiscovery.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` = []

6.45.1 Detailed Description

Stage Container that holds a list of stage containers and randomly chooses one to use.

6.45.2 Constructor & Destructor Documentation

6.45.2.1 __init__()

```
def skdiscovery.framework.StageContainerAlternative.__init__ (
    self,
    list_stagecontainers )
```

Initialize the [StageContainerAlternative](#).

Parameters

<i>list_stagecontainers</i>	List of stage containers
-----------------------------	--------------------------

6.45.3 Member Function Documentation**6.45.3.1 getMetadata()**

```
def skdiscovery.framework.StageContainerAlternative.getMetadata (
    self )
```

Return metadata from the current container.

Returns

metadata from the currently selected container

6.45.3.2 getMetadataNestedGraph()

```
def skdiscovery.framework.StageContainerAlternative.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

Returns

String: Container subgraph

6.45.3.3 getMetadataNestedTypes()

```
def skdiscovery.framework.StageContainerAlternative.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

Returns

string of container and metadata

6.45.3.4 `getMetadataType()`

```
def skdiscovery.framework.StageContainerAlternative.getMetadataType (
    self )
```

Get metadata type.

Returns

String: container type

6.45.3.5 `getObjects()`

```
def skdiscovery.framework.StageContainerAlternative.getObjects (
    self )
```

retrieve the current container as a list

Returns

Current container being used as a list

6.45.3.6 `perturb()`

```
def skdiscovery.framework.StageContainerAlternative.perturb (
    self )
```

choose one of the containers as an alternative and perturb its parameters

6.45.3.7 `reset()`

```
def skdiscovery.framework.StageContainerAlternative.reset (
    self )
```

Reset the current chosen [StageContainer](#).

```
self.currentContainer.reset()
```

6.45.3.8 `run()`

```
def skdiscovery.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
---------------------------	---

6.45.4 Member Data Documentation

6.45.4.1 `currentContainer` [1/2]

```
list skdiscovery.framework.StageContainerAlternative.currentContainer = [] [static]
```

6.45.4.2 `currentContainer` [2/2]

```
skdiscovery.framework.StageContainerAlternative.currentContainer
```

6.45.4.3 `list_stagecontainers`

```
skdiscovery.framework.StageContainerAlternative.list_stagecontainers
```

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

- framework/[stagecontainers.py](#)

6.46 skdiscovery.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`
- `list_currentContainers`
- `currentindex`

Static Public Attributes

- int `length` = 0
- int `currentindex` = 0
- list `list_currentContainers` = []

6.46.1 Detailed Description

In each perturb call, it incrementally adds one of the filters specified in the constructor.

6.46.2 Constructor & Destructor Documentation

6.46.2.1 `__init__`()

```
def skdiscovery.framework.StageContainerIncrementalAdd.__init__ (
    self,
    list_stagecontainers )
```

Initialize the container.

Parameters

<i>list_stagecontainers</i>	List of stage containers.
-----------------------------	---------------------------

6.46.3 Member Function Documentation

6.46.3.1 getMetadata()

```
def skdiscovery.framework.StageContainerIncrementalAdd.getMetadata (
    self )
```

Return the metadata from the currently used stage containers.

Returns

List of metadata from current containers

6.46.3.2 getMetadataNestedGraph()

```
def skdiscovery.framework.StageContainerIncrementalAdd.getMetadataNestedGraph (
    self )
```

Get the nested graph for the container.

Returns

String: Container subgraph

6.46.3.3 getMetadataNestedTypes()

```
def skdiscovery.framework.StageContainerIncrementalAdd.getMetadataNestedTypes (
    self )
```

Get the metadata along with container type.

Returns

string of container and metadata

6.46.3.4 getMetadataType()

```
def skdiscovery.framework.StageContainerIncrementalAdd.getMetadataType (
    self )
```

Get metadata type.

Returns

String: container type

6.46.3.5 getObjects()

```
def skdiscovery.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

6.46.3.6 perturb()

```
def skdiscovery.framework.StageContainerIncrementalAdd.perturb (
    self )
```

Add another stage container to the current list of stage containers.

6.46.3.7 reset()

```
def skdiscovery.framework.StageContainerIncrementalAdd.reset (
    self )
```

Reset the container so that it will only run the first stage container again.

6.46.3.8 run()

```
def skdiscovery.framework.StageContainerIncrementalAdd.run (
    self,
    obj_data_container )
```

Run the current list of stage containers.

6.46.4 Member Data Documentation

6.46.4.1 currentindex [1/2]

```
int skdiscovery.framework.StageContainerIncrementalAdd.currentindex = 0 [static]
```

6.46.4.2 currentindex [2/2]

```
skdiscovery.framework.StageContainerIncrementalAdd.currentindex
```

6.46.4.3 length [1/2]

```
int skdiscovery.framework.StageContainerIncrementalAdd.length = 0 [static]
```

6.46.4.4 length [2/2]

```
skdiscovery.framework.StageContainerIncrementalAdd.length
```

6.46.4.5 list_AllStagecontainers

```
skdiscovery.framework.StageContainerIncrementalAdd.list_AllStagecontainers
```

6.46.4.6 list_currentContainers [1/2]

```
list skdiscovery.framework.StageContainerIncrementalAdd.list_currentContainers = [] [static]
```

6.46.4.7 list_currentContainers [2/2]

```
skdiscovery.framework.StageContainerIncrementalAdd.list_currentContainers
```

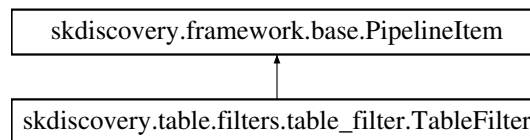
The documentation for this class was generated from the following file:

- [framework/stagecontainers.py](#)

6.47 skdiscovery.table.filters.TableFilter Class Reference

This class removes tables based on their label.

Inheritance diagram for skdiscovery.table.filters.TableFilter:



Public Member Functions

- def `__init__` (self, [str_description](#), [ap_paramList](#))
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

- [str_description](#)
- [ap_paramList](#)
- [ap_paramNames](#)

6.47.1 Detailed Description

This class removes tables based on their label.

6.47.2 Constructor & Destructor Documentation

6.47.2.1 __init__()

```
def skdiscovery.table.filters.TableFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

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

6.47.3 Member Function Documentation

6.47.3.1 __str__()

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

String representation of object.

Returns

String listing all current parameters

6.47.3.2 getMetadata()

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

Retrieve metadata about filter.

Returns

String containing the item description and current parameters for filter.

6.47.3.3 perturbParams()

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

choose other random value for all parameters

6.47.3.4 process()

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

Apply geolocation filter to data set.

Parameters

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

6.47.3.5 resetParams()

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

set all parameters to initial value

6.47.4 Member Data Documentation

6.47.4.1 ap_paramList

skdiscovery.framework.PipelineItem.ap_paramList [inherited]

6.47.4.2 ap_paramNames

skdiscovery.framework.PipelineItem.ap_paramNames [inherited]

6.47.4.3 str_description

skdiscovery.framework.PipelineItem.str_description [inherited]

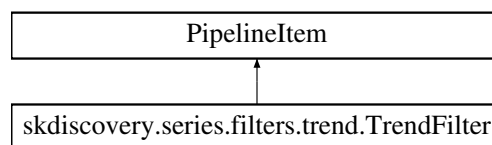
The documentation for this class was generated from the following file:

- [table/filters/table_filter.py](#)

6.48 skdiscovery.series.filters.TrendFilter Class Reference

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

Inheritance diagram for skdiscovery.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`

6.48.1 Detailed Description

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

6.48.2 Constructor & Destructor Documentation

6.48.2.1 `__init__()`

```
def skdiscovery.series.filters.TrendFilter.__init__ (
    self,
    str_description,
    ap_paramList )
```

Initialize Trend Filter.

Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList[list_trendTypes]</i>	List of trend types. List can contain any mix of "linear", "annual", or "semiannual". The default is to remove the linear, annual, and semiannual trends

6.48.3 Member Function Documentation

6.48.3.1 `process()`

```
def skdiscovery.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.
-----------------	--

6.48.4 Member Data Documentation

6.48.4.1 ap_paramNames

skdiscovery.series.filters.TrendFilter.ap_paramNames

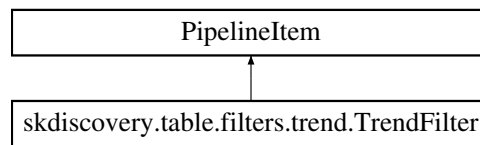
The documentation for this class was generated from the following file:

- series/filters/trend.py

6.49 skdiscovery.table.filters.TrendFilter Class Reference

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

Inheritance diagram for skdiscovery.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`

6.49.1 Detailed Description

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

Works on table data

6.49.2 Constructor & Destructor Documentation

6.49.2.1 `__init__`()

```

def skdiscovery.table.filters.TrendFilter.__init__ (
    self,
    str_description,
    ap_paramList,
    columns = None )
  
```

Initialize Trend Filter.

Parameters

<i>str_description</i>	String describing filter
<i>ap_paramList</i> [<i>list_trendTypes</i>]	List of trend types. List can contain "linear", "annual", or "semiannual"
<i>columns</i>	List of column names to filter

6.49.3 Member Function Documentation

6.49.3.1 process()

```
def skdiscovery.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.
-----------------	--

6.49.4 Member Data Documentation

6.49.4.1 ap_paramNames

```
skdiscovery.table.filters.TrendFilter.ap_paramNames
```

6.49.4.2 columns

```
skdiscovery.table.filters.TrendFilter.columns
```

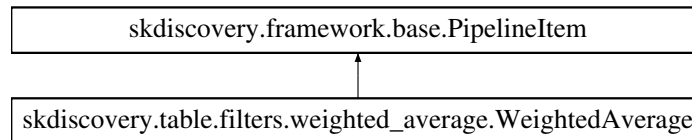
The documentation for this class was generated from the following file:

- [table/filters/trend.py](#)

6.50 skdiscovery.table.filters.WeightedAverage Class Reference

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

Inheritance diagram for skdiscovery.table.filters.WeightedAverage:



Public Member Functions

- def `__init__` (self, str_description, ap_paramList, column_names, std_dev_column_names=None)
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 represntation of object.
- def `getMetadata` (self)
Retrieve metadata about filter.

Public Attributes

- `column_names`
- `std_dev_column_names`
- `str_description`
- `ap_paramList`
- `ap_paramNames`

6.50.1 Detailed Description

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

6.50.2 Constructor & Destructor Documentation

6.50.2.1 `__init__()`

```
def skdiscovery.table.filters.WeightedAverage.__init__ (
    self,
    str_description,
    ap_paramList,
    column_names,
    std_dev_column_names = None )
```

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.

6.50.3 Member Function Documentation

6.50.3.1 `__str__()`

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

String represntation of object.

Returns

String listing all current parameters

6.50.3.2 `getMetadata()`

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

choose other random value for all parameters

6.50.3.4 process()

```
def skdiscovery.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
-----------------	--------------------------

6.50.3.5 resetParams()

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

set all parameters to initial value

6.50.4 Member Data Documentation

6.50.4.1 ap_paramList

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

6.50.4.2 `ap_paramNames`

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

6.50.4.3 `column_names`

`skdiscovery.table.filters.WeightedAverage.column_names`

6.50.4.4 `std_dev_column_names`

`skdiscovery.table.filters.WeightedAverage.std_dev_column_names`

6.50.4.5 `str_description`

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

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

- [table/filters/weighted_average.py](#)

Chapter 7

File Documentation

7.1 framework/base.py File Reference

Classes

- class [skdiscovery.framework.PipelineItem](#)
The general class used to create pipeline items.

Namespaces

- [skdiscovery.framework.base](#)

7.2 framework/discoverypipeline.py File Reference

Classes

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

Namespaces

- [skdiscovery.framework.discoverypipeline](#)

7.3 framework/stagecontainers.py File Reference

Classes

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

Namespaces

- [skdiscovery.framework.stagecontainers](#)

7.4 generic/accumulators/data.py File Reference

Classes

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

Namespaces

- [skdiscovery.generic.accumulators.data](#)

7.5 generic/accumulators/gpshplotter.py File Reference

Classes

- class [skdiscovery.generic.accumulators.GPSHPlotter](#)
Plots results from General_Component_Analysis, for the GPS horizontal or vertical components.

Namespaces

- [skdiscovery.generic.accumulators.gpshplotter](#)

7.6 generic/accumulators/hcluster.py File Reference

Classes

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

Namespaces

- [skdiscovery.generic.accumulators.hcluster](#)

7.7 series/accumulators/plotter.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.accumulators.plotter](#)

7.8 table/accumulators/plotter.py File Reference

Classes

- class [skdiscovery.table.accumulators.Plotter](#)
Make a plot of table data.

Namespaces

- [skdiscovery.table.accumulators.plotter](#)

7.9 series/analysis/correlate.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.analysis.correlate](#)

7.10 table/analysis/correlate.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.analysis.correlate](#)

7.11 series/analysis/gca.py File Reference

Classes

- class [skdiscovery.series.analysis.General_Component_Analysis](#)
Performs either ICA or PCA analysis on series data.

Namespaces

- [skdiscovery.series.analysis.gca](#)

7.12 table/analysis/gca.py File Reference

Classes

- class [skdiscovery.table.analysis.General_Component_Analysis](#)
Performs a general component analysis on table data.

Namespaces

- [skdiscovery.table.analysis.gca](#)

7.13 series/analysis/mogi.py File Reference

Classes

- class [skdiscovery.series.analysis.Mogi_Inversion](#)
Perform a Mogi source inversion on a set of gps series data.

Namespaces

- [skdiscovery.series.analysis.mogi](#)

Functions

- def [skdiscovery.series.analysis.MogiVectors](#) (mogi_res, station_lat_list, station_lon_list, flag3D=False)
Creates a set of Mogi vectors for plotting.

7.14 table/analysis/mogi.py File Reference

Classes

- class [skdiscovery.table.analysis.Mogi_Inversion](#)
Perform a mogi source inversion on a set of gps table data.

Namespaces

- [skdiscovery.table.analysis.mogi](#)

Functions

- def [skdiscovery.table.analysis.MogiVectors](#) (mogi_res, station_lat_list, station_lon_list, flag3D=False)
Creates a set of mogi vectors for plotting.

7.15 series/filters/dataremoover.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.dataremover](#)

7.16 table/filters/dataremover.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.dataremover](#)

7.17 series/filters/hyperbolictan.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.hyperbolictan](#)

7.18 table/filters/hyperbolictan.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.hyperbolictan](#)

7.19 series/filters/interpolate.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.interpolate](#)

7.20 table/filters/interpolate.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.interpolate](#)

7.21 series/filters/kalman.py File Reference

Classes

- class [skdiscovery.series.filters.KalmanFilter](#)
Runs a Kalman Smoother on series data.

Namespaces

- [skdiscovery.series.filters.kalman](#)

7.22 table/filters/kalman.py File Reference

Classes

- class [skdiscovery.table.filters.KalmanFilter](#)
Runs a Kalman Smoother on table data.

Namespaces

- [skdiscovery.table.filters.kalman](#)

7.23 series/filters/lowpass.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.lowpass](#)

7.24 table/filters/lowpass.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.lowpass](#)

7.25 series/filters/median.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.median](#)

7.26 table/filters/median.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.median](#)

7.27 series/filters/offset_detrend.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.offset_detrend](#)

7.28 table/filters/offset_detrend.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.offset_detrend](#)

7.29 series/filters/trend.py File Reference

Classes

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

Namespaces

- [skdiscovery.series.filters.trend](#)

7.30 table/filters/trend.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.trend](#)

7.31 table/analysis/dbscan.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.analysis.dbscan](#)

7.32 table/analysis/midas.py File Reference

Classes

- class [skdiscovery.table.analysis.MIDAS](#)
In A basic [MIDAS](#) trend estimator.

Namespaces

- [skdiscovery.table.analysis.midas](#)

7.33 table/analysis/outlier.py File Reference

Classes

- class [skdiscovery.table.analysis.Outlier](#)
Computes $(data / \text{mad}(data))$ for outlier detection.

Namespaces

- [skdiscovery.table.analysis.outlier](#)

7.34 table/analysis/skew.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.analysis.skew](#)

7.35 table/filters/antenna_offset.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.antenna_offset](#)

7.36 table/filters/calibrate_py File Reference

Classes

- class [skdiscovery.table.filters.CalibrateGRACE](#)
Calibrate Grace Data.

Namespaces

- [skdiscovery.table.filters.calibrate_grace](#)

7.37 table/filters/combine_columns.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.combine_columns](#)

7.38 table/filters/geolocation.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.geolocation](#)

7.39 table/filters/propagate_nans.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.propagate_nans](#)

7.40 table/filters/snow_remover.py File Reference

Classes

- class [skdiscovery.table.filters.SnowRemover](#)
Removes data with snow errors.

Namespaces

- [skdiscovery.table.filters.snow_remover](#)

7.41 table/filters/stabilization.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.stabilization](#)

7.42 table/filters/table_filter.py File Reference

Classes

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

Namespaces

- [skdiscovery.table.filters.table_filter](#)

7.43 table/filters/weighted_average.py File Reference

Classes

- class [skdiscovery.table.filters.WeightedAverage](#)
This filter performs a rolling weighted average using standard deviations as weight.

Namespaces

- [skdiscovery.table.filters.weighted_average](#)

7.44 table/fusion/grace.py File Reference

Classes

- class [skdiscovery.table.fusion.GraceFusion](#)
Fuses GRACE equivalent water depth time series.

Namespaces

- [skdiscovery.table.fusion.grace](#)

7.45 table/fusion/snow.py File Reference

Classes

- class [skdiscovery.table.fusion.SnowFusion](#)
Adds snow time series data to table based on geographic coordinates.

Namespaces

- [skdiscovery.table.fusion.snow](#)

7.46 table/generators/catalog_generator.py File Reference

Classes

- class [skdiscovery.table.generators.CatalogGenerator](#)
In Generates galaxy catalogs for use in DiscoveryPipeline.

Namespaces

- [skdiscovery.table.generators.catalog_generator](#)

7.47 table/generators/data_generator.py File Reference

Classes

- class [skdiscovery.table.generators.DataGenerator](#)

In Class for generating random data.

Namespaces

- [skdiscovery.table.generators.data_generator](#)

7.48 utilities/amazon_control.py File Reference

Namespaces

- [skdiscovery.utilities.amazon_control](#)

Functions

- def [skdiscovery.utilities.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.amazon_control.closeDispyScheduler](#) ()
Close the Dispy Scheduler.
- def [skdiscovery.utilities.amazon_control.startDispyScheduler](#) ()
Start the Dispy Scheduler.
- def [skdiscovery.utilities.amazon_control.generateInfo](#) (instance)
Read metadata from an Amazon instance.
- def [skdiscovery.utilities.amazon_control.updateStatus](#) ()
Update status information in amazon_list.
- def [skdiscovery.utilities.amazon_control.setNumInstances](#) (new_total_instances, instance_type, image_id)
Change the number of running instances.
- def [skdiscovery.utilities.amazon_control.createTunnels](#) ()
Create reverse ssh tunnels to all instances.
- def [skdiscovery.utilities.amazon_control.startDispyNode](#) ()
Start dispy on each Amazon instance.
- def [skdiscovery.utilities.amazon_control.resetInstances](#) ()
Reboot Amazon instances.
- def [skdiscovery.utilities.amazon_control.reset](#) ()
Close and clear Amazon List.
- def [skdiscovery.utilities.amazon_control.close](#) ()
Shutdown all instances, close dispy scheduler and clear Amazon list.
- def [skdiscovery.utilities.amazon_control.clearAmazonList](#) ()
Shutdown connection tunnels to Amazon instances and clear amazon list.

Variables

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

7.49 utilities/amazon_gui.py File Reference

Namespaces

- `skdiscovery.utilities.amazon_gui`

Functions

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

Variables

- `skdiscovery.utilities.amazon_gui.widget_dict` = `OrderedDict()`
- list `skdiscovery.utilities.amazon_gui.disable_list`
- list `skdiscovery.utilities.amazon_gui.key_value_list`

7.50 utilities/astro_tools.py File Reference

Namespaces

- `skdiscovery.utilities.astro_tools`

Functions

- def [skdiscovery.utilities.astro_tools.z_to_v](#) (z)
Convert redshift to km/s assuming shift is due to velocity using special relativity.
- def [skdiscovery.utilities.astro_tools.v_to_z](#) (v)
Convert km/s to redshift assuming all are using special relativity.
- def [skdiscovery.utilities.astro_tools.angular_separation](#) (ra1, dec1, ra2, dec2)
Angular separation between two objects via the haversine formula.
- def [skdiscovery.utilities.astro_tools.move_point](#) (ra, dec, ang_dist, bearing)
Move a point along a great circle at a particular bearing.
- def [skdiscovery.utilities.astro_tools.abs_mag](#) (app_mag, z)
Get the absolute magnitude from apparent magnitude.
- def [skdiscovery.utilities.astro_tools.app_mag](#) (abs_mag, z)
Get the apparent magnitude from absolute magnitude.
- def [skdiscovery.utilities.astro_tools.nfw](#) (R, norm_constant, Rs, Rcore)
2D Navarro-Frenk-White surface radial profile probability density
- def [skdiscovery.utilities.astro_tools.lf](#) (x, A, mstar, alpha)
Schechter function.
- def [skdiscovery.utilities.astro_tools.dlf](#) (x, A, m1, a1, m2, a2)
double Schechter function.
- def [skdiscovery.utilities.astro_tools.cdf_dlf](#) (x, A, m1, a1, m2, a2, start=-26)
Cumulative Schechter function.
- def [skdiscovery.utilities.astro_tools.inv_cdf_dlf](#) (p, A, m1, a1, m2, a2, start=-26, end=-15)
Inverse Cumulative Schechter function.

7.51 utilities/config.py File Reference

Namespaces

- [skdiscovery.utilities.config](#)

Functions

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

7.52 utilities/kalman_smoother.py File Reference

Namespaces

- [skdiscovery.utilities.kalman_smoother](#)

Functions

- def [skdiscovery.utilities.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.kalman_smoother.FitFOGMPParameters](#) (data, Pinit=100, R=1, method='brute', x0=0, clipping=5)
Find best FOGM parameters for a given data set.
- def [skdiscovery.utilities.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.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.kalman_smoother.FOGM](#) (size, t, sigma_sq, R)
Generates data from a First Order Gaussian-Markov process.

7.53 utilities/pbo_tools.py File Reference

Namespaces

- [skdiscovery.utilities.pbo_tools](#)

Functions

- def [skdiscovery.utilities.pbo_tools.mogi](#) (xdata, lat, lon, source_depth, amplitude)
Compute the surface deformation due to changes in a mogi source.
- def [skdiscovery.utilities.pbo_tools.finite_sphere](#) (xdata, lat, lon, source_depth, amplitude, alpha_rad)
Compute the surface deformation due to changes in a finite sphere source.
- def [skdiscovery.utilities.pbo_tools.closed_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta)
Compute the surface deformation due to changes in a closed pipe source.
- def [skdiscovery.utilities.pbo_tools.constant_open_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta)
Compute the surface deformation due to changes in a constant width open pipe source.
- def [skdiscovery.utilities.pbo_tools.rising_open_pipe](#) (xdata, lat, lon, source_depth, amplitude, pipe_delta, open↵_pipe_top)
Compute the surface deformation due to changes in a rising width amplitude open pipe source.
- def [skdiscovery.utilities.pbo_tools.sill](#) (xdata, lat, lon, source_depth, amplitude)
Compute the surface deformation due to changes in a sill-like source.
- def [skdiscovery.utilities.pbo_tools.dirEigenvectors](#) (coord_list, pca_comps, pdir='H')
Takes eigenvectors (north and east) and forces them to point "outward".
- def [skdiscovery.utilities.pbo_tools.datetimeToNumber](#) (in_time)
Converts input pandas Timestamp or pandas DatetimeIndex to unix time.

7.54 utilities/random_walks.py File Reference

Namespaces

- [skdiscovery.utilities.random_walks](#)

Functions

- def [skdiscovery.utilities.random_walks.uniform_walk](#) (pos, grid, step_size=None)
A uniform random walk function.
- def [skdiscovery.utilities.random_walks.gaussian_walk](#) (pos, grid, step_size=None)
A gaussian random walk function.
- def [skdiscovery.utilities.random_walks.keep_in_bound](#) (pos, grid)
Function for truncating and bounding the random walk to within the defined grid.

7.55 utilities/spherical_voronoi.py File Reference

Namespaces

- [skdiscovery.utilities.spherical_voronoi](#)

Functions

- def [skdiscovery.utilities.spherical_voronoi.sphericalToXYZ](#) (lat, lon, radius=1)
Convert spherical coordinates to x,y,z.
- def [skdiscovery.utilities.spherical_voronoi.xyzToSpherical](#) (x, y, z)
Convert x,y,z to spherical coordinates.
- def [skdiscovery.utilities.spherical_voronoi.find_match](#) (region_index, region_list)
Find neighboring regions.
- def [skdiscovery.utilities.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'))
Perform a Spherical Voronoi Tessellation on the input data.

7.56 utilities/ssh_reverse.py File Reference

Classes

- class [skdiscovery.utilities.ssh_reverse.ReverseTunnel](#)
Create a reverse ssh tunnel.

Namespaces

- [skdiscovery.utilities.ssh_reverse](#)

Functions

- def [skdiscovery.utilities.ssh_reverse.print_verbose](#) (s, verbose=False)
Print statement if verbose is True.
- def [skdiscovery.utilities.ssh_reverse.handler](#) (chan, host, port, verbose=False)
Handler is responsible for sending and receiving data through ssh tunnel.
- def [skdiscovery.utilities.ssh_reverse.reverse_forward_tunnel](#) (server_port, remote_host, remote_port, transport, check=30, verbose=False)
Creates a reverse ssh tunnel.

7.57 utilities/trendTools.py File Reference

Namespaces

- [skdiscovery.utilities.trendTools](#)

Functions

- def [skdiscovery.utilities.trendTools.getTrend](#) (xdata)
The getTrend function applies the signal.detrend function.
- def [skdiscovery.utilities.trendTools.sinuFits](#) (xdata, fitN=2, rmve=1)
The sinuFits function fits annual and semi-annual sinusoid trends.
- def [skdiscovery.utilities.trendTools.interpNaN](#) (data)
A simple wrapper for the linear interpolation function from Numpy to fill in NaN's.
- def [skdiscovery.utilities.trendTools.medianFilter](#) (data, window, interpolate=True)
A median filter.

7.58 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.

7.59 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.

Variables

- [skdiscovery.visualization.font](#)

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