Single Molecule Tracking Analysis Documentation

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Chapter 1

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Chapter 2

Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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Chapter 3

Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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Chapter 4

File Index

4.1 File List

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Chapter 5

Namespace Documentation

5.1 BP_TRACKING Namespace Reference

Functions

- main ()
- tracking_plus_save (directory_path, dir_save, file_path, file_counter)
- sorted_alphanumeric (data)

Variables

- str DIRECTORY_MOVIES = "/Volumes/Baljyot_HD/SMT_Olympus/RIF_TREATMET_LIVE/20230528/Movie"
- str MOVIE_BASE_NAME = "nusa_rif"
- str DIRECTORY_SAVE = "Analysis_new"
- dict LINKING_PARAMETERS
- dict LOCALIZATION_PARAMETERS
- dict FILTERING_PARAMETERS
- dict OUTPUT_COLUMNS
- list OUTPUT_COLUMNS_ORDER
- int PAD_ROWS = 3
- model = Model()
- settings = Settings(imp)
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- ds = DisplaySettingsIO.readUserDefault()
- selectionModel = SelectionModel(model)
- displayer = HyperStackDisplayer(model, selectionModel, imp,ds)
- spt_m = model.getSpots()
- tracks_found = model.getTrackModel().trackIDs(True)
- tot_spts = spt_m.getNSpots(True)
- fm = model.getFeatureModel()
- list header_row = [header_name for header_name in OUTPUT_COLUMNS_ORDER]
- list collection_spots_per_track = [header_row]

- track = model.getTrackModel().trackSpots(id)
- int spot_counter = 0
- sid = spot.ID()
- int spot_label = spot_counter
- spot_ID = sid
- track_ID = id
- spot_quality = spot.getFeature('QUALITY')
- spot_x = spot.getFeature('POSITION_X')
- spot_y = spot.getFeature('POSITION_Y')
- spot_z = spot.getFeature('POSITION_Z')
- spot_t = spot.getFeature('POSITION_T')
- spot_frame = spot.getFeature('FRAME')
- spot_radius = spot.getFeature('RADIUS')
- spot_visibility = spot.getFeature('VISIBILITY')
- spot_manual_spot_color = spot.getFeature('MANUAL_SPOT_COLOR')
- spot_mean_intensity_ch1 = spot.getFeature('MEAN_INTENSITY_CH1')
- spot_median_intensity_ch1 = spot.getFeature('MEDIAN_INTENSITY_CH1')
- spot_min_intensity_ch1 = spot.getFeature('MIN_INTENSITY_CH1')
- spot_max_intensity_ch1 = spot.getFeature('MAX_INTENSITY_CH1')
- spot_total_intensity_ch1 = spot.getFeature('TOTAL_INTENSITY_CH1')
- spot_std_intensity_ch1 = spot.getFeature('STD_INTENSITY_CH1')
- spot_contrast_ch1 = spot.getFeature('CONTRAST_CH1')
- spot_snr_ch1 = spot.getFeature('SNR_CH1')
- writer = csv.writer(f,delimiter=',')
- start_time = time.time()

5.1.1 Function Documentation

5.1.1.1 main()

```
BP_TRACKING.main ()
```

5.1.1.2 sorted_alphanumeric()

```
BP_TRACKING.sorted_alphanumeric (
              data)
```

5.1.1.3 tracking_plus_save()

```
BP_TRACKING.tracking_plus_save (
              directory_path,
              dir_save,
              file_path,
              file_counter)
```

5.1.2 Variable Documentation

5.1.2.1 collection_spots_per_track

```
list BP_TRACKING.collection_spots_per_track = [header_row]
```

5.1.2.2 detectorFactory

```
BP_TRACKING.detectorFactory
```

5.1.2.3 detectorSettings

```
BP_TRACKING.detectorSettings
```

5.1.2.4 DIRECTORY_MOVIES

```
str BP_TRACKING.DIRECTORY_MOVIES = "/Volumes/Baljyot_HD/SMT_Olympus/RIF_TREATMET_LIVE/20230528/Movie"
```

5.1.2.5 DIRECTORY_SAVE

```
str BP_TRACKING.DIRECTORY_SAVE = "Analysis_new"
```

5.1.2.6 displayer

```
BP_TRACKING.displayer = HyperStackDisplayer(model, selectionModel, imp,ds)
```

5.1.2.7 ds

```
BP_TRACKING.ds = DisplaySettingsIO.readUserDefault()
```

5.1.2.8 FILTERING_PARAMETERS

```
dict BP_TRACKING.FILTERING_PARAMETERS
```

Initial value:

```
=  {
    "QUALITY": None,
    "MIN_NUMBER_SPOTS_IN_TRACK": None,
    "MAX_NUMBER_SPOTS_IN_TRACK": None
}
```

5.1.2.9 fm

```
BP_TRACKING.fm = model.getFeatureModel()
```

5.1.2.10 header_row

```
list BP_TRACKING.header_row = [header_name for header_name in OUTPUT_COLUMNS_ORDER]
```

5.1.2.11 LINKING_PARAMETERS

```
dict BP_TRACKING.LINKING_PARAMETERS
```

Initial value:

```
=  {
    ’LINKING_MAX_DISTANCE’: 5.0,
    ’GAP_CLOSING_MAX_DISTANCE’: 5.0,
    ’SPLITTING_MAX_DISTANCE’: 0.0,
    ’MERGING_MAX_DISTANCE’: 0.0,
    ’MAX_FRAME_GAP’: 0,
    ’ALLOW_TRACK_SPLITTING’: False,
    ’ALLOW_TRACK_MERGING’: False
}
```

5.1.2.12 LOCALIZATION_PARAMETERS

```
dict BP_TRACKING.LOCALIZATION_PARAMETERS
```

Initial value:

```
=  {
    "DETECTOR_FACTORY": LogDetectorFactory(),
    ’DO_SUBPIXEL_LOCALIZATION’ : True,
    ’RADIUS’ : 2.0,
    ’TARGET_CHANNEL’ : 1,
    ’THRESHOLD’ : 10.0,
    ’DO_MEDIAN_FILTERING’ : True,
}
```

5.1.2.13 model

```
BP_TRACKING.model = Model()
```

5.1.2.14 MOVIE_BASE_NAME

```
str BP_TRACKING.MOVIE_BASE_NAME = "nusa_rif"
```

5.1.2.15 ok

```
BP_TRACKING.ok = trackmate.checkInput()
```

5.1.2.16 OUTPUT_COLUMNS

```
dict BP_TRACKING.OUTPUT_COLUMNS
```

Initial value:

```
=  {
    ’LABEL’:True,
    ’ID’:True,
    ’TRACK_ID’:True,
    ’QUALITY’:True,
    ’POSITION_X’:True,
    ’POSITION_Y’:True,
    ’POSITION_Z’:True,
    ’POSITION_T’:True,
    ’FRAME’:True,
    ’RADIUS’:True,
    ’VISIBILITY’:True,
    ’MANUAL_SPOT_COLOR’:True,
    ’MEAN_INTENSITY_CH1’:True,
    ’MEDIAN_INTENSITY_CH1’:True,
    ’MIN_INTENSITY_CH1’:True,
    ’MAX_INTENSITY_CH1’:True,
    ’TOTAL_INTENSITY_CH1’:True,
    ’STD_INTENSITY_CH1’:True,
    ’CONTRAST_CH1’:True,
    ’SNR_CH1’:True
}
```

5.1.2.17 OUTPUT_COLUMNS_ORDER

```
list BP_TRACKING.OUTPUT_COLUMNS_ORDER
```

Initial value:

```
=  [
    'LABEL', 'ID', 'TRACK_ID', 'QUALITY', 'POSITION_X', 'POSITION_Y', 'POSITION_Z', 'POSITION_T',
    'FRAME',
    'RADIUS', 'VISIBILITY', 'MANUAL_SPOT_COLOR', 'MEAN_INTENSITY_CH1', 'MEDIAN_INTENSITY_CH1',
    'MIN_INTENSITY_CH1',
    'MAX_INTENSITY_CH1', 'TOTAL_INTENSITY_CH1', 'STD_INTENSITY_CH1', 'CONTRAST_CH1', 'SNR_CH1'
]
```

5.1.2.18 PAD_ROWS

```
int BP_TRACKING.PAD_ROWS = 3
```

5.1.2.19 selectionModel

```
BP_TRACKING.selectionModel = SelectionModel(model)
```

5.1.2.20 settings

```
BP_TRACKING.settings = Settings(imp)
```

5.1.2.21 sid

```
BP_TRACKING.sid = spot.ID()
```

5.1.2.22 spot_contrast_ch1

```
BP_TRACKING.spot_contrast_ch1 = spot.getFeature('CONTRAST_CH1')
```

5.1.2.23 spot_counter

```
int BP_TRACKING.spot_counter = 0
```

5.1.2.24 spot_frame

```
BP_TRACKING.spot_frame = spot.getFeature('FRAME')
```

5.1.2.25 spot_ID

```
BP_TRACKING.spot_ID = sid
```

5.1.2.26 spot_label

```
int BP_TRACKING.spot_label = spot_counter
```

5.1.2.27 spot_manual_spot_color

```
BP_TRACKING.spot_manual_spot_color = spot.getFeature('MANUAL_SPOT_COLOR')
```

5.1.2.28 spot_max_intensity_ch1

```
BP_TRACKING.spot_max_intensity_ch1 = spot.getFeature('MAX_INTENSITY_CH1')
```

5.1.2.29 spot_mean_intensity_ch1

```
BP_TRACKING.spot_mean_intensity_ch1 = spot.getFeature('MEAN_INTENSITY_CH1')
```

5.1.2.30 spot_median_intensity_ch1

```
BP_TRACKING.spot_median_intensity_ch1 = spot.getFeature('MEDIAN_INTENSITY_CH1')
```

5.1.2.31 spot_min_intensity_ch1

```
BP_TRACKING.spot_min_intensity_ch1 = spot.getFeature('MIN_INTENSITY_CH1')
```

5.1.2.32 spot_quality

```
BP_TRACKING.spot_quality = spot.getFeature('QUALITY')
```

5.1.2.33 spot_radius

```
BP_TRACKING.spot_radius = spot.getFeature('RADIUS')
```

5.1.2.34 spot_snr_ch1

```
BP_TRACKING.spot_snr_ch1 = spot.getFeature('SNR_CH1')
```

5.1.2.35 spot_std_intensity_ch1

```
BP_TRACKING.spot_std_intensity_ch1 = spot.getFeature('STD_INTENSITY_CH1')
```

5.1.2.36 spot_t

```
BP_TRACKING.spot_t = spot.getFeature('POSITION_T')
```

5.1.2.37 spot_total_intensity_ch1

```
BP_TRACKING.spot_total_intensity_ch1 = spot.getFeature('TOTAL_INTENSITY_CH1')
```

5.1.2.38 spot_visibility

```
BP_TRACKING.spot_visibility = spot.getFeature('VISIBILITY')
```

5.1.2.39 spot_x

```
BP_TRACKING.spot_x = spot.getFeature('POSITION_X')
```

5.1.2.40 spot_y

```
BP_TRACKING.spot_y = spot.getFeature('POSITION_Y')
```

5.1.2.41 spot_z

```
BP_TRACKING.spot_z = spot.getFeature('POSITION_Z')
```

5.1.2.42 spt_m

```
BP_TRACKING.spt_m = model.getSpots()
```

5.1.2.43 start_time

```
BP_TRACKING.start_time = time.time()
```

5.1.2.44 tot_spts

```
BP_TRACKING.tot_spts = spt_m.getNSpots(True)
```

5.1.2.45 track

```
BP_TRACKING.track = model.getTrackModel().trackSpots(id)
```

5.1.2.46 track_ID

```
BP_TRACKING.track_ID = id
```

5.1.2.47 trackerFactory

```
BP_TRACKING.trackerFactory
```

5.1.2.48 trackerSettings

```
BP_TRACKING.trackerSettings
```

5.1.2.49 trackmate

```
BP_TRACKING.trackmate = TrackMate(model, settings)
```

5.1.2.50 tracks_found

```
BP_TRACKING.tracks_found = model.getTrackModel().trackIDs(True)
```

5.1.2.51 writer

```
BP_TRACKING.writer = csv.writer(f,delimiter=',')
```

5.2 localization_merger Namespace Reference

Functions

- pd.DataFrame merge_localization (pd.DataFrame tracks, max_dist=1, max_frame_gap=1)

Variables

- list COL_NAMES_THUNDERSTORM = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma [nm]', 'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]']
- list NEW_COL_NAMES = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma [nm]', 'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]', 'merged']

5.2.1 Detailed Description

```
ThunderSTORM localization merger  TODO THIS DOES NOT WORK YET
=============================================================

This module contains the function to merge localizations from ThunderSTORM .csv file.
The structure of the .csv file is the following:
id, frame,  x [nm], y [nm], sigma [nm], intensity [photon], offset [photon],    bkgstd [photon],    chi2,   ur

id: the id of the localization
frame: the frame number
x [nm]: the x coordinate of the localization in nanometers
y [nm]: the y coordinate of the localization in nanometers
sigma [nm]: the sigma of the localization in nanometers
intensity [photon]: the intensity of the localization in photon
offset [photon]: the offset of the localization in photon
bkgstd [photon]: the background standard deviation of the localization in photon
chi2: the chi2 of the localization
uncertainty [nm]: the uncertainty of the localization in nanometers
```

5.2.2 Function Documentation

5.2.2.1 merge_localization()

```
pd.DataFrame localization_merger.merge_localization (
             pd.DataFrame tracks,
              max_dist = 1,
              max_frame_gap = 1)
```

```
Merge localizations into one localization given a maximum distance and a maximum frame gap.
The function merge_localization() takes as input a DataFrame containing the localizations to be merged and ret
There is a new column at the end called 'merged' which contains the number of the merged localization producec

Parameters:
-----------
tracks : pandas.DataFrame
    DataFrame containing the localizations to be merged. (this is the output of ThunderSTORM .csv file, see dc
max_dist : float (nm - nanometers, default = 1)
    Maximum distance between two localizations to be merged (in nanometers)
max_frame_gap : int (default = 0, no frame gap)
    Maximum frame gap between two localizations to be merged (in frames)

Returns:
--------
merged_tracks : pandas.DataFrame
    DataFrame containing the merged localizations with a new column 'merged' containing the number of the merg
```

5.2.3 Variable Documentation

5.2.3.1 COL_NAMES_THUNDERSTORM

```
list localization_merger.COL_NAMES_THUNDERSTORM = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma
[nm]', 'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]']
```

5.2.3.2 NEW_COL_NAMES

```
list localization_merger.NEW_COL_NAMES = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma [nm]',
'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]', 'merged']
```

5.3 localization_setter Namespace Reference

Classes

- class mask_localization
- class path_structure

Variables

- str RELATIVE_ANALYSIS_FOLDER = "TS_Analysis"
- int BOUNDING_BOX_EXTRA_BORDER = 2
- list paths
- ml = mask_localization(path)

5.3.1 Variable Documentation

5.3.1.1 BOUNDING_BOX_EXTRA_BORDER

```
int localization_setter.BOUNDING_BOX_EXTRA_BORDER = 2
```

5.3.1.2 ml

```
localization_setter.ml = mask_localization(path)
```

5.3.1.3 paths

```
list localization_setter.paths
```

Initial value:

```
=  [
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_rif_fixed/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_m9_fixed/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_hex5_fixed_2/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_hex5_fixed/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_ez_fixed_2/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_ez_fixed/TS",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/ll_hex5_fixed/TS",
            "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231015/ll_ez/TS"
    ]
```

5.3.1.4 RELATIVE_ANALYSIS_FOLDER

```
str localization_setter.RELATIVE_ANALYSIS_FOLDER = "TS_Analysis"
```

5.4 scale_space_plus_database_tracked Namespace Reference

Classes

- class segmentation_scale_space

Variables

- int CORRECTION_FACTOR = 1.
- str LOCALIZATION_UNIQUE_TYPE = "mean"
- list cds
- list t_strings
- dict blob_parameters
- dict fitting_parameters
- list img_dims
- list rescale_pixel_size
- list type_analysis_file
- list total_frames
- list subframes
- list pixel_size
- list loc_error
- list include_all
- batch

5.4.1 Variable Documentation

5.4.1.1 batch

```
scale_space_plus_database_tracked.batch
```

Initial value:

```
=  segmentation_scale_space(cds[i],
                                          t_strings[i],
                                          blob_parameters,
                                          fitting_parameters,
                                          img_dims[i],
                                          rescale_pixel_size[i],
                                          type_analysis_file[i],
                                          total_frames[i],
                                          subframes[i],
                                          pixel_size[i],
                                          loc_error[i],
                                          include_all[i])
```

5.4.1.2 blob_parameters

```
dict scale_space_plus_database_tracked.blob_parameters
```

Initial value:

```
=  {
        "threshold": 3e-2, \
        "overlap": 0, \
        "median": False, \
        "min_sigma": 4/np.sqrt(2), \
        "max_sigma": 20/np.sqrt(2), \
        "num_sigma": 30, \
        "detection": 'bp', \
        "log_scale": False
        }
```

5.4.1.3 cds

```
list scale_space_plus_database_tracked.cds
```

Initial value:

```
= [
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_120min/20190527/rpoc_ez"
    ]
```

5.4.1.4 CORRECTION_FACTOR

```
int scale_space_plus_database_tracked.CORRECTION_FACTOR = 1.
```

5.4.1.5 fitting_parameters

```
dict scale_space_plus_database_tracked.fitting_parameters
```

Initial value:

```
= {
        "mask_size":5,
        "plot_fit":False,
        "fitting_image":"LAP",
        "radius_func":np.mean,#identity,
        "residual_func":residuals_gaus2d,
        "sigma_range":4,
        "centroid_range":3,
        "height_range":1
        }
```

5.4.1.6 img_dims

```
list scale_space_plus_database_tracked.img_dims
```

Initial value:

```
= [
        (290,290)
    ]
```

5.4.1.7 include_all

```
list scale_space_plus_database_tracked.include_all
```

Initial value:

```
= [
        False
    ]
```

5.4.1.8 loc_error

```
list scale_space_plus_database_tracked.loc_error
```

Initial value:

```
= [
        20
    ]
```

5.4.1.9 LOCALIZATION_UNIQUE_TYPE

```
str scale_space_plus_database_tracked.LOCALIZATION_UNIQUE_TYPE = "mean"
```

5.4.1.10 pixel_size

```
list scale_space_plus_database_tracked.pixel_size
```

Initial value:

```
00001 =  [
00002         130
00003     ]
```

5.4.1.11 rescale_pixel_size

```
list scale_space_plus_database_tracked.rescale_pixel_size
```

Initial value:

```
00001 =  [
00002         10
00003     ]
```

5.4.1.12 subframes

```
list scale_space_plus_database_tracked.subframes
```

Initial value:

```
00001 =  [
00002         10
00003     ]
```

5.4.1.13 t_strings

```
list scale_space_plus_database_tracked.t_strings
```

Initial value:

```
00001 =  [
00002         "rpoc_ez"
00003     ]
```

5.4.1.14 total_frames

```
list scale_space_plus_database_tracked.total_frames
```

Initial value:

```
00001 =  [
00002         5000
00003     ]
```

5.4.1.15 type_analysis_file

```
list scale_space_plus_database_tracked.type_analysis_file
```

Initial value:

```
=  [
        "new"
    ]
```

5.5 scale_space_plus_fixed_palm Namespace Reference

Classes

- class Reconstruct_Fixed_PALM_DATASETS
- class Reconstruct_Masked_PALM_DATASETS
- class Reconstruct_Tracked_PALM_DATASETS_with_mask

Functions

- load_localizations (localizations_path, skiprows=4)
- load_localizations_TS (localizations_path, skiprows=0)
- pd.DataFrame get_unique_localizations (pd.DataFrame localizations_df, str unique_loc_type="first")
- pd.DataFrame get_unique_localizations_TS (pd.DataFrame localizations_df, str unique_loc_type="first")
- rescale_scale_space_blob_detection (blobs, callable rescaling_func, **kwargs)

Variables

- int CORRECTION_FACTOR = 1.
- str LOCALIZATION_UNIQUE_TYPE = "mean"
- list XY_NAMES = ['x','y']
- list global_path
- dict blob_parameters
- dict fitting_parameters
- sm_rec

5.5.1 Detailed Description

```
Helper script to do the reconstruction and scale space blob detection along with the DBSCAN clustering on fixe
This is different from scale_space_plus_database_tracked.py since it inforces a cell mask for each cell in a m


##############################################################################################################
File structure:
---------------
The file structure is as follows:

<main_path>
    /Movies
        /Movie_<01>
            /Cell_<cell_number>
                /localizations.csv
                /mask.tif

This is the base file structure for the PALM data. The script will look for the localizations and mask files i
```

```
The localizations file needs to be in the form of TRACKMATE output from the GUI. TODO make it more general.

The objective of this script is to add the following files to the above structure: (new files and directories

<main_path>
    /Movies
        /Movie_<01>
            /Cell_<cell_number>
                /localizations.csv
                /mask.tif
                /reconstruction.tif #
                /uniform_reconstruction.tif #
                /normal_scale_projection.tif #
                /reconstruction_parameters.json #
                    /Analysis #
                        /scale_space_plus_blob_fitted.csv #
                        /scale_space_plus_blob_scale.csv #
                        /DBSCAN_clusters.csv #
                        /analysis_parameters.json #
```

5.5.2 Function Documentation

5.5.2.1 get_unique_localizations()

```
pd.DataFrame scale_space_plus_fixed_palm.get_unique_localizations (
             pd.DataFrame localizations_df,
             str unique_loc_type = "first")
```

```
For each unique track_ID get the first localization or the mean value of all the localizations

Parameters:
-----------
localizations_df: pd.DataFrame
    The dataframe of the localizations
unique_loc_type: str
    The type of unique localization to get. Can be either "first" or "mean"
```

5.5.2.2 get_unique_localizations_TS()

```
pd.DataFrame scale_space_plus_fixed_palm.get_unique_localizations_TS (
             pd.DataFrame localizations_df,
             str unique_loc_type = "first")
```

```
For each unique track_ID get the first localization or the mean value of all the localizations

Parameters:
-----------
localizations_df: pd.DataFrame
    The dataframe of the localizations
unique_loc_type: str
    The type of unique localization to get. Can be either "first" or "mean"
```

5.5.2.3 load_localizations()

```
scale_space_plus_fixed_palm.load_localizations (
              localizations_path,
              skiprows = 4)
```

```
Load the localizations from the localizations.csv file
```

5.5.2.4 load_localizations_TS()

```
scale_space_plus_fixed_palm.load_localizations_TS (
              localizations_path,
              skiprows = 0)
```

```
Load the localizations from the localizations.csv file (ThunderSTORM format)
```

5.5.2.5 rescale_scale_space_blob_detection()

```
scale_space_plus_fixed_palm.rescale_scale_space_blob_detection (
              blobs,
             callable rescaling_func,
             ** kwargs)
```

5.5.3 Variable Documentation

5.5.3.1 blob_parameters

```
dict scale_space_plus_fixed_palm.blob_parameters
```

Initial value:

```
=  {
        "threshold": 2e-1, \
        "overlap": 0, \
        "median": False, \
        "min_sigma": 3/np.sqrt(2), \
        "max_sigma": 20/np.sqrt(2), \
        "num_sigma": 30, \
        "detection": 'bp', \
        "log_scale": False
        }
```

5.5.3.2 CORRECTION_FACTOR

```
int scale_space_plus_fixed_palm.CORRECTION_FACTOR = 1.
```

5.5.3.3 fitting_parameters

```
dict scale_space_plus_fixed_palm.fitting_parameters
```

Initial value:

```
=  {
        "mask_size":5,
        "plot_fit":False,
        "fitting_image":"LAP",
        "radius_func":np.mean,#identity,
        "residual_func":residuals_gaus2d,
        "sigma_range":4,
        "centroid_range":2,
        "height_range":1
        }
```

5.5.3.4 global_path

```
list scale_space_plus_fixed_palm.global_path
```

Initial value:

```
=  [
        "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_rif_fixed_2"
     ]
```

5.5.3.5 LOCALIZATION_UNIQUE_TYPE

```
str scale_space_plus_fixed_palm.LOCALIZATION_UNIQUE_TYPE = "mean"
```

5.5.3.6 sm_rec

```
scale_space_plus_fixed_palm.sm_rec
```

Initial value:

```
=  Reconstruct_Fixed_PALM_DATASETS(cd = global_path[i],
                                   blob_parameters = blob_parameters,
                                   fitting_parameters = fitting_parameters,
                                   rescale_pixel_size = 10,
                                   pixel_size = 130,
                                   loc_error = 20,
                                   include_all = False)
```

5.5.3.7 XY_NAMES

```
list scale_space_plus_fixed_palm.XY_NAMES = ['x','y']
```

5.6 SMT Namespace Reference

Namespaces

- namespace SMT_Analysis_BP

5.7 SMT.SMT_Analysis_BP Namespace Reference

Namespaces

- namespace databases
- namespace helpers
- namespace Parameter_Store

5.8 SMT.SMT_Analysis_BP.databases Namespace Reference

Namespaces

- namespace data_path_container
- namespace directoryManipulator
- namespace structure_storage
- namespace trajectory_analysis_script

5.9 SMT.SMT_Analysis_BP.databases.data_path_container Namespace Reference

Variables

- dict rpoc_ez_paths_keywords
- dict rpoc_m9_paths_keywords
- dict rpoc_hex5_paths_keywords
- dict laci_laco_ez_paths_keywords
- dict laci_laco_m9_paths_keywords
- dict laci_laco_hex5_paths_keywords
- dict rpoc_rif_paths
- dict rpoc_ez_cluster_tracking_paths
- dict nusa_ez_paths_keywords
- dict nusa_m9_paths_keywords
- dict nusa_hex5_paths_keywords
- dict nusa_rif_paths_keywords
- list rpoc

    movie paths in volumes
- list ll

5.9.1 Variable Documentation

5.9.1.1 laci_laco_ez_paths_keywords

```
dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_ez_paths_keywords
```

Initial value:
```
=  {"LL_EZ":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_120min/20190527/ll_ez'
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_120min/20200217/ll_ez'
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_120min/20200217/ll_ez_
      }
}
```

5.9.1.2 laci_laco_hex5_paths_keywords

`dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_hex5_paths_keywords`

Initial value:

```
=  {"LL_Hex5":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_5min_5pHex/20200216/l
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_5min_5pHex/20200216/l
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/EZ_5min_5pHex/20200216/l
    }
}
```

5.9.1.3 laci_laco_m9_paths_keywords

`dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_m9_paths_keywords`

Initial value:

```
=  {"LL_M9":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/M9/20200216/ll_m9":{"t_s
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/M9/20200216/ll_m9_2":{"t_
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/LacI_LacO_DATA/M9/20200216/ll_m9_3":{"t_
    }
}
```

5.9.1.4 ll

`list SMT.SMT_Analysis_BP.databases.data_path_container.ll`

Initial value:

```
=  [
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20190527/ll_ez/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20200217/ll_ez/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20200217/ll_ez_2/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_m9/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_m9_2/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_m9_3/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_hex5/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_hex5_2/Movie",
    "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/ll_hex5_3/Movie"
]
```

5.9.1.5 nusa_ez_paths_keywords

`dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_ez_paths_keywords`

Initial value:

```
=  {"NUSA_EZ":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_120min/20180907/Nusa_ez":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_120min/20190305/Nusa_ez":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_120min/20230619/Nusa_ez":{
    }
}
```

5.9.1.6 nusa_hex5_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_hex5_paths_keywords

Initial value:

```
=  {"NUSA_Hex5":{

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_5min_5pHex/15/nusa_ez_hex5"

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_5min_5pHex/15/nusa_ez_hex5_

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_5min_5pHex/15/nusa_ez_hex5_

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_5min_5pHex/16/nusa_ez_hex5"

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/EZ_5min_5pHex/16/nusa_ez_hex5_
     }
}
```

5.9.1.7 nusa_m9_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_m9_paths_keywords

Initial value:

```
=  {"NUSA_M9":{

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/M9/12/nusa_m9":{"t_string":"nu

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/M9/12/nusa_m9_2":{"t_string":"

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/M9/20191216/nusa_m9":{"t_strin

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/M9/20191218/nusa_m9":{"t_strin
     }
}
```

5.9.1.8 nusa_rif_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_rif_paths_keywords

Initial value:

```
=  {"NUSA_RIF":{

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/100ugml_5min_RIF/20230528/nusa

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/100ugml_5min_RIF/20230618/nusa

    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/NUSA_DATA/100ugml_5min_RIF/20230618/nusa
     }
}
```

5.9.1.9 rpoc

list SMT.SMT_Analysis_BP.databases.data_path_container.rpoc

Initial value:

```
=  [
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20190527/rpoc_ez/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20181003/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20180813/RPOC/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20190515/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/12/rpoc_m9/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/12/rpoc_m9_2/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/15/rp_ez_hex5/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/15/rp_ez_hex5_2/Movie",
     "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/16/rp_ez_hex5/Movie"
]
```

movie paths in volumes

5.9.1.10 rpoc_ez_cluster_tracking_paths

dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_ez_cluster_tracking_paths

Initial value:
```
=  {"RPOC_EZ_CLUSTER_TRACKING":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_CLUSTER_TRACKING/20231009":{"t_str
      }
}
```

5.9.1.11 rpoc_ez_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_ez_paths_keywords

Initial value:
```
=  {"RPOC_EZ":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_120min/20180813/Other_RPOC
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_120min/20181003/RPOC_new":
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_120min/20190527/rpoc_ez":{
      }
}
```

5.9.1.12 rpoc_hex5_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_hex5_paths_keywords

Initial value:
```
=  {"RPOC_Hex5":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_5min_5pHex/20200215/rp_ez_
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_5min_5pHex/20200215/rp_ez_
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/EZ_5min_5pHex/20200216/rp_ez_
      }
}
```

5.9.1.13 rpoc_m9_paths_keywords

dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_m9_paths_keywords

Initial value:
```
=  {"RPOC_M9":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/M9/20200212/rpoc_m9":{"t_stri
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/M9/20200212/rpoc_m9_2":{"t_st
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/M9/20190515/rpoc_m9":{"t_stri
      }
}
```

5.9.1.14 rpoc_rif_paths

dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_rif_paths

Initial value:
```
=  {"RPOC_RIF":{
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/100ugml_5min_RIF/20230528/rpoc
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/100ugml_5min_RIF/20230617/rpoc
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/SMT_FAST_CAPTURE/RPOC_DATA/100ugml_5min_RIF/20230617/rpoc
      }
}
```

5.10 SMT.SMT_Analysis_BP.databases.directoryManipulator Namespace Reference

Namespaces

- namespace format_mask_structure
- namespace tifanal

5.11 SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure Namespace Reference

Classes

- class movie_mask_directory_structure_manager

Functions

- read_npy_file (path, correct_dtype=True)
- dict obtain_masks_npy (npy_output_file)
- None _reorder_file_names (file_paths, end_string=None)

Variables

- list path

    testing
- mask_dir = movie_mask_directory_structure_manager(path)

5.11.1 Detailed Description

```
Helper script to find all the masks in a directory and format them into a directory structure

The directory structure is as follows:

-parent_dir
    -full_path_to_mask_dir

    -Movies
        -Movie_1
            -IMAGEJ_ROI.zip
            -Cell_1
                -mask.tif

This is repeated for each movie defined by the number of mask files found.
The cells are determined by the number of unique masks found in each mask file.

The IMAGEJ_ROI.zip file is the ROI file that works for input into ImageJ for further analysis
```

5.11.2 Function Documentation

5.11.2.1 _reorder_file_names()

```
None SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure._reorder_file_←
names (
              file_paths,
              end_string = None)  [protected]
```

```
Reorders the names of the files to start from 1->end.
Given a set of files in the directory, it will reorder them to start from 1->end
so <name>_20.tif will be <name>_1.tif, <name>_21.tif will be <name>_2.tif and so on
This is to rename the file
```

5.11.2.2 obtain_masks_npy()

```
dict SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.obtain_masks_npy
(
              npy_output_file)
```

```
Obtains the masks from the npy file
```

5.11.2.3 read_npy_file()

```
SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.read_npy_file (
              path,
              correct_dtype = True)
```

```
Reads the npy file from the path
```

5.11.3 Variable Documentation

5.11.3.1 mask_dir

```
SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.mask_dir = movie_mask_directory_struc
```

5.11.3.2 path

```
list SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.path
```

Initial value:

```
=  [
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231015/ll_ez/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/ll_hex5_fixed/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_ez_fixed/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_ez_fixed_2/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_hex5_fixed/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_hex5_fixed_2/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_m9_fixed/TS/gfp",
    "/Users/baljyot/Documents/CODE/GitHub_t2/Baljyot_EXP_RPOC/DATA/Fixed_100ms/20231017/rp_rif_fixed/TS/gfp"
        ]
```

testing

5.12 SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal Namespace Reference

Variables

- dict SEGMENT_TYPE
- int STACK_STEP = 5
- int CONVERT_NAME = 1
- str DIR_PATH = "/Volumes/Baljyot_HD/SMT_Olympus/RIF_TREATMET_LIVE/20230528/Movie"
- root = tk.Tk()
- filez = fd.askopenfilenames(parent=root, title='Choose a file', initialdir=DIR_PATH)
- root_dir = os.path.dirname(filez[0])
- sorted_a_files = sorted(filez,key=lambda x: int(x.split("/")[-1].split(".")[0].split("_")[-1]))
- temp_im = io.imread(sorted_a_files[i])
- temp_del = temp_im[:]
- length = int(len(temp_del)/STACK_STEP)
- list hold_img = [ ]
- list hold_name = [ ]
- movie_name = sorted_a_files[i].split("/")[-1].split(".")[0]
- updated_movie_name = movie_name.split("_")[:-1]

5.12.1 Variable Documentation

5.12.1.1 CONVERT_NAME

```
int SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.CONVERT_NAME = 1
```

5.12.1.2 DIR_PATH

```
str SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.DIR_PATH = "/Volumes/Baljyot_←
HD/SMT_Olympus/RIF_TREATMET_LIVE/20230528/Movie"
```

5.12.1.3 filez

```
SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.filez = fd.askopenfilenames(parent=root,
title='Choose a file', initialdir=DIR_PATH)
```

5.12.1.4 hold_img

```
list SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.hold_img = [ ]
```

5.12.1.5 hold_name

```
list SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.hold_name = [ ]
```

5.12.1.6 length

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.length = int(len(temp_del)/STACK_STEP)

5.12.1.7 movie_name

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.movie_name = sorted_a_files[i].split("/")[-1].split

5.12.1.8 root

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.root = tk.Tk()

5.12.1.9 root_dir

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.root_dir = os.path.dirname(filez[0])

5.12.1.10 SEGMENT_TYPE

dict SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.SEGMENT_TYPE

Initial value:

```
00001 =  {
00002     "mean":np.mean,
00003     "median":np.median,
00004     "max":np.max,
00005     "min":np.min,
00006     "sum":np.sum,
00007     "std":np.std
00008 }
```

5.12.1.11 sorted_a_files

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.sorted_a_files = sorted(filez,key=lambda x: int(x.split("/")[-1].split(".")[0].split("_")[-1]))

5.12.1.12 STACK_STEP

int SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.STACK_STEP = 5

5.12.1.13 temp_del

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.temp_del = temp_im[:]

5.12.1.14 temp_im

SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.temp_im = io.imread(sorted_a_files[i])

5.12.1.15 updated_movie_name

```
str SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.updated_movie_name = movie_↩
name.split("_")[:-1]
```

5.13 SMT.SMT_Analysis_BP.databases.structure_storage Namespace Reference

Variables

- dict SEGMENTATION_FOLDER_TYPES

    FOLDER STRUCTURES ########.
- dict ANALYSIS_FOLDER_TYPES
- dict LOADING_DROP_BLOB_TYPES

5.13.1 Detailed Description

```
Collection of structured data for utility. Mainly used within trajectory_analysis_script.py and scale_scale_pl
```

5.13.2 Variable Documentation

5.13.2.1 ANALYSIS_FOLDER_TYPES

```
dict SMT.SMT_Analysis_BP.databases.structure_storage.ANALYSIS_FOLDER_TYPES
```

Initial value:

```
00001 =  {
00002     "TRACKMATE": "Analysis",
00003     "Scale": "Analysis",
00004     "Fitted": "Analysis",
00005     "SCALE_SPACE_PLUS": "Analysis",
00006     "DBSCAN": "Analysis_DBSCAN"
00007 }
```

5.13.2.2 LOADING_DROP_BLOB_TYPES

```
dict SMT.SMT_Analysis_BP.databases.structure_storage.LOADING_DROP_BLOB_TYPES
```

Initial value:

```
00001 =  {
00002     "TRACKMATE": True,
00003     "Scale": False,
00004     "Fitted": False,
00005     "SCALE_SPACE_PLUS": True,
00006     "DBSCAN": True
00007 }
```

5.13.2.3 SEGMENTATION_FOLDER_TYPES

```
dict SMT.SMT_Analysis_BP.databases.structure_storage.SEGMENTATION_FOLDER_TYPES
```

Initial value:

```
00001 =  {
00002     "TRACKMATE": "Segmented",
00003     "Scale": "Segmented_mean",
00004     "Fitted": "Segmented_mean",
00005     "SCALE_SPACE_PLUS": "segmented_scale_space_plus",
00006     "DBSCAN": "segmented_scale_space_plus"
00007 }
```

FOLDER STRUCTURES ########.

5.14 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script Namespace Reference

Classes

- class boundary_analysis
- class Cell
- class Movie_frame
- class run_analysis
- class Trajectory
- class Trajectory_Drop_Mapping

Variables

- list TRACK_TYPES

5.14.1 Detailed Description

```
Documentation for trajectory_analysis_script.py

This script is used to analyse the data from the trajectory analysis script
It does this by reading the data from the trajectory analysis script and then making mappings of the SMT data

The core of the script is the run_analysis class, which is used to analyse a single dataset
Each database in a given experiment is analysed by a separate instance of this class
Each instance of this class is initialised with the working directory and the unique string identifier for the
The mapping of the SMT data to drops and cells is done by the analyse_cell_tracks method among others
The core mapping is as follows:
Movies -> Cells -> Drops -> Trajectories
The class also contains methods to plot the data and to save the data to a .mat file

The script also contains a number of helper functions that are used by the class
These are mostly used to read the data from the trajectory analysis script and to plot the data and make class

The script also contains a number of functions that are used to analyse the data
These are mostly used to analyse the data and to plot the data and make classifications

Classes:
--------
1. run_analysis: class for each dataset to analyse
2. Movie_frame: class for each frame of view in a movie
3. Cell: class for each cell in a frame of view
4. Drop: class for each drop in a cell
5. Trajectory: class for each trajectory in a drop
6. Tracjectory_Drop_Mapping: class for each mapping of a trajectory to a drop

7. boundary_analysis: class for each boundary analysis of a dataset

Author: Baljyot Singh Parmar
```

5.14.2 Variable Documentation

5.14.2.1 TRACK_TYPES

```
list SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.TRACK_TYPES
```

Initial value:

```
00001 =  [
00002      "IN",
00003      "IO",
00004      "OUT",
00005      "ALL"
00006 ]
```

5.15 SMT.SMT_Analysis_BP.helpers Namespace Reference

Namespaces

- namespace analysisFunctions
- namespace clusterMethods
- namespace ioModule
- namespace misc

5.16 SMT.SMT_Analysis_BP.helpers.analysisFunctions Namespace Reference

Namespaces

- namespace Analysis_functions
- namespace angle_between_vectors
- namespace bootstrap_util
- namespace dir_invert_images
- namespace features_from_mask
- namespace MSD_Utils
- namespace NND
- namespace nucleoid_detection
- namespace scale_space_plus
- namespace smallestenclosingcircle

5.17 SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_↩ functions Namespace Reference

Functions

- non_linear_curvefit (func, xdata, ydata, p0=None, method='lm', bounds=None)

  RANDOM FITTING FUNCTIONS ##.
- linear_fitting (xdata, ydata, deg=1)
- gaus1D (x, a, b, c)
- gaus2D (x, a, b, c, a1, b1, c1)

- gaussian_fit (x, p0, p1, p2)
- Thompson_localization_precision (float psf_sigma, float pixel_size, float|np.ndarray num_photons, float background_photons)
- rayleigh_corr (x, corr, sigma, A)
- nnd_correction_rayleigh (x, sigma, xc, w, a1, a2, a3)
- cum_sum (data, binz=10)

    RANDOM UTILITY FUNCTIONS ##.
- rescale (x, a, b)
- dif_dis (x, y)
- dist (x, y, c1, c2)
- d_to_rad (deg_)
- rad_to_d (rad_)
- cm_normal (x, y)
- con_pix_si (data, con_nm=0.130, con_ms=20., which=0)
- float radius_of_gyration (∗args)
- photon_conversion_from_AUD (float|np.ndarray AUD, float|int photon_conversion_factor, float|int quantum↩_efficiency, float|int dark_offset)
- bin_ndarray (ndarray, new_shape, operation='sum')
- bin_img (img, bin=2, operation='sum')
- convert_3d_to_2d (a)
- point_inside_circle2D (circle, point)
- reshape_col2d (arr, permutations)
- range_distance (a, b)
- rt_to_xy (r, theta)
- pad_array (subarray, shape, top_left_coord, pad=0)
- sorted_alphanumeric (data)
- subarray2D (arr, mask, full=True, transpose=True)
- flatten (t)
- rescale_range (x, min_x, max_x, a, b)
- dic_union_two (dic_1, dic_2)

    MSD calculations for sim data format of dict ##############################.
- MSD_tavg1 (x, y, f, f_inc=False)
- MSD_tavg (x, y, f, f_inc=False)
- MSD_tavg_single (x, f, f_inc=False)
- track_decomp (x, y, f, max_track_decomp)
- fit_MSD_loc_err (t, p_0, p_1, p_2)
- fit_MSD (t, p_0, p_1, p_2)
- fit_MSD_Linear (t, p_0, p_1)
- find_diffusion_coefficient (time, distance, dim)
- find_static_localization_error_MSD (sigma, dim)
- _random_starting_point (start, end)
- squared_mean_difference (a)
- point_per_frame_difference (true_points_per_frame, extracted_points_per_frame)

    Track percent identity functions ###.
- percent_error (true, estimate, abs=True)
- _point_identity (point_true, track_estimate, distance_threshold)
- identity_tracks (track_true, track_estimate, ∗∗kwargs)
- identity_track_matrix (tracks_true, tracks_estimate, verbose=True, ∗∗kwargs)
- point_error_detection (true_points, extracted_points, threshold=0.5)
- points_per_frame_convert (tracks)
- dict points_per_frame_bulk_sort (np.ndarray x, np.ndarray y, np.ndarray t)
- convert_point_pairs (tracks)
- point_pair_error_detection (true_point_pairs, extracted_point_pairs, threshold=0.5)
- dict area_points_per_frame (dict points_per_frame, callable area_func=radius_of_gyration)
- convex_hull_area (points)

5.17.1 Detailed Description

```
This module contains a collection of functions for analysis

Some of the functions are old and not used anymore, but I am keeping them here for now
Author: Baljyot Singh Parmar
```

5.17.2 Function Documentation

5.17.2.1 _point_identity()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions._point_identity (
point_true,
track_estimate,
distance_threshold) [protected]

```
 Documentation for _point_identity

Parameters:
-----------
point_true : array
    true point, shape (,2)
track_estimate : array
    estimated track, shape (n,2)
distance_threshold : float
    distance threshold for the point to be considered a match

Returns:
--------
1 : int
    if the point is within the distance threshold
0 : int
    if the point is not within the distance threshold

Notes:
------
1. Assumes that the tracks and points are formatted as [[x,y,T],[x,y,T],...,[x,y,T]] numpy arrays and [x,y,T]
```

5.17.2.2 _random_starting_point()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions._random_starting_point (
start,
end) [protected]

5.17.2.3 area_points_per_frame()

dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.area_points_per_frame (
dict *points_per_frame*,
callable *area_func* = radius_of_gyration)

```
Parameters:
-----------
points_per_frame : dict
    dictionary of points per frame, keys are the frame number and the values are the points in that frame of s
area_func : callable
    function to calculate the area of the points per frame, default is radius of gyration
Returns:
--------
area_per_frame : dict
    dictionary of area per frame, keys are the frame number and the values are the area of the points in that
```

5.17.2.4 bin_img()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.bin_img (
              img,
              bin = 2,
              operation = 'sum')
```

```
Docstring for bin_img

Parameters:
-----------
img : numpy array
    The image to be binned
bin : int, optional (default=2)
    The binning factor, this is the number of pixels to be binned together for each axis
operation : str, optional (default='sum')
    The operation to be performed on the pixels, can be 'sum' or 'mean'

Returns:
--------
numpy array
    The binned image of shape (img.shape[0]//bin,img.shape[1]//bin)
```

5.17.2.5 bin_ndarray()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.bin_ndarray (
              ndarray,
              new_shape,
              operation = 'sum')
```

```
Docstring for bin_ndarray
Bins an ndarray in all axes based on the target shape, by summing or
    averaging.

Parameters:
-----------
ndarray : numpy array
    The array to be binned
new_shape : tuple
    The shape of the output array
operation : str, optional (default='sum')
    The operation to be performed on the pixels, can be 'sum' or 'mean'

Returns:
--------
numpy array
    The binned array of shape new_shape

Raises:
-------
ValueError
    If the operation is not 'sum' or 'mean'
ValueError
    If the number of dimensions of the input array does not match the length of the new_shape tuple

Examples:
---------
>>> m = np.arange(0,100,1).reshape((10,10))
>>> n = bin_ndarray(m, new_shape=(5,5), operation='sum')
>>> print(n)
    [[ 22  30  38  46  54]
    [102 110 118 126 134]
    [182 190 198 206 214]
    [262 270 278 286 294]
    [342 350 358 366 374]]
```

5.17.2.6 cm_normal()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.cm_normal (
              x,
              y)
```

5.17.2.7 con_pix_si()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.con_pix_si (
              data,
              con_nm = 0.130,
              con_ms = 20.,
              which = 0)
```

5.17.2.8 convert_3d_to_2d()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convert_3d_to_2d (
              a)
```

5.17.2.9 convert_point_pairs()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convert_point_pairs (
              tracks)
```

```
Docstring for convert_point_pairs
Convert a track dictionary to a point pair dictionary where the keys is a combination of the two frames of the
point pairs are defined as consecutive points in a track.
eg: track = [[x1,y1,frame1],[x2,y2,frame2],[x3,y3,frame3]]
    point_pairs = {"frame1,frame2":[[x1,y1,frame1],[x2,y2,frame2]],"frame1,frame2":[[x2,y2,frame2],[x3,y3,fram

Parameters:
-----------
tracks : dict, keys are track numbers and values are tracks as defined above
    dictionary of tracks where the keys are the track numbers and the values are the tracks

Returns:
--------
point_pairs : dict, keys is a combination of the two frames of the points are point pairs as defined above
    dictionary of point pairs where the keys is a combination of the two frames of the points and the values a
```

5.17.2.10 convex_hull_area()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convex_hull_area (
              points)
```

```
Docstring for convex_hull_area
Calculate the convex hull area of a set of points

Parameters:
-----------
points : numpy array of shape (n,2)
    points to calculate the convex hull area

Returns:
--------
hull_points : numpy array of shape (n,2)
    convex hull area of the input points
```

5.17.2.11 cum_sum()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.cum_sum (
              data,
              binz = 10)
```

RANDOM UTILITY FUNCTIONS ###.

5.17.2.12 d_to_rad()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.d_to_rad (
              deg_)
```

5.17.2.13 dic_union_two()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dic_union_two (
              dic_1,
              dic_2)
```

MSD calculations for sim data format of dict ###############################.

```
Documentation for dic_union_two
Find the unique union of two dictionaries, assumes the values are lists

Parameters:
-----------
dic_1 : dict
    dictionary 1
dic_2 : dict
    dictionary 2

Returns:
--------
dic_union : dict
    dictionary of the unique union of the two dictionaries

Notes:
------
The values of the dictionaries must be lists for the list concatenation to work properly
This function turns the values of the dictionaries into lists, if arrays are needed then the values must be co
```

5.17.2.14 dif_dis()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dif_dis (
              x,
              y)
```

5.17.2.15 dist()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dist (
              x,
              y,
              c1,
              c2)
```

```
Distance(s) x,y away from a point c1,c2 in 2D
```

5.17.2.16 find_diffusion_coefficient()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.find_diffusion_coefficient (
              time,
              distance,
              dim)
```

```
Docstring for find_diffusion_coefficient
This function finds the diffusion coefficient given a time and distance, this is just a simple calculation:
D = (1/(2*dim))*(distance)^2/time

Parameters:
-----------
time : array-like or int or float
    The time
distance : array-like or int or float
    The distance
dim : int
    The dimensionality of the system

Returns:
--------
float or numpy array
    The diffusion coefficient, units are based on the units of the input parameters (time and distance, ie: um
```

5.17.2.17 find_static_localization_error_MSD()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.find_static_localization_↩
error_MSD (
              sigma,
              dim)
```

```
Docstring for find_static_localization_error_MSD
Given the isotropic gaussian scale (sigma), this function finds the static localization error (sigma_loc) usin
sigma_loc = 2n*(sigma)^2

Parameters:
-----------
sigma : array-like or int or float
    The isotropic gaussian scale
dim : int
    The dimensionality of the system

Returns:
--------
float or numpy array
    The static localization error
```

5.17.2.18 fit_MSD()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD (
              t,
              p_0,
              p_1,
              p_2)
```

5.17.2.19 fit_MSD_Linear()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD_Linear (
              t,
              p_0,
              p_1)
```

5.17.2.20 fit_MSD_loc_err()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD_loc_err (
              t,
              p_0,
              p_1,
              p_2)
```

5.17.2.21 flatten()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.flatten (
              t)
```

```
function to flatten a list of any dimension (arbitrary sublist dimension)

Parameters
----------
t : list
    list of any size

Returns
-------
list
    flattened list along all dimensions of t.
```

5.17.2.22 gaus1D()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaus1D (
              x,
              a,
              b,
              c)
```

5.17.2.23 gaus2D()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaus2D (
              x,
              a,
              b,
              c,
              a1,
              b1,
              c1)
```

5.17.2.24 gaussian_fit()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaussian_fit (
              x,
              p0,
              p1,
              p2)
```

5.17.2.25 identity_track_matrix()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.identity_track_matrix (
              tracks_true,
              tracks_estimate,
              verbose = True,
             ** kwargs)
```

```
 Documentation for identity_track_matrix
This creates all unique combinations of tracks and then finds the identity between each pair

Parameters:
-----------
tracks_true : dict
    dict of true tracks, shape (n,2). Key is the track number, value is the track
tracks_estimate : dict
    dict of estimated tracks, shape (m,2). Key is the track number, value is the track
verbose : bool
    if True then return all the identity matrices, if False then only return the per track results

Returns:
--------
max_identity : array
    array of the maximum identity between each true track and the estimated tracks
lengh_error : array
    array of the percent error between the lengths of each true track and the estimated tracks
identity_matrix : array
    matrix of the identity between each pair of tracks
length_error_matrix : array
    matrix of the percent error between the lengths of each pair of tracks

Notes:
------
```

5.17.2.26 identity_tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.identity_tracks (
              track_true,
              track_estimate,
             ** kwargs)
```

```
 Documentation for identity_tracks

Parameters:
-----------
track_true : array
    true track, shape (n,2)
track_estimate : array
    estimated track, shape (m,2), m can be different than n
threshold : float
    distance threshold for the point to be considered a match
```

```
Returns:
--------
mean_point_identity : float
    mean percent identity between the points in the true track and the estimated track
length_error : float
    percent error between the lengths of the tracks

Notes:
------
1. Assumes that the tracks and points are formatted as [[x,y,T],[x,y,T],...,[x,y,T]] numpy arrays and [x,y,T]
2. Assumes that the true track is not empty
3. Assumes that the estimated track is not empty
```

5.17.2.27 linear_fitting()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.linear_fitting (
xdata,
ydata,
deg = 1)

```
Docstring for linear_fitting
This function perfroms a linear fit to the data using polyfit

Parameters:
-----------
xdata : numpy array
    The x data
ydata : numpy array
    The y data
deg : int, optional (default=1)
    The degree of the polynomial to be fitted

Returns:
--------
numpy array with 2 elements
    1. The polynomial coefficients
    2. The covariance matrix
```

5.17.2.28 MSD_tavg()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg (
x,
y,
f,
f_inc = False)

5.17.2.29 MSD_tavg1()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg1 (
x,
y,
f,
f_inc = False)

5.17.2.30 MSD_tavg_single()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg_single (
              x,
              f,
              f_inc = False)
```

5.17.2.31 nnd_correction_rayleigh()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.nnd_correction_rayleigh (
              x,
              sigma,
              xc,
              w,
              a1,
              a2,
              a3)
```

5.17.2.32 non_linear_curvefit()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.non_linear_curvefit (
              func,
              xdata,
              ydata,
              p0 = None,
              method = 'lm',
              bounds = None)
```

RANDOM FITTING FUNCTIONS ##.

```
Docstring for non_linear_curvefit
This function fits a curve to the data using scipy.optimize.curve_fit

Parameters:
-----------
func : function
    The function to be fitted to the data
xdata : numpy array
    The x data
ydata : numpy array
    The y data
p0 : numpy array, optional (default=None)
    The initial guess for the parameters
method : str, optional (default='lm')
    The method to be used for the curve fitting, can be 'lm' or 'trf' or 'dogbox'
bounds : tuple, optional (default=None)
    The lower and upper bounds for the parameters

Returns:
--------
tuple
    The fitted parameters and the covariance matrix
```

5.17.2.33 pad_array()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.pad_array (
              subarray,
              shape,
              top_left_coord,
              pad = 0)
```

```
Parameters
----------
subarray : 2D array-like
    array to pad
shape : tuple, list, array-like of length 2
    2D shape of the full array
top_left_coord : list, array-like of length 2
    coordinate of the top left corner of the subarray in the full array of shape

Returns
-------
array-like 2D
    returns the full array of with size shape entries of the subarray are inputted relative to top_left_coord
    padded with 0s
```

5.17.2.34 percent_error()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.percent_error (
              true,
              estimate,
              abs = True)
```

```
 Documentation for percent_error

Parameters:
-----------
true : float
    true value
estimate : float
    estimated value
abs : bool (default = True)
    if abs == True then the absolute value of the percent error is returned

Returns:
--------
percent_error : float
    percent error between the true and estimated values

Notes:
------
1. Assumes that the true and estimated values are floats
2. Assumes that the true value is not zero
3. Assumes that the true value is not negative
4. Assumes that the true value is not NaN
5. Assumes that the estimated value is not NaN
```

5.17.2.35 photon_conversion_from_AUD()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.photon_conversion_from_AUD (
             float|np.ndarray AUD,
             float|int photon_conversion_factor,
             float|int quantum_efficiency,
             float|int dark_offset)
```

```
Converting from AUD to photons for a CMOS camera using the formula:
photons = (AUD - dark_offset)*photon_conversion_factor/quantum_efficiency

Parameters:
-----------
AUD : float or numpy array
    The AUD values
photon_conversion_factor : float or int
    The photon conversion factor
quantum_efficiency : float or int
    The quantum efficiency at a wavelength for the detector (from 0-1, ie 0% - 100%)
```

5.17.2.36 point_error_detection()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_error_detection (
true_points,
extracted_points,
threshold = 0.5)

```
Docstring for point_error_detection
Calculate the error between the true points and the extracted points per frame

Parameters:
-----------
true_points : dict
    dictionary of true points where the keys are the frame numbers and the values are the true points in that
extracted_points : dict
    dictionary of extracted points where the keys are the frame numbers and the values are the extracted point
threshold : float
    threshold for the distance between the true points and the extracted points

Returns:
--------
percent_detected : float
    percent of the true points that are detected
```

5.17.2.37 point_inside_circle2D()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_inside_circle2D (
circle,
point)

```
Check if a point is inside a circle

Parameters:
-----------
circle : tuple
    (x,y,radius) of the circle
point : tuple
    (x,y) of the point

Returns:
--------
bool
    True if the point is inside the circle, False otherwise

Raises:
-------
TypeError
    If circle or point are not tuples
TypeError
```

```
    If circle or point are not tuples of length 3 and 2 respectively
TypeError
    If circle or point are not tuples of numbers
ValueError
    If the radius of the circle is not positive

Examples:
---------
>>> point_inside_circle2D((0,0,1),(0,0))
True
>>> point_inside_circle2D((0,0,1),(0,1))
False

Notes:
------
1. This function is not vectorized, so it will not work with numpy arrays
2. This function is not robust to floating point errors
```

5.17.2.38 point_pair_error_detection()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_pair_error_detection (
true_point_pairs,
extracted_point_pairs,
threshold = 0.5)

```
Docstring for point_pair_error_detection
Calculate the error between the true point pairs and the extracted point pairs per frame
point_pairs = {"frame1,frame2":[[x1,y1,frame1],[x2,y2,frame2]],"frame1,frame2":[[x2,y2,frame2],[x3,y3,frame3]]

Parameters:
-----------
true_point_pairs : dict, keys is a combination of the two frames of the points are point pairs as defined abov
    dictionary of true point pairs where the keys is a combination of the two frames of the points and the val
extracted_point_pairs : dict, keys is a combination of the two frames of the points are point pairs as definec
    dictionary of extracted point pairs where the keys is a combination of the two frames of the points and th
threshold : float
    threshold for the distance between the true point pairs and the extracted point pairs

Returns:
--------
percent_detected : float
    percent of the true point pairs that are detected
mismatch_error : float
    percent of true detected point pairs over the total amount of extracted pairs
```

5.17.2.39 point_per_frame_difference()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_per_frame_difference (
true_points_per_frame,
extracted_points_per_frame)

Track percent identity functions ###.

```
 Documentation for point_per_frame_difference
Finds the closest point in the extracted points per frame to the true points per frame and returns the differe
for each such point in each frame

Parameters:
-----------
true_points_per_frame : dict
    dictionary of the true points per frame, key = frame number, value = array of points, shape (n,2)
extracted_points_per_frame : dict
    dictionary of the extracted points per frame, key = frame number, value = array of points, shape (n,2)

Returns:
--------
```

5.17.2.40 points_per_frame_bulk_sort()

```
dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.points_per_frame_bulk_↩
sort (
            np.ndarray x,
            np.ndarray y,
            np.ndarray t)
```

```
Utility function, shouldn't be needed.

Sorts points by frame number. The output should be a dict with keys of frame numbers and values of points in t

Parameters:
-----------
x : np.ndarray
    x coordinates of points
y : np.ndarray
    y coordinates of points
t : np.ndarray
    frame numbers of points

Returns:
--------
points_per_frame : dict
    dictionary of points per frame where the keys are the frame numbers and the values are the points in that
```

5.17.2.41 points_per_frame_convert()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.points_per_frame_convert (
             tracks)
```

```
 Docstring for points_per_frame_convert
Take a track dictionary and convert it to a points per frame dictionary where the keys are the frame numbers a

Parameters:
-----------
tracks : dict
    dictionary of tracks where the keys are the track numbers and the values are the tracks

Returns:
--------
points_per_frame : dict
    dictionary of points per frame where the keys are the frame numbers and the values are the points in that
```

5.17.2.42 rad_to_d()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rad_to_d (
             rad_)
```

5.17.2.43 radius_of_gyration()

```
float SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.radius_of_gyration (
             * args)
```

```
Determine the radius of gyration of a particle given its x,y coordinates.
If only one argument is given, it is assumed to be a 2D array of x,y coordinates.
If two arguments are given, they are assumed to be x,y coordinates.

Parameters:
-----------
*args : array-like
    if one argument is given, it is assumed to be a 2D array of x,y coordinates. (N,2)
    if two arguments are given, they are assumed to be x,y coordinates. (N,),(N,)

Returns:
--------
r_g: float
    radius of gyration of particles

Raises:
-------
ValueError
    if the number of arguments is not 1 or 2
```

5.17.2.44 range_distance()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.range_distance (
              a,
              b)
```

```
Docstring for range_distance

Parameters:
-----------
a : float
    The first number
b : float
    The second number

Returns:
--------
float
    The distance between the two numbers
```

5.17.2.45 rayleigh_corr()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rayleigh_corr (
              x,
              corr,
              sigma,
              A)
```

5.17.2.46 rescale()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rescale (
              x,
              a,
              b)
```

5.17.2.47 rescale_range()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rescale_range (
              x,
              min_x,
              max_x,
              a,
              b)
```

```
https://stats.stackexchange.com/questions/281162/scale-a-number-between-a-range
```

5.17.2.48 reshape_col2d()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.reshape_col2d (
              arr,
              permutations)
```

```
Docstring for reshape_col2d
This function reshapes a 2D array by permuting the columns in the order specified by permutations

Parameters:
-----------
arr : numpy array
    The array to be reshaped
permutations : list of integers
    The permutations to be applied to the columns of arr

Returns:
--------
numpy array
    The reshaped array

NOTES:
------
Sometimes this breaks i have no idea why. Use with caution
```

5.17.2.49 rt_to_xy()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rt_to_xy (
              r,
              theta)
```

```
Docstring for rt_to_xy

Parameters:
-----------
r : float
    The radial coordinate
theta : float
    The angular coordinate

Returns:
--------
tuple
    The x and y coordinates
```

5.17.2.50 sorted_alphanumeric()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.sorted_alphanumeric (
              data)
```

5.17.2.51 squared_mean_difference()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.squared_mean_difference (
              a)
```

5.17.2.52 subarray2D()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.subarray2D (
              arr,
              mask,
              full = True,
              transpose = True)
```

```
Gives a new array from a 2D defined by mask. Assumes mask is [n,m]

Parameters
----------
arr : 2D numpy array-like
    original array to be zoomed
mask : 2D numpy array-like
    2D mask defining the corners of the box to make the subarray
full : bool
    if True return the full size array with 0 entry anywhere not in the subarray
    else return a new array defined by the mask
transpose : bool
    if true transpose the mask before subindexing
    else use mask as is

Returns
-------
numpy array-like
    subarray defined using the mask.
    array is same shape as original with 0 values outside subarray if full = True

Notes
-----
Assumes mask is the same shape or smaller than the input array
```

5.17.2.53 Thompson_localization_precision()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.Thompson_localization_↩
precision (
             float psf_sigma,
             float pixel_size,
             float|np.ndarray num_photons,
             float background_photons)
```

```
Theory from Thompson et al. 2002 (Precise Nanometer Localization Analysis for Individual Fluorescent Probes)
For a gaussian PSF, the localization precision is given by:
sigma_loc^2 = (psf_sigma^2 + pixel_size^2 /12)/num_photons + (8*pi*psf_sigma^4*background_photons^2)/(num_phot

This is assuming that the fit of the single molecule localization is done using a least squares fit

Parameters: ( all units for the parameters need to be the same)
-----------
psf_sigma : float
    The sigma of the PSF
pixel_size : float
    The size of a pixel
num_photons : float or numpy array
    The number of photons
background_photons : float
    The number of background photons

Returns:
--------
float or numpy array
    The localization precision
```

5.17.2.54 track_decomp()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.track_decomp (
              x,
              y,
              f,
              max_track_decomp)
```

5.18 SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors Namespace Reference

Classes

- class Angle_Storage
- class Track_Calculations
- class Track_Calculations_Individual_Dict

Functions

- dict Angle_track (dict tracks, conversion_factor=None, tau_conversion_factor=None, min_track_length=3, max_track_length=100, **kwargs)
- np.ndarray trajectory_angles (np.ndarray trajectory)
- float asymmetry_metric (np.ndarray angle_distribution, np.ndarray forward_angle_range, np.ndarray backward_angle_range)

5.18.1 Function Documentation

5.18.1.1 Angle_track()

```
dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_track (
             dict tracks,
              conversion_factor = None,
              tau_conversion_factor = None,
              min_track_length = 3,
              max_track_length = 100,
             ** kwargs)
```

```
Documentation for Angle_track

Parameters:
-----------
tracks : dict
    dictionary of tracks, key = track ID, value = [[x,y],...] of coordinates
conversion_factor : float (default = None)
    if conversion_factor != None then the coordinates are converted to the desired units before the MSD is cal
tau_conversion_factor : float (default = None)
    if tau_conversion_factor != None then the time lags are converted to the desired units before the MSD is c
    units are for [0->n] (int) -> seconds (1 = 0.02 seconds)
min_track_length : int (default = 2)
    the minimum length of a track to be included in the MSD calculation
max_track_length : int (default = 100)
    the maximum length of a track to be included in the MSD calculation

Returns:
--------
return_dict : dict
    dictionary of angles for each track, key = track ID, value = dictionary of angles of the trajectory at eac
    This has two keys, "ensemble_angles" and "track_angles" which are the ensemble angles and the angles for e
    Final structure is:
    return_dict = {
        "ensemble_angles":{time_lag:angles,...},
        "track_angles":{track_ID:{time_lag:angles,...},...}
        "track_storage":{track_ID:[[x,y],...],...}
    }
```

5.18.1.2 asymmetry_metric()

```
float SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.asymmetry_metric (
             np.ndarray angle_distribution,
             np.ndarray forward_angle_range,
             np.ndarray backward_angle_range)
```

```
Calculates the asymmetry metric for the forward and backward angle distributions.
Defined as the difference between the percentage of angles in the forward and backward angle ranges. This metr
-1 and 1, where -1 indicates that all angles are in the backward angle range and 1 indicates that all angles a

Parameters:
-----------
angle_distribution: 1D array
    Array of angles between the vectors of the trajectory
forward_angle_range: 1D array of length 2
    Range of angles to consider for the forward angle distribution (in radians)
backward_angle_range: 1D array of length 2
    Range of angles to consider for the backward angle distribution (in radians)

Returns:
--------
asymmetry: float
    Asymmetry metric for the forward and backward angle distributions
```

5.18.1.3 trajectory_angles()

```
np.ndarray SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.trajectory_↩
angles (
            np.ndarray trajectory)
```

```
 Calculates the angles between the vectors of a trajectory. (using the cosine rule)

Parameters:
-----------
trajectory: 2D array
    Array of x and y coordinates of a trajectory (in the form [[x1, y1], [x2, y2], ...])

Returns:
--------
angles: 1D array
    Array of angles between the vectors of the trajectory (in radians)
```

5.19 SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util Namespace Reference

Functions

- bootstrap_hist (data, bins, n_bootstraps=1000, bootsize=None, bootfunc=np.mean)
- bootstrap_mean_std (values, n_bootstraps, bootsize, log_values=False)
- bootstrap_statistic (values, n_bootstraps, bootsize, log_values=False, statistic="mean")

Variables

- list BOOTSTRAP_PARAMS_NAMES
- list BOOTSTRAP_PARAMS_DEFAULTS

5.19.1 Detailed Description

```
Utility functions for bootstrapping different types of data

Containing functions:
1) bootstrap_hist = histogram bootstrap with bin selection
2) bootstrap_mean_std = bootstrap for the observable of mean and std
3) bootstrap_statistics = same as bootstrap_mean_std but for a user defined statistic (mean, std, IQR, etc ...
```

5.19.2 Function Documentation

5.19.2.1 bootstrap_hist()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_hist (
              data,
              bins,
              n_bootstraps = 1000,
              bootsize = None,
              bootfunc = np.mean)
```

```
Parameters:
-----------
data : array-like (1D)
    data to bootstrap
bins : int or array-like
    bins to use for the histogram, if int, then the bins are calculated using the histogram function
n_bootstraps : int
    number of times to bootstrap the data
bootsize : int or float
    number of data points to bootstrap, if float < 0, then the number of data points is calculated as a percer
bootfunc : function
    function to use to calculate the mean of the bootstrapped data

Returns:
--------
hist_mean : array-like
    mean of the bootstrapped histogram along each bin
hist_std : array-like
    std of the bootstrapped histogram along each bin
bins : array-like
    bins used for the histogram
```

5.19.2.2 bootstrap_mean_std()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_mean_std (
              values,
              n_bootstraps,
              bootsize,
              log_values = False)
```

```
Parameters:
-----------
values : array-like (1D)
    values to bootstrap
n_bootstraps : int
    number of times to bootstrap the data
bootsize : int or float
    number of data points to bootstrap, if float < 0, then the number of data points is calculated as a percer
log_values : bool
    whether to take the log of the values before bootstrapping

Returns:
--------
mean : float
    mean of the bootstrapped values
std : float
    std of the bootstrapped values
```

5.19.2.3 bootstrap_statistic()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_statistic (
              values,
              n_bootstraps,
              bootsize,
              log_values = False,
              statistic = "mean")
```

```
Parameters:
-----------
values : array-like (1D)
    values to bootstrap
n_bootstraps : int
    number of times to bootstrap the data
bootsize : int or float
    number of data points to bootstrap, if float < 0, then the number of data points is calculated as a percer
log_values : bool
    whether to take the log of the values before bootstrapping
statistic : str
    statistic to calculate, must be one of ["mean","median","std","var","min","max"]

Returns:
--------
value : float
    value of the statistic
```

5.19.3 Variable Documentation

5.19.3.1 BOOTSTRAP_PARAMS_DEFAULTS

list SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.BOOTSTRAP_PARAMS_DEFAULTS

Initial value:

```
00001 =  [
00002     1000,
00003     None,
00004     np.mean,
00005     np.std
00006 ]
```

5.19.3.2 BOOTSTRAP_PARAMS_NAMES

list SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.BOOTSTRAP_PARAMS_NAMES

Initial value:

```
00001 =  [
00002     "n_bootstraps",
00003     "bootsize",
00004     "bootfunc",
00005     "booterrorfunc"
00006 ]
```

5.20 SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_↩ images Namespace Reference

Functions

- save_invert_images (path, ∗∗kwargs)

Variables

- dir_path = str(sys.argv[1])

5.20.1 Detailed Description

```
This script takes input at runtime to a directory where images are kept to invert them and save them in a new

Author: Baljyot Singh Parmar
```

5.20.2 Function Documentation

5.20.2.1 save_invert_images()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_images.save_invert_images (
              path,
             ** kwargs)
```

```
Makes directory to store inverted images and put files there

Parameters:
-----------
path: str
    path to the directory holding the images to invert
Keyword Arguments:
------------------
invert_path: str
    path to the directory to store the inverted images

Returns:
--------
None
```

5.20.3 Variable Documentation

5.20.3.1 dir_path

```
list SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_images.dir_path = str(sys.↩
argv[1])
```

5.21 SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_↩ mask Namespace Reference

Classes

- class extract_mask_properties

Variables

- str path = '/Users/baljyot/Documents/SMT_Movies/testing_SM_recon/Movies/Movie_1/Cell_1/mask.tif'
- mask = io.imread(path)
- prop_obj = extract_mask_properties(mask)
- fig
- ax
- color
- label

5.21.1 Detailed Description

```
Module focused on extracting features from a mask image.

Main properties focused on extracting:
    - Area
    - Bounding Box
    - Centroid
    - r_offset (bottom left corner of bounding box)
```

5.21.2 Variable Documentation

5.21.2.1 ax

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.ax
```

5.21.2.2 color

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.color
```

5.21.2.3 fig

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.fig
```

5.21.2.4 label

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.label
```

5.21.2.5 mask

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.mask = io.imread(path)
```

5.21.2.6 path

```
str SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.path = '/Users/baljyot/Documents/SMT↩
_Movies/testing_SM_recon/Movies/Movie_1/Cell_1/mask.tif'
```

5.21.2.7 prop_obj

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.prop_obj = extract_mask_properties(mask)
```

5.22 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils Namespace Reference

Classes

- class Calculation_abc
- class DatabaseOrderUtil
- class MSD_Calculations
- class MSD_Calculations_Track_Dict
- class MSD_storage

Functions

- msd_avgerage_utility (dict displacements, bool bootstrap=False, float bootstrap_samples=0.1, float bootstrap_percentile=0.95, bootstrap_num=100, **kwargs)
- MSD_Tracks (tracks, permutation=True, conversion_factor=None, tau_conversion_factor=None, min_track↩ _length=1, max_track_length=10, **kwargs)
- radius_of_confinement (t, r_sqr, D, loc_msd)
- radius_of_confinement_xy (t, r_sqr, D, loc_msd_x, loc_msd_y)
- power_law_xy (t, alpha, D, loc_msd_x, loc_msd_y)
- power_law (t, alpha, D, loc_msd)
- linear_MSD_fit (t, a, b)
- combine_track_dicts (dicts)
- _msd_tau_utility_all (x, y, tau)
- _msd_tau_utility_single (x, y, tau)
- MSD_tau_utility (x, y, tau=1, permutation=True)
- MSD_tau (x, y, permutation=True)

5.22.1 Function Documentation

5.22.1.1 _msd_tau_utility_all()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils._msd_tau_utility_all (
              x,
              y,
              tau)  [protected]
```

```
 Documentation for _msd_tau_utility_all

Parameters:
-----------
x : array
    x positions of the data
y : array
    y positions of the data
tau : int
    time lag for the MSD calculation

Returns:
--------
displacements : array, shape (n,2)
    array of displacements for all possible permutations of the data

Notes:
------
For the theory behind this see https://web.mit.edu/savin/Public/.Tutorial_v1.2/Concepts.html#A1
```

5.22.1.2 _msd_tau_utility_single()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils._msd_tau_utility_single (
              x,
              y,
              tau)  [protected]
```

5.22.1.3 combine_track_dicts()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.combine_track_dicts (
              dicts)
```

```
each dict is going to contain 4 dicts of name "IN","IO","OUT","ALL"
we need to keep this strucutre for the final combined dict
```

5.22.1.4 linear_MSD_fit()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.linear_MSD_fit (
              t,
              a,
              b)
```

```
linear fit function
expects t to be scaled with log10, and returns msd output in log10
b = log10(4*D)
a = alpha
t = log10(tau)
```

5.22.1.5 msd_avgerage_utility()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.msd_avgerage_utility (
             dict displacements,
             bool bootstrap = False,
             float bootstrap_samples = 0.1,
             float bootstrap_percentile = 0.95,
              bootstrap_num = 100,
             ** kwargs)
```

```
Documentation for _msd_avgerage_utility

Parameters:
-----------
displacements : dict
    dictionary of displacements for each time lag, key = time lag, value = array of displacements, shape (n,D)
bootstrap : bool (default = False)
    if bootstrap == True then the MSD is calculated for all possible permutations of the data
    if bootstrap == False then the MSD is calculated for the data in the order it is given
bootstrap_samples : float (default = 0.1)
    the fraction of the data to use for the bootstrap (0.1 = 10%)
bootstrap_percentile : float (default = 0.95)
    the percentile to use for the bootstrap (0.95 = 95%)
bootstrap_num : int (default = 100)
    the number of bootstrap iterations to perform

Returns:
--------
msd : dict
    dictionary of the MSD for each time lag, key = time lag, value = array of MSD values, shape (n,)
error_msd : dict (this is the standard error of the mean of the MSD)
    dictionary of the error in the MSD for each time lag, key = time lag, value = array of error in the MSD va
```

5.22.1.6 MSD_tau()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_tau (
              x,
              y,
              permutation = True)
```

```
Documentation for MSD_tau

Parameters:
-----------
x : array
    x positions of the data
y : array
    y positions of the data
permutation : bool
    if permutation == True then the MSD is calculated for all possible permutations of the data
    if permutation == False then the MSD is calculated for the data in the order it is given

Returns:
--------
displacements : dict
    dictionary of displacements for each time lag, key = time lag, value = array of displacements, shape (n,2)
```

5.22.1.7 MSD_tau_utility()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_tau_utility (
              x,
              y,
              tau = 1,
              permutation = True)
```

```
Documentation for MSD_tau_utility

Parameters:
-----------
x : array
    x positions of the data
y : array
    y positions of the data
tau : int
    time lag for the MSD calculation
permutation : bool
    if permutation == True then the MSD is calculated for all possible permutations of the data
    if permutation == False then the MSD is calculated for the data in the order it is given

Returns:
--------
displacements : array, shape (n,2)
    array of displacements
```

5.22.1.8 MSD_Tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Tracks (
              tracks,
              permutation = True,
              conversion_factor = None,
              tau_conversion_factor = None,
              min_track_length = 1,
              max_track_length = 10,
             ** kwargs)
```

```
Documentation for MSD_Tracks

Parameters:
-----------
tracks : dict
    dictionary of tracks, key = track ID, value = [[x,y],...] of coordinates
permutation : bool (default = True, don't change this)
    if permutation == True then the MSD is calculated for all possible permutations of the data
    if permutation == False then the MSD is calculated for the data in the order it is given
conversion_factor : float (default = None)
    if conversion_factor != None then the coordinates are converted to the desired units before the MSD is cal
tau_conversion_factor : float (default = None)
    if tau_conversion_factor != None then the time lags are converted to the desired units before the MSD is c
    units are for [0->n] (int) -> seconds (1 = 0.02 seconds)
min_track_length : int (default = 1)
    the minimum length of a track to be included in the MSD calculation
max_track_length : int (default = 10)
    the maximum length of a track to be included in the MSD calculation

KWARGS:
-------
Passed to msd_avgerage_utility() -> (bootstrap:bool=False,bootstrap_samples:float=0.1,bootstrap_percentile:flo

Returns:
--------
return_dict : dict
    dictionary of MSD curves for each track, key = track ID, value = dictionary of displacements for each time

Notes:
------
1. Only implimented sequential tau. If trajectories are missing coordinate values (ex. if using gap linking ir
```

5.22.1.9 power_law()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.power_law (
t,
alpha,
D,
loc_msd)

5.22.1.10 power_law_xy()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.power_law_xy (
t,
alpha,
D,
loc_msd_x,
loc_msd_y)

5.22.1.11 radius_of_confinement()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.radius_of_confinement (
t,
r_sqr,
D,
loc_msd)

5.22.1.12 radius_of_confinement_xy()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.radius_of_confinement_xy (
              t,
              r_sqr,
              D,
              loc_msd_x,
              loc_msd_y)
```

5.23 SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND Namespace Reference

Classes

- class TestNearestNeighbourDistances2D
- class TestPairwiseArray

Functions

- pairwise_array (n)
- nearest_neighbour_distances_2d (x0, y0, x1, y1, verbose_return=False, conversion_factor=0.13)

5.23.1 Function Documentation

5.23.1.1 nearest_neighbour_distances_2d()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.nearest_neighbour_distances_2d (
              x0,
              y0,
              x1,
              y1,
              verbose_return = False,
              conversion_factor = 0.13)
```

```
Docstring for nearest_neighbour_distances_2d
finds the nearest neighbour distances for two time points

Parameters:
-----------
x0: array-like
    x coordinates for the first time point
y0: array-like
    y coordinates for the first time point
x1: array-like
    x coordinates for the second time point
y1: array-like
    y coordinates for the second time point
verbose_return: bool
    if True, returns a dictionary with the nearest neighbour distances for x and y
conversion_factor: float
    conversion factor to convert to a certain unit. Default is 0.13, which is the conversion factor for the 10

Returns:
--------
```

```
nearest_neighbour_distances: array-like
    nearest neighbour distances for the two time points
nearest_neighbour_distances_x: array-like
    nearest neighbour distances for the two time points in the x direction
nearest_neighbour_distances_y: array-like
    nearest neighbour distances for the two time points in the y direction

Notes:
------
1. If verbose_return is True, the function returns a dictionary with the nearest neighbour distances for x and
```

5.23.1.2 pairwise_array()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.pairwise_array (
              n)
```

```
Generates the pairwise array of consecutive integers from 0 to n-1.
```

5.24 SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_↩ detection Namespace Reference

Functions

- find_nuc (img, str typee, regions=True, ∗∗kwargs)
- get_training_set (img)
- get_region (image, type=regionprops, connectivity=2, ∗∗kawrgs)
- plot_regions (regions, fig, ax, colorbar_mappable, plot=False)

Variables

- dict TESTED_DICT

5.24.1 Detailed Description

```
This module contains the functions used to detect the nucleoids in the images

It uses the Random Forest Classifier to detect the nucleoids in the images and then uses the regionprops funct

Author: Baljyot Singh Parmar
```

5.24.2 Function Documentation

5.24.2.1 find_nuc()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.find_nuc (
              img,
             str typee,
              regions = True,
             ** kwargs)
```

```
Parameters:
-----------
img : 2D array-like
    image to be segmented
typee : str
    type of image to be segmented. These should have keys in TESTED_DICT. If not then raise error that the "ty
regions : bool, default = True
    if True then return the regionprops of the segmented image
**kwargs : dict
    keyword arguments to be passed to the function. These are:
        connectivity : int, default = 2
            connectivity of the image. This is passed to the regionprops function
        sigma_max : int, default = 10
            maximum sigma value to be used in the multiscale_basic_features function
        sigma_min : int, default = 1
            minimum sigma value to be used in the multiscale_basic_features function
        given_type : dict | str, default = None (dict if passing thresholds, str if passing Cell wise threshol
            dictionary containing the values of the thresholds. If not given then the values are taken from TE
            if str:
                if "Threshold_23" then use a cell wide threshold where nucleoid_threshold = (2/3)*max(img) and
                if "Threshold_12" then use a cell wide threshold where nucleoid_threshold = (1/2)*max(img) and
                if "Threshold_13" then use a cell wide threshold where nucleoid_threshold = (1/3)*max(img) and
                if "Threshold_34" then use a cell wide threshold where nucleoid_threshold = (3/4)*max(img) and
Returns:
--------
result : 2D array-like
    segmented image. This is a mask with at max 3 values. 2 for background, 1 for nucleoid and 3 for rest of t
region_result : list of RegionProperties
    list of region properties of the segmented image. This is returned only if regions = True
```

5.24.2.2 get_region()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.get_region (
              image,
              type = regionprops,
              connectivity = 2,
             ** kawrgs)
```

```
Parameters
----------
image : 2D array-like
    binary image (0,1) where 1 indicates the region to fit
type : functional, default = regionprops
    the function type used to fit the image. Default assumes elliptical shapes

Returns
-------
propertieslist of RegionProperties
    Each item describes one labeled region, and can be accessed using the attributes listed below.

Notes
-----
```

```
The following properties can be accessed as attributes or keys:

areaint
-------
Number of pixels of the region.

area_bboxint
------------
Number of pixels of bounding box.

area_convexint
--------------
Number of pixels of convex hull image, which is the smallest convex polygon that encloses the region.

area_filledint
--------------
Number of pixels of the region will all the holes filled in. Describes the area of the image_filled.

axis_major_lengthfloat
----------------------
The length of the major axis of the ellipse that has the same normalized second central moments as the region.

axis_minor_lengthfloat
----------------------
The length of the minor axis of the ellipse that has the same normalized second central moments as the region.

bboxtuple
---------
Bounding box (min_row, min_col, max_row, max_col). Pixels belonging to the bounding box are in the half-open i

centroidarray
-------------
Centroid coordinate tuple (row, col).

centroid_localarray
-------------------
Centroid coordinate tuple (row, col), relative to region bounding box.

centroid_weightedarray
----------------------
Centroid coordinate tuple (row, col) weighted with intensity image.

centroid_weighted_localarray
----------------------------
Centroid coordinate tuple (row, col), relative to region bounding box, weighted with intensity image.

coords(N, 2) ndarray
Coordinate list (row, col) of the region.

eccentricityfloat
-----------------
Eccentricity of the ellipse that has the same second-moments as the region. The eccentricity is the ratio of t

equivalent_diameter_areafloat
-----------------------------
The diameter of a circle with the same area as the region.

euler_numberint
---------------
Euler characteristic of the set of non-zero pixels. Computed as number of connected components subtracted by n

extentfloat
-----------
Ratio of pixels in the region to pixels in the total bounding box. Computed as area / (rows * cols)

feret_diameter_maxfloat
-----------------------
Maximum Feret's diameter computed as the longest distance between points around a region's convex hull contour

image(H, J) ndarray
Sliced binary region image which has the same size as bounding box.

image_convex(H, J) ndarray
```

```
Binary convex hull image which has the same size as bounding box.

image_filled(H, J) ndarray
Binary region image with filled holes which has the same size as bounding box.

image_intensityndarray
----------------------
Image inside region bounding box.

inertia_tensorndarray
---------------------
Inertia tensor of the region for the rotation around its mass.

inertia_tensor_eigvalstuple
---------------------------
The eigenvalues of the inertia tensor in decreasing order.

intensity_maxfloat
------------------
Value with the greatest intensity in the region.

intensity_meanfloat
-------------------
Value with the mean intensity in the region.

intensity_minfloat
------------------
Value with the least intensity in the region.

labelint
--------
The label in the labeled input image.

moments(3, 3) ndarray
Spatial moments up to 3rd order:

m_ij = sum{ array(row, col) * row^i * col^j }
where the sum is over the row, col coordinates of the region.

moments_central(3, 3) ndarray
Central moments (translation invariant) up to 3rd order:

mu_ij = sum{ array(row, col) * (row - row_c)^i * (col - col_c)^j }

where the sum is over the row, col coordinates of the region, and row_c and col_c are the coordinates of the r

moments_hutuple
---------------
Hu moments (translation, scale and rotation invariant).

moments_normalized(3, 3) ndarray
Normalized moments (translation and scale invariant) up to 3rd order:

nu_ij = mu_ij / m_00^[(i+j)/2 + 1]

where m_00 is the zeroth spatial moment.

moments_weighted(3, 3) ndarray
Spatial moments of intensity image up to 3rd order:

wm_ij = sum{ array(row, col) * row^i * col^j }

where the sum is over the row, col coordinates of the region.

moments_weighted_central(3, 3) ndarray
Central moments (translation invariant) of intensity image up to 3rd order:

wmu_ij = sum{ array(row, col) * (row - row_c)^i * (col - col_c)^j }

where the sum is over the row, col coordinates of the region, and row_c and col_c are the coordinates of the r

moments_weighted_hutuple
------------------------
```

```
Hu moments (translation, scale and rotation invariant) of intensity image.

moments_weighted_normalized(3, 3) ndarray
Normalized moments (translation and scale invariant) of intensity image up to 3rd order:

wnu_ij = wmu_ij / wm_00^[(i+j)/2 + 1]

where wm_00 is the zeroth spatial moment (intensity-weighted area).

orientationfloat
----------------
Angle between the 0th axis (rows) and the major axis of the ellipse that has the same second moments as the re

perimeterfloat
--------------
Perimeter of object which approximates the contour as a line through the centers of border pixels using a 4-co

perimeter_croftonfloat
----------------------
Perimeter of object approximated by the Crofton formula in 4 directions.

slicetuple of slices
--------------------
A slice to extract the object from the source image.

solidityfloat
-------------
Ratio of pixels in the region to pixels of the convex hull image.

Each region also supports iteration, so that you can do:

for prop in region:
    print(prop, region[prop])
```

5.24.2.3 get_training_set()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.get_training_set (
img)

5.24.2.4 plot_regions()

SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.plot_regions (
regions,
fig,
ax,
colorbar_mappable,
plot = False)

```
Parameters
----------
regions : list, output from regionprops
    takes the output of the regionprops from sklearn
fig : plt.figure object
    figure object to plot onto
ax : axis object
    axis object on which to plot to
colorbar_mappable : colobar mappable
    colorbar_mappable opbject

Returns
-------
```

5.24.3 Variable Documentation

5.24.3.1 TESTED_DICT

```
dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.TESTED_DICT
```

5.25 SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_↩ plus Namespace Reference

Classes

- class ScaleSpacePlus
- class SM_reconstruction_image
- class SM_reconstruction_masked

Functions

- get_gaussian (mu, sigma, domain=[list(range(10)), list(range(10))])

Variables

- dict KEY_IMAGE
- int MASK_VALUE = 255
- int BOUNDING_BOX_PADDING = 5
- dict CONVERSION_TYPES = {'RC_to_Original':0,'original_to_RC':1}
- int RANDOM_SEED = 666

5.25.1 Detailed Description

```
Suite of functions and classes to perfrom the scale space plus procedure to create the reconstruction image fc
```

5.25.2 Function Documentation

5.25.2.1 get_gaussian()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.get_gaussian (
              mu,
              sigma,
              domain = [list(range(10)), list(range(10))])
```

```
Parameters
----------
mu : array-like or float of floats
    center position of gaussian (x,y) or collection of (x,y)
sigma : float or array-like of floats of shape mu
    sigma of the gaussian
domain : array-like, Defaults to 0->9 for x,y
    x,y domain over which this gassuain is over


Returns
-------
array-like 2D
    values of the gaussian centered at mu with sigma across the (x,y) points defined in domain

Notes:
------
THIS IS IMPORTANT: MAKE SURE THE TYPES IN EACH PARAMETER ARE THE SAME!!!!
```

5.25.3 Variable Documentation

5.25.3.1 BOUNDING_BOX_PADDING

```
int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.BOUNDING_BOX_PADDING = 5
```

5.25.3.2 CONVERSION_TYPES

```
dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.CONVERSION_TYPES = {'RC_↩
to_Original':0,'original_to_RC':1}
```

5.25.3.3 KEY_IMAGE

```
dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.KEY_IMAGE
```

Initial value:

```
00001 =  {
00002      'png':skimage.io.imsave,
00003      'jpg':skimage.io.imsave,
00004      'tif':skimage.io.imsave,
00005      'svg':skimage.io.imsave
00006      }
```

5.25.3.4 MASK_VALUE

```
int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.MASK_VALUE = 255
```

5.25.3.5 RANDOM_SEED

```
int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.RANDOM_SEED = 666
```

5.26 SMT.SMT_Analysis_BP.helpers.analysisFunctions.↩ smallestenclosingcircle Namespace Reference

Functions

- make_circle (points)
- _make_circle_one_point (points, p)
- _make_circle_two_points (points, p, q)
- make_diameter (a, b)
- make_circumcircle (a, b, c)
- is_in_circle (c, p)
- _cross_product (x0, y0, x1, y1, x2, y2)

Variables

- int _MULTIPLICATIVE_EPSILON = 1 + 1e-14

5.26.1 Function Documentation

5.26.1.1 _cross_product()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._cross_product (
            x0,
            y0,
            x1,
            y1,
            x2,
            y2) [protected]
```

5.26.1.2 _make_circle_one_point()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._make_circle_one_point (
            points,
            p) [protected]
```

5.26.1.3 _make_circle_two_points()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._make_circle_two_points
(
            points,
            p,
            q) [protected]
```

5.26.1.4 is_in_circle()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.is_in_circle (
            c,
            p)
```

5.26.1.5 make_circle()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_circle (
            points)
```

5.26.1.6 make_circumcircle()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_circumcircle (
            a,
            b,
            c)
```

5.26.1.7 make_diameter()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_diameter (
            a,
            b)
```

5.26.2 Variable Documentation

5.26.2.1 _MULTIPLICATIVE_EPSILON

```
int SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._MULTIPLICATIVE_↩
EPSILON = 1 + 1e-14  [protected]
```

5.27 SMT.SMT_Analysis_BP.helpers.clusterMethods Namespace Reference

Namespaces

- namespace blob_detection
- namespace clustering_methods

5.28 SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection Namespace Reference

Classes

- class blob_detection

Functions

- identity (x)
- iso_gaus (p, x, y, z)
- residuals_gaus2d (p, x, y, z, ∗∗kwargs)
- gaussian2D (x, y, cen_x, cen_y, sig_x, sig_y, offset, height, kwargs={})

Variables

- int FWHM_FACTOR = 2.∗(np.log(2.+np.sqrt(3)))

5.28.1 Detailed Description

```
Documentation for blob_detection.py

This file contains the class blob_detection which is used to detect blobs in an image. It uses the skimage.blo
It also has the option to fit the blobs with a 2D gaussian function.
The class also has the option to fit the blobs with a 2D gaussian function. This is done by using the lmfit pa
Detection can be done using the skimage.blob_log() function or a custom function. The custom function is a mod

Classes:
--------
blob_detection: see class docstring for more info, this is the main class that is used to detect blobs in an i
```

5.28.2 Function Documentation

5.28.2.1 gaussian2D()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.gaussian2D (
              x,
              y,
              cen_x,
              cen_y,
              sig_x,
              sig_y,
              offset,
              height,
              kwargs = {})
```

```
 2d gaussian anistropic
```

5.28.2.2 identity()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.identity (
              x)
```

```
identity function, returns the input

Parameters:
-----------
x : any
    input to be returned

Returns:
--------
x : any
    input

Uses:
-----
identity(x) = x
```

5.28.2.3 iso_gaus()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.iso_gaus (
              p,
              x,
              y,
              z)
```

5.28.2.4 residuals_gaus2d()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.residuals_gaus2d (
              p,
              x,
              y,
              z,
             ** kwargs)
```

```
Residual calculator for a 2D gaussian for lmfit.minimize

Parameters
----------
p : Parameter() object
    Parameters
x : independent variable
    x values
y : independent variable
    y values
z : z = f(x,y)
    function values at x,y. Where function is the one we are trying to fit

Returns
-------
array-like
    residuals of the function z-f(x,y) (2D gaussian)
```

5.28.3 Variable Documentation

5.28.3.1 FWHM_FACTOR

```
int SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.FWHM_FACTOR = 2.*(np.log(2.+np.↩
sqrt(3)))
```

5.29 SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods Namespace Reference

Functions

- scale_space_plus_blob_detection (img, blob_parameters, fitting_parameters, show=False)
- perfrom_DBSCAN_Cluster (localizations, D, minP, show=False)
- perform_HDBSCAN_Cluster (localizations, min_cluster_size, min_samples, show=False)

5.29.1 Function Documentation

5.29.1.1 perform_HDBSCAN_Cluster()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.perform_HDBSCAN_Cluster (
              localizations,
              min_cluster_size,
              min_samples,
              show = False)
```

```
Parameters:
-----------
localizations: np.ndarray
    Numpy array of the localizations in the form [[x,y],...]
min_cluster_size: int
    The minimum size of clusters
min_samples: int
    The number of samples in a neighborhood for a point to be considered as a core point.
show: bool
    Whether or not to display a plot of the clusters

Returns:
--------
cluster_labels: np.ndarray
    Numpy array of the cluster labels in the form [0,0,1,1,2,2,...]
cluster_centers: np.ndarray
    Numpy array of the cluster centers in the form [[x,y],...]
cluster_radii: np.ndarray
    Numpy array of the cluster radii in the form [r1,r2,...]
loc_per_cluster: np.ndarray
    Numpy array of the number of localizations per cluster in the form [n1,n2,...]
```

5.29.1.2 perfrom_DBSCAN_Cluster()

SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.perfrom_DBSCAN_Cluster (
localizations,
D,
minP,
show = False)

```
Parameters:
-----------
localizations: np.ndarray
    Numpy array of the localizations in the form [[x,y],...]
D: float, in the units of the localizations
    The maximum distance between two samples for one to be considered as in the neighborhood of the other
minP: int
    The number of samples (or total weight) in a neighborhood for a point to be considered as a core point.

Returns:
--------
cluster_labels: np.ndarray
    Numpy array of the cluster labels in the form [0,0,1,1,2,2,...]
cluster_centers: np.ndarray
    Numpy array of the cluster centers in the form [[x,y],...]
cluster_radii: np.ndarray
    Numpy array of the cluster radii in the form [r1,r2,...]
loc_per_cluster: np.ndarray
    Numpy array of the number of localizations per cluster in the form [n1,n2,...]
```

5.29.1.3 scale_space_plus_blob_detection()

SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.scale_space_plus_blob_detection
(
img,
blob_parameters,
fitting_parameters,
show = False)

```
Wrapper for the blob_detection function in the blob_detection.py file
See the blob_detection.py file for more details on the parameters
```

5.30 SMT.SMT_Analysis_BP.helpers.ioModule Namespace Reference

Namespaces

- namespace import_functions
- namespace logging_and_print_util
- namespace pickle_util
- namespace plotting_functions
- namespace SMT_converters

5.31 SMT.SMT_Analysis_BP.helpers.ioModule.import_functions Namespace Reference

Functions

- read_data (path, delimiter=',', skiprow=1, ∗∗kwargs)
- read_file (file_loc)
- combine_path (root, path)
- find_image (path, ends_with='.tif', full_path=False)
- name_sorter (strings, keyword)
- find_files (path, extension, keyword=None)
- invert_I16u (img, array=False)
- invert_img (path)
- save_img (object, path)

5.31.1 Detailed Description

```
This file contains most functions used in Input/Output of different files and directories

Author: Baljyot Singh Parmar
```

5.31.2 Function Documentation

5.31.2.1 combine_path()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.combine_path (
              root,
              path)
```

```
Parmaters
---------
root : str
    path of the root directory
path : str
    name of the file or directory to combine with root

Returns
-------
string
    combined path given root and path
```

5.31.2.2 find_files()

SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.find_files (
path,
extension,
keyword = None)

```
Docstring for find_files
Finds files in a directory with a specific extension and keyword in the name

Parameters:
-----------
path : str
    path to the directory where the files are located
extension : str
    extension of the files to be found
keyword : str
    keyword to be searched in the file name
Returns:
--------
files : list
    list of files that match the criteria
```

5.31.2.3 find_image()

SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.find_image (
path,
ends_with = '.tif',
full_path = False)

```
    Docstring for find_image:
    Find all files in a directory that end with a certain string

    Parameters
    ----------
    path : string
        Full path of the directory in which to find the files. Not recursive find!
    ends_with : string, default = '.tif'
        Unique string to find files that end with this string
    full_path : bool
        if true return the full path of the file, else return just the file name
    Returns
    -------
    list
        list of file paths with the root provided in Parameters with contrainsts of ends_with
```

5.31.2.4 invert_I16u()

SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.invert_I16u (
img,
array = False)

```
    Parameters
    ----------
    img : PIL.Image object
        image object to invert
    array : bool
        if true return a numpy array of the inverted image, else return a PIL.Image object

    Returns
    -------
    PIL.Image object or numpy based on the boolean value of array
        inverted image
```

5.31.2.5 invert_img()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.invert_img (
              path)
```

```
Parameters
----------
path : string
    full path of the image to invert

Returns
-------
PIL Image object
    to save this image use object.save(new_path)
```

5.31.2.6 name_sorter()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.name_sorter (
              strings,
              keyword)
```

```
    Docstring for name_sorter:
    Find all the strings in a list that contain a keyword

    Parameters:
    -----------
    strings : list
        list of strings to search through
    keyword : string
        keyword to search for in the list of strings

    Returns:
    --------
    list
        list of strings that contain the keyword
```

5.31.2.7 read_data()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.read_data (
              path,
              delimiter = ',',
              skiprow = 1,
             ** kwargs)
```

```
    Parameters
    ----------

    path : str
        path to the file to be read

    delimiter : str
        delimiter used in the file to seperate individual value

    skiprow : int
        number of rows to skip from the start of the file before reading

    Returns
    -------

    array-like
        array of the loaded data
```

5.31.2.8 read_file()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.read_file (
              file_loc)
```

```
Parameters
    ----------

file_loc : str
        path to the file

Returns
    -------

Array-like
        the array is 2D array of the pixel locations
```

5.31.2.9 save_img()

```
SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.save_img (
              object,
              path)
```

```
    Paramteres
    ----------
    object : PIL.Image object
        image object
    path : str
        path to which this image should be saved
```

5.32 SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util Namespace Reference

Functions

- beautiful_print (∗args, ∗∗kwargs)
- beautiful_print_dict (dict dict_to_print, ∗∗kwargs)
- beautiful_print_list (list list_to_print, ∗∗kwargs)

5.32.1 Detailed Description

```
This is a utility module to house functions and classes involved in logging and printing to the console.

Mainly this is for beautifying the console output and logging to a file if needed

Might just be better to use pprint (url: https://docs.python.org/3/library/pprint.html)
```

5.32.2 Function Documentation

5.32.2.1 beautiful_print()

SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print (
    * *args*,
    ** *kwargs*)

```
This function is a wrapper around the print function that adds a line of dashes before and after the print sta

Parameters:
-----------
*args: list
    list of arguments to pass to the print function
**kwargs: dict
    dict of keyword arguments to pass to the print function

Returns:
--------
None
```

5.32.2.2 beautiful_print_dict()

SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print_dict (
    dict *dict_to_print*,
    ** *kwargs*)

```
This function is a wrapper around the print function that adds a line of dashes before and after the print sta

Parameters:
-----------
dict_to_print: dict
    dict to print
**kwargs: dict
    dict of keyword arguments to pass to the print function

Returns:
--------
None
```

5.32.2.3 beautiful_print_list()

SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print_list (
    list *list_to_print*,
    ** *kwargs*)

```
This function is a wrapper around the print function that adds a line of dashes before and after the print sta

Parameters:
-----------
list_to_print: list
    list to print
**kwargs: dict
    dict of keyword arguments to pass to the print function

Returns:
--------
None
```

5.33 SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util Namespace Reference

Classes

- class PickleUtil
- class TestPickleUtil

5.33.1 Detailed Description

```
Utility functions for pickling and unpickling objects.
Generically, this is used to save and load models with doc specific to the object.
```

5.34 SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions Namespace Reference

Classes

- class run_analysis_plotting

Functions

- circles (x, y, s, c='b', vmin=None, vmax=None, **kwargs)
- create_circle_obj (dims, fill=False)
- create_box_plot (box_data, tick_list, y_label="", x_label="", y_lim=(), title="", show=False)
- read_imag (path, fig=False, ax=False, show=True)
- contour_intens (img, fig=False, ax=False, show=True, seg=True, perc=95)
- spacialplot_msd (op, fig=False, ax=False, show=True)
- other_plot (op, fig=False, ax=False, show=True)
- animate (i, ax)
- circular_hist (ax, x, bins=16, density=True, offset=0, gaps=True, **kwargs)
- create_circular_mask (h, w, center=None, radius=None)
- plot_stacked_bar (data, series_labels, category_labels=None, show_values=False, value_format="{}", y_↩
label=None, colors=None, grid=True, reverse=False)

5.34.1 Detailed Description

```
This script contains all the plotting functions used in the trajectory_analysis_script.py

Author: Baljyot Singh Parmar
```

5.34.2 Function Documentation

5.34.2.1 animate()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.animate (
            i,
            ax)
```

5.34.2.2 circles()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.circles (
    x,
    y,
    s,
    c = 'b',
    vmin = None,
    vmax = None,
    ** kwargs)
```

```
Make a scatter of circles plot of x vs y, where x and y are sequence
like objects of the same lengths. The size of circles are in data scale.

Parameters
----------
x,y : scalar or array_like, shape (n, )
    Input data
s : scalar or array_like, shape (n, )
    Radius of circle in data unit.
c : color or sequence of color, optional, default : 'b'
    `c` can be a single color format string, or a sequence of color
    specifications of length `N`, or a sequence of `N` numbers to be
    mapped to colors using the `cmap` and `norm` specified via kwargs.
    Note that `c` should not be a single numeric RGB or RGBA sequence
    because that is indistinguishable from an array of values
    to be colormapped. (If you insist, use `color` instead.)
    `c` can be a 2-D array in which the rows are RGB or RGBA, however.
vmin, vmax : scalar, optional, default: None
    `vmin` and `vmax` are used in conjunction with `norm` to normalize
    luminance data.  If either are `None`, the min and max of the
    color array is used.
kwargs : `~matplotlib.collections.Collection` properties
    Eg. alpha, edgecolor(ec), facecolor(fc), linewidth(lw), linestyle(ls),
    norm, cmap, transform, etc.

Returns
-------
paths : `~matplotlib.collections.PathCollection`

Examples
--------
a = np.arange(11)
circles(a, a, a*0.2, c=a, alpha=0.5, edgecolor='none')
plt.colorbar()

License
--------
This code is under [The BSD 3-Clause License]
(http://opensource.org/licenses/BSD-3-Clause)
```

5.34.2.3 circular_hist()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.circular_hist (
    ax,
    x,
    bins = 16,
    density = True,
    offset = 0,
    gaps = True,
    ** kwargs)
```

```
Produce a circular histogram of angles on ax.

Parameters
----------
ax : matplotlib.axes._subplots.PolarAxesSubplot
    axis instance created with subplot_kw=dict(projection='polar').

x : array
    Angles to plot, expected in units of radians.

bins : int, optional
    Defines the number of equal-width bins in the range. The default is 16.

density : bool, optional
    If True plot frequency proportional to area. If False plot frequency
    proportional to radius. The default is True.

offset : float, optional
    Sets the offset for the location of the 0 direction in units of
    radians. The default is 0.

gaps : bool, optional
    Whether to allow gaps between bins. When gaps = False the bins are
    forced to partition the entire [-pi, pi] range. The default is True.

**kwargs : type
    Other arguments are passed directly to `matplotlib.axes.Axes.bar`.

Returns
-------
n : array or list of arrays
    The number of values in each bin.

bins : array
    The edges of the bins.

patches : `.BarContainer` or list of a single `.Polygon`
    Container of individual artists used to create the histogram
    or list of such containers if there are multiple input datasets.
```

5.34.2.4 contour_intens()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.contour_intens (
              img,
              fig = False,
              ax = False,
              show = True,
              seg = True,
              perc = 95)
```

5.34.2.5 create_box_plot()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_box_plot (
              box_data,
              tick_list,
              y_label = "",
              x_label = "",
              y_lim = (),
              title = "",
              show = False)
```

5.34.2.6 create_circle_obj()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_circle_obj (
              dims,
              fill = False)
```

```
INPUTS:
dims = array-like
    [x,y,r]
    x = x coordinate of center of circle
    y = y coordinate of center of circle
    r = radius of circle

RETURNS:
Circle object to be used in ax.add_artist
```

5.34.2.7 create_circular_mask()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_circular_mask (
              h,
              w,
              center = None,
              radius = None)
```

```
 h,w are the dimensions of the image
```

5.34.2.8 other_plot()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.other_plot (
              op,
              fig = False,
              ax = False,
              show = True)
```

5.34.2.9 plot_stacked_bar()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.plot_stacked_bar (
              data,
              series_labels,
              category_labels = None,
              show_values = False,
              value_format = "{}",
              y_label = None,
              colors = None,
              grid = True,
              reverse = False)
```

```
Plots a stacked bar chart with the data and labels provided.

Keyword arguments:
data            -- 2-dimensional numpy array or nested list
                   containing data for each series in rows
series_labels   -- list of series labels (these appear in
                   the legend)
category_labels -- list of category labels (these appear
                   on the x-axis)
show_values     -- If True then numeric value labels will
                   be shown on each bar
value_format    -- Format string for numeric value labels
                   (default is "{}")
y_label         -- Label for y-axis (str)
colors          -- List of color labels
grid            -- If True display grid
reverse         -- If True reverse the order that the
                   series are displayed (left-to-right
                   or right-to-left)
```

5.34.2.10 read_imag()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.read_imag (
              path,
              fig = False,
              ax = False,
              show = True)
```

5.34.2.11 spacialplot_msd()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.spacialplot_msd (
              op,
              fig = False,
              ax = False,
              show = True)
```

5.35 SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters Namespace Reference

Classes

- class IO_run_analysis

Functions

- list convert_track_data_SMAUG_format (dict track_data)
- list convert_track_data_NOBIAS_format_global (dict track_data, int max_tau=1)
- _convert_track_data_NOBIAS_format_tau (displacement_dict, tau, bool include_cor_obs=False)

5.35.1 Function Documentation

5.35.1.1 _convert_track_data_NOBIAS_format_tau()

```
SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters._convert_track_data_NOBIAS_format_tau (
              displacement_dict,
              tau,
             bool  include_cor_obs = False)  [protected]
```

```
 Docstring for _convert_track_data_NOBIAS_format_tau
This is a utility function for convert_track_data_NOBIAS_format_global that formats the track data for a speci

Parameters:
-----------
displacement_dict: dict
    dict of the form {track_id:{tau:[[x1-x0,x2-x1,...],[y1-y0,y2-y1,...]],...},...}
    This is the output from the MSD_Tracks function in Analysis_functions.py
tau: int
    the tau to use for the NOBIAS analysis
include_cor_obs: bool
    whether to include the correlation observations in the output

Returns:
--------
nobias_dict_out: dict
    dict of the form {"obs":[[x1-x0,x2-x1,...],[y1-y0,y2-y1,...]],"TrID":[track_id1,track_id1,...]}
    "obs" is 2 x T where T is the number of frames and 2 is the dimension of the data (x,y)
    "TrID" is a list of track ids that correspond to the displacements in "obs"

Notes:
------
For the "cor_obs" key, i have no idea what the values for this are and as such i am leaving it out. But can be
```

5.35.1.2 convert_track_data_NOBIAS_format_global()

```
list SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.convert_track_data_NOBIAS_format_←
global (
             dict track_data,
             int  max_tau = 1)
```

```
 Docstring for convert_track_data_NOBIAS_format_global
This should be run in the background to gain all the tau permutations for posterity but the main function shou
for a single tau. The other funtions will be described later.

Parameters:
-----------
track_data: dict
    dict of track data in the format {track_id:[[x0,y0,frame0],[x1,y1,frame1],...],...}
max_tau: int
    the maximum tau to use for the NOBIAS analysis

Returns:
--------
track_data_NOBIAS: list of dict
    dict of the form [{"obs":[[x1-x0,x2-x1,...],[y1-y0,y2-y1,...]],"TrID":[track_id1,track_id1,...]},...]
    Each element in the list is a dict of the displacements for a given tau
    "obs" is 2 x T where T is the number of frames and 2 is the dimension of the data (x,y)
    "TrID" is a list of track ids that correspond to the displacements in "obs"
    For example:
    {"obs":[[x1-x0,x2-x1,...],[y1-y0,y2-y1,...]],"TrID":[1,1,...]}
    this means that the displacements in "obs" are for track id 1



Notes:
------
This function is used to convert track data in the format {track_id:[[x0,y0,frame0],[x1,y1,frame1],...],...}
to the format required for NOBIAS analysis
```

5.35.1.3 convert_track_data_SMAUG_format()

```
list SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.convert_track_data_SMAUG_format (
            dict track_data)
```

5.36 SMT.SMT_Analysis_BP.helpers.misc Namespace Reference

Namespaces

- namespace decorators
- namespace diff_mw
- namespace errors
- namespace guassian_fit

5.37 SMT.SMT_Analysis_BP.helpers.misc.decorators Namespace Reference

Classes

- class CountCalls

Functions

- deprecated (reason)
- timer (func)
- debug (func)
- slow_down (_func=None, ∗, rate=1)
- repeat (_func=None, ∗, num_times=2)
- singleton (cls)
- cache (func)
- set_unit (unit)

Variables

- tuple string_types = (type(b''), type(u''))

5.37.1 Function Documentation

5.37.1.1 cache()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.cache (
              func)
```

```
Keep a cache of previous function calls
```

5.37.1.2 debug()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.debug (
              func)
```

```
Print the function signature and return value
```

5.37.1.3 deprecated()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.deprecated (
              reason)
```

```
This is a decorator which can be used to mark functions
as deprecated. It will result in a warning being emitted
when the function is used.
```

5.37.1.4 repeat()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.repeat (
              _func = None,
             * ,
              num_times = 2)
```

```
Repeat the function a number of times

Parameters:
-----------
num_times : int
    number of times to repeat the function

Returns:
--------
decorator_repeat : function
    decorator function
```

5.37.1.5 set_unit()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.set_unit (
              unit)
```

```
Register a unit on a function
```

5.37.1.6 singleton()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.singleton (
              cls)
```

```
Make a class a Singleton class (only one instance)
```

5.37.1.7 slow_down()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.slow_down (
              _func = None,
             * ,
              rate = 1)
```

```
Sleep given amount of seconds before calling the function
```

5.37.1.8 timer()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.timer (
              func)
```

```
Print the runtime of the decorated function
```

5.37.2 Variable Documentation

5.37.2.1 string_types

```
tuple SMT.SMT_Analysis_BP.helpers.misc.decorators.string_types = (type(b''), type(u''))
```

5.38 SMT.SMT_Analysis_BP.helpers.misc.diff_mw Namespace Reference

Functions

- mw_to_diff (mw, n, T=310.15, micron=True)

Variables

- int mw_RPOC = 155160
- int mw_NUSA = 54871
- int mw_LACI = 38590
- int mw_RNAP = 350000
- int vis_ecoli = 950
- float vis_cyto_ecoli = 2.82
- dif_RPOC = mw_to_diff(mw_RPOC,vis_cyto_ecoli)
- dif_NUSA = mw_to_diff(mw_NUSA,vis_cyto_ecoli)
- dif_LACI = mw_to_diff(mw_LACI,vis_cyto_ecoli)
- dif_RNAP = mw_to_diff(mw_RNAP,vis_cyto_ecoli)

5.38.1 Function Documentation

5.38.1.1 mw_to_diff()

```
SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_to_diff (
              mw,
              n,
              T = 310.15,
              micron = True)
```

```
    Documentation:
    Given the molecular weight, returns the diffusion coefficent assuming a spherical shape of the moleucle wh

    From: A Novel Correlation for Protein Diffusion Coefficients Based on Molecular Weight and Radius of Gyrat

    Parameters:
    -----------
    mw = molecular weight in g*mol^-1

    n = solution viscocity in c*P

    T = Temperature of the solution in K (default is 310.15K = 37C)

    micron = if True:
                 return diffusion coefficient value as um^2*s^-1
             if False:
                 return diffusion coefficient value as m^2*s^-1


    Return:
    -------
    Diffusion Coefficient in m^2*s^-1 if mircon is False
```

5.38.2 Variable Documentation

5.38.2.1 dif_LACI

```
SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_LACI = mw_to_diff(mw_LACI,vis_cyto_ecoli)
```

5.38.2.2 dif_NUSA

```
SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_NUSA = mw_to_diff(mw_NUSA,vis_cyto_ecoli)
```

5.38.2.3 dif_RNAP

```
SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_RNAP = mw_to_diff(mw_RNAP,vis_cyto_ecoli)
```

5.38.2.4 dif_RPOC

```
SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_RPOC = mw_to_diff(mw_RPOC,vis_cyto_ecoli)
```

5.38.2.5 mw_LACI

`int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_LACI = 38590`

5.38.2.6 mw_NUSA

`int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_NUSA = 54871`

5.38.2.7 mw_RNAP

`int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_RNAP = 350000`

5.38.2.8 mw_RPOC

`int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_RPOC = 155160`

5.38.2.9 vis_cyto_ecoli

`float SMT.SMT_Analysis_BP.helpers.misc.diff_mw.vis_cyto_ecoli = 2.82`

5.38.2.10 vis_ecoli

`int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.vis_ecoli = 950`

5.39 SMT.SMT_Analysis_BP.helpers.misc.errors Namespace Reference

Classes

- class InitializationKeys
- class InitializationValues

5.40 SMT.SMT_Analysis_BP.helpers.misc.guassian_fit Namespace Reference

Classes

- class SM_Localization_Image
- class SM_localization_movie

Functions

- gaussian2D (x, y, cen_x, cen_y, sig_x, sig_y, offset, height, kwargs={})

    define some gaussian models for fitting
- gaussian2D_theta (x, y, cen_x, cen_y, sig_x, sig_y, theta, offset, height, kwargs={})
- gaussian1D (x, cen_x, sig_x, offset, height, kwargs={})
- gaussian2D_residual (params, x, y, data, kwargs={})

    define some residual functions for fitting
- gaussian2D_theta_residual (params, x, y, data, kwargs={})
- gaussian1D_residual (params, x, data, kwargs={})
- find_peaks (image, **kwargs)

    define functions to find candidate peaks in a signal for a 2D signal (image)
- save_dataframe (pd.DataFrame df, str path)

Variables

- str path = "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/20190527/rpoc_ez/Movie/rpoc_ez_6.tif"
- image = imread(path)
- sm_localization_movie = SM_localization_movie(image)
- fit_results_df

5.40.1 Function Documentation

5.40.1.1 find_peaks()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.find_peaks (
              image,
             ** kwargs)
```

define functions to find candidate peaks in a signal for a 2D signal (image)

```
Finds candidate peaks in a 2D image using skimage.feature.peak_local_max

Parameters:
-----------
image: 2D numpy array
    image to find peaks in
kwargs: dict
    dictionary of keyword arguments to pass to peak_local_max
    See skimage.feature.peak_local_max for more details
    Some useful kwargs:
        min_distance: int
            minimum distance in pixels between peaks
        threshold_abs: int
            minimum intensity of peaks
        exclude_border: int
            number of pixels to exclude from the border of the image
```

5.40.1.2 gaussian1D()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian1D (
              x,
              cen_x,
              sig_x,
              offset,
              height,
              kwargs = {})
```

```
 1d gaussian function
```

5.40.1.3 gaussian1D_residual()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian1D_residual (
              params,
              x,
              data,
              kwargs = {})
```

```
1d gaussian residual function
```

5.40.1.4 gaussian2D()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D (
              x,
              y,
              cen_x,
              cen_y,
              sig_x,
              sig_y,
              offset,
              height,
              kwargs = {})
```

define some gaussian models for fitting

```
2d gaussian function no theta
```

5.40.1.5 gaussian2D_residual()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_residual (
              params,
              x,
              y,
              data,
              kwargs = {})
```

define some residual functions for fitting

```
2d gaussian residual function
```

5.40.1.6 gaussian2D_theta()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_theta (
              x,
              y,
              cen_x,
              cen_y,
              sig_x,
              sig_y,
              theta,
              offset,
              height,
              kwargs = {})
```

```
2d gaussian function with theta
```

5.40.1.7 gaussian2D_theta_residual()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_theta_residual (
              params,
              x,
              y,
              data,
              kwargs = {})
```

```
 2d gaussian residual function with theta
```

5.40.1.8 save_dataframe()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.save_dataframe (
             pd.DataFrame df,
             str path)
```

```
Saves a dataframe to a csv file

Parameters:
-----------
df: pandas.DataFrame
    dataframe to save
path: str
    path to save the dataframe to
```

5.40.2 Variable Documentation

5.40.2.1 fit_results_df

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.fit_results_df
```

Initial value:

```
=  sm_localization_movie.fit(
        gaussian2D_residual,
        {'cen_x':0,'cen_y':0,'sig_x':1,'sig_y':1,'offset':0,'height':1},
 {'cen_x':(-np.inf,np.inf),'cen_y':(-np.inf,np.inf),'sig_x':(0,np.inf),'sig_y':(0,np.inf),'offset':(-np.inf,np.inf),'hei
        prune_direction={'sig_x':(0.7,2),'sig_y':(0.7,2)})
```

5.40.2.2 image

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.image = imread(path)
```

5.40.2.3 path

```
str SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.path = "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot↩
_temp/20190527/rpoc_ez/Movie/rpoc_ez_6.tif"
```

5.40.2.4 sm_localization_movie

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.sm_localization_movie = SM_localization_movie(image)
```

5.41 SMT.SMT_Analysis_BP.Parameter_Store Namespace Reference

Namespaces

- namespace global_params

5.42 SMT.SMT_Analysis_BP.Parameter_Store.global_params Namespace Reference

Variables

- dict PIXELSIZES
- dict PHOTON_CONVERSION_FACTORS
- dict READOUT_NOISE
- dict DARK_OFFSET
- dict QUANTUM_EFFICIENCY_561

5.42.1 Detailed Description

```
This file contains all the global parameters that are used in the code.
These parameters are used in different modules of the code, and may not be useful for the user to change.

Author: Baljyot Singh Parmar
Date: 2023-04-20
```

5.42.2 Variable Documentation

5.42.2.1 DARK_OFFSET

```
dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.DARK_OFFSET
```

Initial value:

```
00001 =   {"olympus_sCMOS_old":100,
00002                 "olympus_sCMOS_new":100,
00003                 "confocal":None}
```

5.42.2.2 PHOTON_CONVERSION_FACTORS

```
dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.PHOTON_CONVERSION_FACTORS
```

Initial value:

```
00001 =   {"olympus_sCMOS_old":0.49,
00002                                 "olympus_sCMOS_new":0.23,
00003                                 "confocal":None}
```

5.42.2.3 PIXELSIZES

```
dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.PIXELSIZES
```

Initial value:

```
00001 =  {"olympus_pixel_size":130,
00002              "confocal_pixel_size":79,
00003              "olympus_pixel_size_1x1":65}
```

5.42.2.4 QUANTUM_EFFICIENCY_561

```
dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.QUANTUM_EFFICIENCY_561
```

Initial value:

```
00001 =  {"olympus_sCMOS_old":0.71,
00002                          "olympus_sCMOS_new":0.95,
00003                          "confocal":None}
```

5.42.2.5 READOUT_NOISE

```
dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.READOUT_NOISE
```

Initial value:

```
00001 =  {"olympus_sCMOS_old":1.9,
00002                 "olympus_sCMOS_new":1.35,
00003                 "confocal":None}
```

5.43 testing_new_script Namespace Reference

Variables

- str dir_tiff = '/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/12/rpoc_m9'
- files = glob.glob(dir_tiff + '/' +'∗seg.tif')
- str root = dir_tiff
- str save_analysis_dir = dir_tiff + '/' + 'Analysis_test'
- str_name_fil = files[z]
- imp = IJ.openImage(str_name_fil)
- dims = imp.getDimensions();
- model = Model()
- logger = Logger.IJ_LOGGER
- settings = Settings(imp)
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- initialSpotFilterValue
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- selectionModel = SelectionModel(model)
- displayer = HyperStackDisplayer(model, selectionModel, imp)
- int go = 0
- fm = model.getFeatureModel()
- a = model.getSpots().iterator(True)

- str cd = root
- v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- track = model.getTrackModel().trackSpots(id)
- sid = spot.ID()
- x = spot.getFeature('POSITION_X')
- y = spot.getFeature('POSITION_Y')
- t = spot.getFeature('FRAME')
- rad = spot.getFeature('RADIUS')
- q = spot.getFeature('QUALITY')
- snr = spot.getFeature('SNR')
- mean = spot.getFeature('MEAN_INTENSITY')
- str dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] + '.tif_spots' +'.csv'
- spamWriter = csv.writer(f, delimiter=',')

5.43.1 Variable Documentation

5.43.1.1 a

```
testing_new_script.a = model.getSpots().iterator(True)
```

5.43.1.2 cd

```
str testing_new_script.cd = root
```

5.43.1.3 detectorFactory

```
testing_new_script.detectorFactory
```

5.43.1.4 detectorSettings

```
testing_new_script.detectorSettings
```

5.43.1.5 dims

```
testing_new_script.dims = imp.getDimensions();
```

5.43.1.6 dir_name_save_inten

```
str testing_new_script.dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] + '.tif↩
_spots' +'.csv'
```

5.43.1.7 dir_tiff

```
str testing_new_script.dir_tiff = '/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/12/rpoc_m9'
```

5.43.1.8 displayer

```
testing_new_script.displayer = HyperStackDisplayer(model, selectionModel, imp)
```

5.43.1.9 files

```
testing_new_script.files = glob.glob(dir_tiff + '/' +'*seg.tif')
```

5.43.1.10 fm

```
testing_new_script.fm = model.getFeatureModel()
```

5.43.1.11 go

```
int testing_new_script.go = 0
```

5.43.1.12 imp

```
testing_new_script.imp = IJ.openImage(str_name_fil)
```

5.43.1.13 initialSpotFilterValue

```
testing_new_script.initialSpotFilterValue
```

5.43.1.14 logger

```
testing_new_script.logger = Logger.IJ_LOGGER
```

5.43.1.15 mean

```
testing_new_script.mean = spot.getFeature('MEAN_INTENSITY')
```

5.43.1.16 model

```
testing_new_script.model = Model()
```

5.43.1.17 ok

```
testing_new_script.ok = trackmate.checkInput()
```

5.43.1.18 q

```
testing_new_script.q = spot.getFeature('QUALITY')
```

5.43.1.19 rad

```
testing_new_script.rad = spot.getFeature('RADIUS')
```

5.43.1.20 root

```
str testing_new_script.root = dir_tiff
```

5.43.1.21 save_analysis_dir

```
str testing_new_script.save_analysis_dir = dir_tiff + '/' + 'Analysis_test'
```

5.43.1.22 selectionModel

```
testing_new_script.selectionModel = SelectionModel(model)
```

5.43.1.23 settings

```
testing_new_script.settings = Settings(imp)
```

5.43.1.24 sid

```
testing_new_script.sid = spot.ID()
```

5.43.1.25 snr

```
testing_new_script.snr = spot.getFeature('SNR')
```

5.43.1.26 spamWriter

```
testing_new_script.spamWriter = csv.writer(f, delimiter=',')
```

5.43.1.27 str_name_fil

```
testing_new_script.str_name_fil = files[z]
```

5.43.1.28 t

```
testing_new_script.t = spot.getFeature('FRAME')
```

5.43.1.29 track

```
testing_new_script.track = model.getTrackModel().trackSpots(id)
```

5.43.1.30 trackerFactory

```
testing_new_script.trackerFactory
```

5.43.1.31 trackerSettings

```
testing_new_script.trackerSettings
```

5.43.1.32 trackmate

```
testing_new_script.trackmate = TrackMate(model, settings)
```

5.43.1.33 v

```
testing_new_script.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
```

5.43.1.34 x

```
testing_new_script.x = spot.getFeature('POSITION_X')
```

5.43.1.35 y

```
testing_new_script.y = spot.getFeature('POSITION_Y')
```

5.44 tracking_tif_jpy Namespace Reference

Variables

- str dir_tiff = '/Users/baljyot/Documents/2019-2020/RNAP_PAPER/Baljyot_EXP_RPOC/DATA/new_↩ days/20190527/ll_ez/segmented'
- list files = [fi for fi in files if fi.endswith("seg.tif")]
- num_files = len(files)
- str save_analysis_dir = dir_tiff + '/' + 'Analysis'
- str str_name_fil = root + '/' + files [z]
- imp = IJ.openImage(str_name_fil)
- model = Model()
- settings = Settings()
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- selectionModel = SelectionModel(model)
- displayer = HyperStackDisplayer(model, selectionModel, imp)
- int go = 0
- fm = model.getFeatureModel()
- a = model.getSpots().iterator(True)
- str cd = "D:\\Baljyot_Experiments\\20190524\\rpoc\\segmented"
- x = i.getFeature("POSITION_X")
- y = i.getFeature("POSITION_Y")
- std = i.getFeature("STANDARD_DEVIATION")
- rad = i.getFeature("RADIUS")
- ed = i.getFeature("ESTIMATED_DIAMETER")
- str dir_name_save_inten = save_analysis_dir + '/' + files[z] + '_' + 'spots' +'.csv'
- spamWriter = csv.writer(f, delimiter=',')

5.44.1 Variable Documentation

5.44.1.1 a

```
tracking_tif_jpy.a = model.getSpots().iterator(True)
```

5.44.1.2 cd

```
str tracking_tif_jpy.cd = "D:\\Baljyot_Experiments\\20190524\\rpoc\\segmented"
```

5.44.1.3 detectorFactory

```
tracking_tif_jpy.detectorFactory
```

5.44.1.4 detectorSettings

```
tracking_tif_jpy.detectorSettings
```

5.44.1.5 dir_name_save_inten

```
str tracking_tif_jpy.dir_name_save_inten = save_analysis_dir + '/' + files[z] + '_' + 'spots'
+'.csv'
```

5.44.1.6 dir_tiff

```
str tracking_tif_jpy.dir_tiff = '/Users/baljyot/Documents/2019-2020/RNAP_PAPER/Baljyot_EXP_↵
RPOC/DATA/new_days/20190527/ll_ez/segmented'
```

5.44.1.7 displayer

```
tracking_tif_jpy.displayer = HyperStackDisplayer(model, selectionModel, imp)
```

5.44.1.8 ed

```
tracking_tif_jpy.ed = i.getFeature("ESTIMATED_DIAMETER")
```

5.44.1.9 files

```
list tracking_tif_jpy.files = [ fi for fi in files if fi.endswith("seg.tif") ]
```

5.44.1.10 fm

```
tracking_tif_jpy.fm = model.getFeatureModel()
```

5.44.1.11 go

```
int tracking_tif_jpy.go = 0
```

5.44.1.12 imp

```
tracking_tif_jpy.imp = IJ.openImage(str_name_fil)
```

5.44.1.13 model

```
tracking_tif_jpy.model = Model()
```

5.44.1.14 num_files

```
tracking_tif_jpy.num_files = len(files)
```

5.44.1.15 ok

```
tracking_tif_jpy.ok = trackmate.checkInput()
```

5.44.1.16 rad

```
tracking_tif_jpy.rad = i.getFeature("RADIUS")
```

5.44.1.17 save_analysis_dir

```
str tracking_tif_jpy.save_analysis_dir = dir_tiff + '/' + 'Analysis'
```

5.44.1.18 selectionModel

```
tracking_tif_jpy.selectionModel = SelectionModel(model)
```

5.44.1.19 settings

```
tracking_tif_jpy.settings = Settings()
```

5.44.1.20 spamWriter

```
tracking_tif_jpy.spamWriter = csv.writer(f, delimiter=',')
```

5.44.1.21 std

```
tracking_tif_jpy.std = i.getFeature("STANDARD_DEVIATION")
```

5.44.1.22 str_name_fil

```
str tracking_tif_jpy.str_name_fil = root + '/' + files [z]
```

5.44.1.23 trackerFactory

```
tracking_tif_jpy.trackerFactory
```

5.44.1.24 trackerSettings

```
tracking_tif_jpy.trackerSettings
```

5.44.1.25 trackmate

```
tracking_tif_jpy.trackmate = TrackMate(model, settings)
```

5.44.1.26 x

```
tracking_tif_jpy.x = i.getFeature("POSITION_X")
```

5.44.1.27 y

```
tracking_tif_jpy.y = i.getFeature("POSITION_Y")
```

5.45 tracking_tif_jpy_track Namespace Reference

Variables

- str dir_tiff = '/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_data'
- list files = ["Hurst_0.5_Diff_1e-2_seg.tiff"]
- str root = dir_tiff
- str save_analysis_dir = dir_tiff + '/' + 'Analysis'
- str str_name_fil = root + '/' + files[z]
- imp = IJ.openImage(str_name_fil)
- dims = imp.getDimensions();
- model = Model()
- settings = Settings()
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- initialSpotFilterValue
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- selectionModel = SelectionModel(model)
- displayer = HyperStackDisplayer(model, selectionModel, imp)
- int go = 0
- fm = model.getFeatureModel()
- a = model.getSpots().iterator(True)
- str cd = "/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_data"
- v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- track = model.getTrackModel().trackSpots(id)
- sid = spot.ID()
- x = spot.getFeature('POSITION_X')
- y = spot.getFeature('POSITION_Y')
- t = spot.getFeature('FRAME')
- rad = spot.getFeature('RADIUS')
- q = spot.getFeature('QUALITY')
- snr = spot.getFeature('SNR')
- mean = spot.getFeature('MEAN_INTENSITY')
- str dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] + '.tif_spots' +'.csv'
- spamWriter = csv.writer(f, delimiter=',')

5.45.1 Variable Documentation

5.45.1.1 a

```
tracking_tif_jpy_track.a = model.getSpots().iterator(True)
```

5.45.1.2 cd

```
str tracking_tif_jpy_track.cd = "/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_data"
```

5.45.1.3 detectorFactory

```
tracking_tif_jpy_track.detectorFactory
```

5.45.1.4 detectorSettings

```
tracking_tif_jpy_track.detectorSettings
```

5.45.1.5 dims

```
tracking_tif_jpy_track.dims = imp.getDimensions();
```

5.45.1.6 dir_name_save_inten

```
str tracking_tif_jpy_track.dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] +
'.tif_spots' +'.csv'
```

5.45.1.7 dir_tiff

```
str tracking_tif_jpy_track.dir_tiff = '/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_↩
data'
```

5.45.1.8 displayer

```
tracking_tif_jpy_track.displayer = HyperStackDisplayer(model, selectionModel, imp)
```

5.45.1.9 files

```
list tracking_tif_jpy_track.files = ["Hurst_0.5_Diff_1e-2_seg.tiff"]
```

5.45.1.10 fm

```
tracking_tif_jpy_track.fm = model.getFeatureModel()
```

5.45.1.11 go

```
int tracking_tif_jpy_track.go = 0
```

5.45.1.12 imp

```
tracking_tif_jpy_track.imp = IJ.openImage(str_name_fil)
```

5.45.1.13 initialSpotFilterValue

```
tracking_tif_jpy_track.initialSpotFilterValue
```

5.45.1.14 mean

```
tracking_tif_jpy_track.mean = spot.getFeature('MEAN_INTENSITY')
```

5.45.1.15 model

```
tracking_tif_jpy_track.model = Model()
```

5.45.1.16 ok

```
tracking_tif_jpy_track.ok = trackmate.checkInput()
```

5.45.1.17 q

```
tracking_tif_jpy_track.q = spot.getFeature('QUALITY')
```

5.45.1.18 rad

```
tracking_tif_jpy_track.rad = spot.getFeature('RADIUS')
```

5.45.1.19 root

```
str tracking_tif_jpy_track.root = dir_tiff
```

5.45.1.20 save_analysis_dir

```
str tracking_tif_jpy_track.save_analysis_dir = dir_tiff + '/' + 'Analysis'
```

5.45.1.21 selectionModel

```
tracking_tif_jpy_track.selectionModel = SelectionModel(model)
```

5.45.1.22 settings

```
tracking_tif_jpy_track.settings = Settings()
```

5.45.1.23 sid

```
tracking_tif_jpy_track.sid = spot.ID()
```

5.45.1.24 snr

```
tracking_tif_jpy_track.snr = spot.getFeature('SNR')
```

5.45.1.25 spamWriter

```
tracking_tif_jpy_track.spamWriter = csv.writer(f, delimiter=',')
```

5.45.1.26 str_name_fil

```
str tracking_tif_jpy_track.str_name_fil = root + '/' + files[z]
```

5.45.1.27 t

```
tracking_tif_jpy_track.t = spot.getFeature('FRAME')
```

5.45.1.28 track

```
tracking_tif_jpy_track.track = model.getTrackModel().trackSpots(id)
```

5.45.1.29 trackerFactory

```
tracking_tif_jpy_track.trackerFactory
```

5.45.1.30 trackerSettings

```
tracking_tif_jpy_track.trackerSettings
```

5.45.1.31 trackmate

```
tracking_tif_jpy_track.trackmate = TrackMate(model, settings)
```

5.45.1.32 v

```
tracking_tif_jpy_track.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
```

5.45.1.33 x

```
tracking_tif_jpy_track.x = spot.getFeature('POSITION_X')
```

5.45.1.34 y

```
tracking_tif_jpy_track.y = spot.getFeature('POSITION_Y')
```

5.46 trackmate_exp Namespace Reference

Variables

- imp = IJ.openImage('/Users/baljyot/Desktop/Baljyot_EXP_RPOC/Scripts/0.tif')
- model = Model()
- settings = Settings()
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- initialSpotFilterValue
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- selectionModel = SelectionModel(model)
- displayer = HyperStackDisplayer(model, selectionModel, imp)
- fm = model.getFeatureModel()
- v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- track = model.getTrackModel().trackSpots(id)
- sid = spot.ID()
- x = spot.getFeature('POSITION_X')
- y = spot.getFeature('POSITION_Y')
- t = spot.getFeature('FRAME')
- q = spot.getFeature('QUALITY')
- snr = spot.getFeature('SNR')
- mean = spot.getFeature('MEAN_INTENSITY')

5.46.1 Variable Documentation

5.46.1.1 detectorFactory

```
trackmate_exp.detectorFactory
```

5.46.1.2 detectorSettings

```
trackmate_exp.detectorSettings
```

5.46.1.3 displayer

```
trackmate_exp.displayer = HyperStackDisplayer(model, selectionModel, imp)
```

5.46.1.4 fm

```
trackmate_exp.fm = model.getFeatureModel()
```

5.46.1.5 imp

```
trackmate_exp.imp = IJ.openImage('/Users/baljyot/Desktop/Baljyot_EXP_RPOC/Scripts/0.tif')
```

5.46.1.6 initialSpotFilterValue

```
trackmate_exp.initialSpotFilterValue
```

5.46.1.7 mean

```
trackmate_exp.mean = spot.getFeature('MEAN_INTENSITY')
```

5.46.1.8 model

```
trackmate_exp.model = Model()
```

5.46.1.9 ok

```
trackmate_exp.ok = trackmate.checkInput()
```

5.46.1.10 q

```
trackmate_exp.q = spot.getFeature('QUALITY')
```

5.46.1.11 selectionModel

```
trackmate_exp.selectionModel = SelectionModel(model)
```

5.46.1.12 settings

```
trackmate_exp.settings = Settings()
```

5.46.1.13 sid

```
trackmate_exp.sid = spot.ID()
```

5.46.1.14 snr

```
trackmate_exp.snr = spot.getFeature('SNR')
```

5.46.1.15 t

```
trackmate_exp.t = spot.getFeature('FRAME')
```

5.46.1.16 track

```
trackmate_exp.track = model.getTrackModel().trackSpots(id)
```

5.46.1.17 trackerFactory

```
trackmate_exp.trackerFactory
```

5.46.1.18 trackerSettings

```
trackmate_exp.trackerSettings
```

5.46.1.19 trackmate

```
trackmate_exp.trackmate = TrackMate(model, settings)
```

5.46.1.20 v

```
trackmate_exp.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
```

5.46.1.21 x

```
trackmate_exp.x = spot.getFeature('POSITION_X')
```

5.46.1.22 y

```
trackmate_exp.y = spot.getFeature('POSITION_Y')
```

5.47 trackmate_scripting Namespace Reference

Variables

- imp = IJ.openImage('https://fiji.sc/samples/FakeTracks.tif')
- model = Model()
- settings = Settings(imp)
- detectorFactory
- detectorSettings
- trackerFactory
- trackerSettings
- initialSpotFilterValue
- trackmate = TrackMate(model, settings)
- ok = trackmate.checkInput()
- sm = SelectionModel(model)
- ds = DisplaySettingsIO.readUserDefault()
- displayer = HyperStackDisplayer(model, sm, imp, ds)
- fm = model.getFeatureModel()
- v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- track = model.getTrackModel().trackSpots(id)
- sid = spot.ID()
- x = spot.getFeature('POSITION_X')
- y = spot.getFeature('POSITION_Y')
- t = spot.getFeature('FRAME')
- q = spot.getFeature('QUALITY')
- snr = spot.getFeature('SNR_CH1')
- mean = spot.getFeature('MEAN_INTENSITY_CH1')

5.47.1 Variable Documentation

5.47.1.1 detectorFactory

```
trackmate_scripting.detectorFactory
```

5.47.1.2 detectorSettings

```
trackmate_scripting.detectorSettings
```

5.47.1.3 displayer

```
trackmate_scripting.displayer = HyperStackDisplayer( model, sm, imp, ds )
```

5.47.1.4 ds

```
trackmate_scripting.ds = DisplaySettingsIO.readUserDefault()
```

5.47.1.5 fm

```
trackmate_scripting.fm = model.getFeatureModel()
```

5.47.1.6 imp

```
trackmate_scripting.imp = IJ.openImage('https://fiji.sc/samples/FakeTracks.tif')
```

5.47.1.7 initialSpotFilterValue

```
trackmate_scripting.initialSpotFilterValue
```

5.47.1.8 mean

```
trackmate_scripting.mean = spot.getFeature('MEAN_INTENSITY_CH1')
```

5.47.1.9 model

```
trackmate_scripting.model = Model()
```

5.47.1.10 ok

```
trackmate_scripting.ok = trackmate.checkInput()
```

5.47.1.11 q

```
trackmate_scripting.q = spot.getFeature('QUALITY')
```

5.47.1.12 settings

```
trackmate_scripting.settings = Settings(imp)
```

5.47.1.13 sid

```
trackmate_scripting.sid = spot.ID()
```

5.47.1.14 sm

```
trackmate_scripting.sm = SelectionModel( model )
```

5.47.1.15 snr

```
trackmate_scripting.snr = spot.getFeature('SNR_CH1')
```

5.47.1.16 t

```
trackmate_scripting.t = spot.getFeature('FRAME')
```

5.47.1.17 track

```
trackmate_scripting.track = model.getTrackModel().trackSpots(id)
```

5.47.1.18 trackerFactory

```
trackmate_scripting.trackerFactory
```

5.47.1.19 trackerSettings

```
trackmate_scripting.trackerSettings
```

5.47.1.20 trackmate

```
trackmate_scripting.trackmate = TrackMate(model, settings)
```

5.47.1.21 v

```
trackmate_scripting.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
```

5.47.1.22 x

```
trackmate_scripting.x = spot.getFeature('POSITION_X')
```

5.47.1.23 y

```
trackmate_scripting.y = spot.getFeature('POSITION_Y')
```

5.48 utility_database Namespace Reference

Classes

- class Counter_start_stop

Variables

- list ALLOWED_START_TYPES = [int,float]

5.48.1 Variable Documentation

5.48.1.1 ALLOWED_START_TYPES

```
list utility_database.ALLOWED_START_TYPES = [int,float]
```

Chapter 6

Class Documentation

6.1 SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage Class Reference

Public Member Functions

- None __init__ (self, name, track_class_type, storage_data)
- ensemble_angles (self)
- ensemble_angles (self, ensemble_angles)
- track_angles (self)
- track_angles (self, track_angles)
- track_lengths (self)
- track_lengths (self, track_lengths)
- track_storage (self)
- track_storage (self, track_storage)

Public Attributes

- name
- track_class_type
- storage_data

Protected Member Functions

- _store_data (self)

Protected Attributes

- _ensemble_angles
- _track_angles
- _track_lengths
- _track_storage

6.1.1 Constructor & Destructor Documentation

6.1.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.__↩
init__ (
              self,
              name,
              track_class_type,
              storage_data)
```

6.1.2 Member Function Documentation

6.1.2.1 _store_data()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage._store_data
(
              self)  [protected]
```

6.1.2.2 ensemble_angles() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.ensemble_↩
angles (
              self)
```

6.1.2.3 ensemble_angles() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.ensemble_↩
angles (
              self,
              ensemble_angles)
```

6.1.2.4 track_angles() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_angles
(
              self)
```

6.1.2.5 track_angles() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_angles
(
              self,
              track_angles)
```

6.1.2.6 track_lengths() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_↩
lengths (
              self)
```

6.1.2.7 track_lengths() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_↩
lengths (
              self,
              track_lengths)
```

6.1.2.8 track_storage() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_↩
storage (
              self)
```

6.1.2.9 track_storage() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_↩
storage (
              self,
              track_storage)
```

6.1.3 Member Data Documentation

6.1.3.1 _ensemble_angles

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage._ensemble_↩
angles  [protected]
```

6.1.3.2 _track_angles

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage._track_↩
angles  [protected]
```

6.1.3.3 _track_lengths

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage._track_↩
lengths  [protected]
```

6.1.3.4 _track_storage

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage._track_↩
storage  [protected]
```

6.1.3.5 name

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.name
```

6.1.3.6 storage_data

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.storage_data
```

6.1.3.7 track_class_type

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage.track_↩
class_type
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/angle_between_vectors.py

6.2 SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.↩ blob_detection Class Reference

Public Member Functions

- __init__ (self, path, median=False, threshold=0.0005, min_sigma=1.0, max_sigma=1.5, num_sigma=500, overlap=1., logscale=False, verbose=False, exclude_border=False)
- open_file (self)
- detection (self, type='skimage', ∗∗kwargs)
- blob_logv2 (self, image, min_sigma=1, max_sigma=50, num_sigma=10, threshold=.2, overlap=.↩ 5, log_scale=False, ∗, exclude_border=False, ∗∗kwargs)
- initalize_2dgaus (self, ∗∗kwargs)

Public Attributes

- img
- median
- threshold
- min_sigma
- max_sigma
- num_sigma
- overlap
- log_scale
- median_filter_size
- fitting_parameters
- verbose

Protected Member Functions

- _update_fitting_parameters (self, kwargs={})
- _prune_blobs (self, blobs_array, overlap, ∗, sigma_dim=1, ∗∗kwargs)
- _update_blob_estimate (self, blobs_pruned, fit_object, radius_func=None)
- _create_mask (self, img, coords, size, sigma_indx)
- _gaussian_mesh_helper (self, mesh_2d, initial_xy, sub_arr=[3, 3])

6.2.1 Detailed Description

```
Parameters TODO
----------
Path : string
    Full path of the image to be read
median : bool
    if true apply a median filter to the image before blog detection
threshold : float
    threshold for the blob detection
min_sigma : float
    Minimum value of the gaussian sigma for the blobs
max_sigma : float
    Maximum value of the gaussian sigma for the blobs
num_sigma : int
    Eqidistant values between min_sigma and max_sigma to consider
overlap : float
    Allowed overlap of identified blobs. If 1, full overlap is allowed

Methods TODO
-------
open_file()
    opens the file and applied media filter if true
    retuns an array
detection()
    applies blob detection using np.blob_log
    returns array of blob attributes or dictionary of blob attributes
Notes
-----
theory: https://www.cse.psu.edu/~rtc12/CSE586/lectures/featureExtractionPart2_6pp.pdf
https://cvgl.stanford.edu/teaching/cs231a_winter1415/lecture/lecture10_detector_descriptors_2015_notes.pdf
```

6.2.2 Constructor & Destructor Documentation

6.2.2.1 __init__()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.__init__ (
              self,
              path,
              median = False,
              threshold = 0.0005,
              min_sigma = 1.0,
              max_sigma = 1.5,
              num_sigma = 500,
              overlap = 1.,
              logscale = False,
              verbose = False,
              exclude_border = False)
```

```
Initilizes the class object with the parameters for the blob detection

Parameters:
-----------
Path : string or 2d array
    Full path of the image to be read or the 2d array of the image
median : bool
    if true apply a median filter to the image before blog detection
threshold : float
    threshold for the blob detection
min_sigma : float
    Minimum value of the gaussian sigma for the blobs
max_sigma : float
    Maximum value of the gaussian sigma for the blobs
num_sigma : int
    Eqidistant values between min_sigma and max_sigma to consider
overlap : float
    Allowed overlap of identified blobs. If 1, full overlap is allowed
logscale : bool
    if True, use a log scale for the sigma values
verbose : bool
    if True, return out the parameters used for the blob detection and fitting
exclude_border : tuple of ints, int, or False, optional, Default is False.
    If tuple of ints, the length of the tuple must match the input array's
    dimensionality.  Each element of the tuple will exclude peaks from
    within `exclude_border`-pixels of the border of the image along that
    dimension.
    If nonzero int, `exclude_border` excludes peaks from within
    `exclude_border`-pixels of the border of the image.
    If zero or False, peaks are identified regardless of their
    distance from the border. See method "blob_logv2" for more info
Notes:
------
1. The blob detection is done using the skimage.blob_log() function or a custom function. The custom function
2. To use the custom function, call the method detection() with the argument type='bp' else the default is 'sk
```

6.2.3 Member Function Documentation

6.2.3.1 _create_mask()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection._create_mask (
self,
img,
coords,
size,
sigma_indx) [protected]

```
mask of the image at the center point of the pixel coordinate. Also applies the fits
TODO make this modular and seperate the mask creation and the fitting to allow better user control.

Parameters
----------
img : 2D array
    array defining the image
coords : (N,3) array
    array defining the [x,y,radius] of the blobs
size : int
    size of the square box around coord[:2] in which to fit
sigma_indx : N array
    array defining the index of the sigmas used for each blob in coords

Returns
-------
lmfit.minimize.fit objects in a list: [object, object, ... ]
    the fit objects created by lmfit.minizie for each coord.
```

```
Raises
------
TypeError
    "size needs to an integer value"
Exception
    "simga_indx needs to be same shape as coords"
```

6.2.3.2 _gaussian_mesh_helper()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection._gaussian_mesh_helper (
self,
mesh_2d,
initial_xy,
sub_arr = [3,3]) [protected]

```
takes a 2d_mesh (image data) and a bounding box to return a list of (x,y,z) in that bounding box
box is implimented from the center point of the pixel. this function works similar to Analysis_functions.subar

Parameters
----------
mesh_2d : 2D array
    image data in 2D array format
initial_xy : tuple or array-like of len 2
    [x,y] coordinate of the center point around which to create the subarray
sub_arr : tuple or 1D array, optional
    the grid size from the center to create the mesh, by default [3,3]

Returns
-------
1D list
    array containing:
        x,y: the x,y coordinates of the meshgrid
        mesh_view: subarray defined from the original image
        centers: centers of the mesh
```

6.2.3.3 _prune_blobs()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection._prune_blobs (
self,
blobs_array,
overlap,
* ,
sigma_dim = 1,
** *kwargs*) [protected]

```
Eliminated blobs with area overlap. UPDATED: compared to the skimage implimentation this prunes based on the
maximum value of the laplacian of the blobs rather than if the blob is bigger or not.

Parameters
----------
blobs_array : ndarray
    A 2d array with each row representing 3 (or 4) values,
    ``(row, col, sigma)`` or ``(pln, row, col, sigma)`` in 3D,
    where ``(row, col)`` (``(pln, row, col)``) are coordinates of the blob
    and ``sigma`` is the standard deviation of the Gaussian kernel which
    detected the blob.
    This array must not have a dimension of size 0.
overlap : float
    A value between 0 and 1. If the fraction of area overlapping for 2
```

```
    blobs is greater than 'overlap' the smaller blob is eliminated.
sigma_dim : int, optional
    The number of columns in ''blobs_array'' corresponding to sigmas rather
    than positions.

KWARGS
------
max_lap: N-array
    array of values for each blob indicating the max value of the laplacian that created it
sigma_indx: n-array
    array of indexes of the sigmas for the blob, this is just inputted for conveniecne in later calulations. N

Returns
-------
A : ndarray
    'array' with overlapping blobs removed.

Notes
-----
Example: blob1 = [100,100,3], blob2 = [101,101,3]
max_lap = [1,2]. If the overlap is larger than the threshold used then blob2 is choosen because it produces a
```

6.2.3.4 _update_blob_estimate()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection._update_blob_estimate (
self,
blobs_pruned,
fit_object,
radius_func = None) [protected]

```
Using fitted parameters update the esimates of the centroid and sigmas for blob fit

Parameters
----------
blobs_pruned: (ndarry)
    output from self._prune_blobs()
fit_object: (lmfit.minimize.fit object)
    instances of the .fit object from lmfit's minimize
radius_func: (functional, optional)
    Which function to use to remap anisotropic sigmas into isotropic sigma. Defaults to None.


Returns
-------
(N,3) array
    first output is [(x,y,s),...] of the blobs updates
(N,3) array
    second is the original blobs inputed for comparison
```

6.2.3.5 _update_fitting_parameters()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection._update_fitting_↩
parameters (
self,
kwargs = {}) [protected]

```
Updates the fitting_parameters to be used in each iteration of this class object

Kwargs
------
mask_size: int
    when fitting the image with a function this is size of square round a reference point to use for fit
residual_func: functional
    function to use when defining the residuals for the fitting
fit_method: string, default 'least squares'
    method of the fitting to use
radius_func: functional, default numpy.mean
    function to use as a method to take two sigams and convert to one radius
plot_fit: bool
    if True, plots each fit with the fit statistics
centroid_range: int or float-like
    controls the bounds on the fit for the centroid (x,y). Ie: the min fit is x-centroid_range, and max is x+c
    same for y.
sigma_range: int or float-like
    controls the bounds on the fit for the sigmas (s_x,s_y). Ie: the min fit is s_x-sigma_range, and max is s_
    same for y.
fitting_image: string
    if "Original" use the original image to fit function
    else use the Laplacian image created with the sigma that maximized the laplacian

Notes
-----
Some of these expect a certain type to work. This is not fully coded yet and might break if you give inputs wh
to it.
```

6.2.3.6 blob_logv2()

SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.blob_logv2 (
self,
image,
min_sigma = 1,
max_sigma = 50,
num_sigma = 10,
threshold = .2,
overlap = .5,
log_scale = False,
* ,
exclude_border = False,
** *kwargs*)

```
Finds blobs in the given grayscale image. Adapted from the implimentation of skimage blob-log:
https://scikit-image.org/docs/stable/auto_examples/features_detection/plot_blob.html

Blobs are found using the Laplacian of Gaussian (LoG) method [1]_.
For each blob found, the method returns its coordinates and the standard
deviation of the Gaussian kernel that detected the blob.

Parameters
----------
image : 2D or 3D ndarray
    Input grayscale image, blobs are assumed to be light on dark
    background (white on black).
min_sigma : scalar or sequence of scalars, optional
    the minimum standard deviation for Gaussian kernel. Keep this low to
    detect smaller blobs. The standard deviations of the Gaussian filter
    are given for each axis as a sequence, or as a single number, in
    which case it is equal for all axes.
max_sigma : scalar or sequence of scalars, optional
    The maximum standard deviation for Gaussian kernel. Keep this high to
    detect larger blobs. The standard deviations of the Gaussian filter
    are given for each axis as a sequence, or as a single number, in
```

```
    which case it is equal for all axes.
num_sigma : int, optional
    The number of intermediate values of standard deviations to consider
    between `min_sigma` and `max_sigma`.
threshold : float, optional.
    The absolute lower bound for scale space maxima. Local maxima smaller
    than thresh are ignored. Reduce this to detect blobs with less
    intensities.
overlap : float, optional
    A value between 0 and 1. If the area of two blobs overlaps by a
    fraction greater than `threshold`, the blob with the smaller maximum
    laplacian value is eliminated. If set to 1, then all overlapping blobs
    are kept.
log_scale : bool, optional
    If set intermediate values of standard deviations are interpolated
    using a logarithmic scale to the base `10`. If not, linear
    interpolation is used.
exclude_border : tuple of ints, int, or False, optional
    If tuple of ints, the length of the tuple must match the input array's
    dimensionality.  Each element of the tuple will exclude peaks from
    within `exclude_border`-pixels of the border of the image along that
    dimension.
    If nonzero int, `exclude_border` excludes peaks from within
    `exclude_border`-pixels of the border of the image.
    If zero or False, peaks are identified regardless of their
    distance from the border.

Returns
-------
A : (n, image.ndim + sigma) ndarray
    A 2d array with each row representing 2 coordinate values for a 2D
    image, and 3 coordinate values for a 3D image, plus the sigma(s) used.
    When a single sigma is passed, outputs are:
    ``(r, c, sigma)`` or ``(p, r, c, sigma)`` where ``(r, c)`` or
    ``(p, r, c)`` are coordinates of the blob and ``sigma`` is the standard
    deviation of the Gaussian kernel which detected the blob. When an
    anisotropic gaussian is used (sigmas per dimension), the detected sigma
    is returned for each dimension.

References
----------
.. [1] https://en.wikipedia.org/wiki/Blob_detection#The_Laplacian_of_Gaussian

Examples
--------
>>> from skimage import data, feature, exposure
>>> img = data.coins()
>>> img = exposure.equalize_hist(img)  # improves detection
>>> feature.blob_log(img, threshold = .3)
array([[124.        , 336.        ,  11.88888889],
    [198.        , 155.        ,  11.88888889],
    [194.        , 213.        ,  17.33333333],
    [121.        , 272.        ,  17.33333333],
    [263.        , 244.        ,  17.33333333],
    [194.        , 276.        ,  17.33333333],
    [266.        , 115.        ,  11.88888889],
    [128.        , 154.        ,  11.88888889],
    [260.        , 174.        ,  17.33333333],
    [198.        , 103.        ,  11.88888889],
    [126.        , 208.        ,  11.88888889],
    [127.        , 102.        ,  11.88888889],
    [263.        , 302.        ,  17.33333333],
    [197.        ,  44.        ,  11.88888889],
    [185.        , 344.        ,  17.33333333],
    [126.        ,  46.        ,  11.88888889],
    [113.        , 323.        ,   1.        ]])

Notes
-----
The radius of each blob is approximately :math:`\sqrt{2}\sigma` for
a 2-D image and :math:`\sqrt{3}\sigma` for a 3-D image.
```

6.2.3.7 detection()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.detection (
              self,
              type = 'skimage',
             ** kwargs)
```

```
Applies the blob_log scheme to detect blobs in an image using the parameters of this class object
Full list see __init__().__doc__

Parameters
----------
type: string
    if "bp" use the custom blob_logv2() elif "skimage" use the skimage implimentation of blob_log

Returns
-------
if verbose is True: return type is a dictionary
    returns a dictionary of the parameters used for the blob detection and fitting and the fitted objects
else: return type is a numpy array of size 3 tuples
    returns the scale space blobs found in the image

Notes:
------
1. For 2D images the blob radius estimate is the standard deviation of the gaussian fit to the image times sqr
2. Scale fits are isotropic
3. Fitted fits are anisotropic and are size 4 tuples with simga_x and sigma_y
```

6.2.3.8 initalize_2dgaus()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.initalize_2dgaus (
              self,
             ** kwargs)
```

```
initalizes lmfit parameters

Returns
-------
Parameter() class object
    class object defining the parameters with bounds for the fit later on
```

6.2.3.9 open_file()

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.open_file (
              self)
```

```
Opens and retuns array of the image data

Parameters
----------
self.img: string of a path or path object, or 2D image
    if path provided opens the file and reads in image data to apply filter or applies filter is self.img is 2
self.median: bool
    if True applies a median filter of size self.median_filter_size before returning 2D array


Returns
-------
array-like
    2D array of the image data
```

6.2.4 Member Data Documentation

6.2.4.1 fitting_parameters

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.fitting_parameters`

6.2.4.2 img

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.img`

6.2.4.3 log_scale

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.log_scale`

6.2.4.4 max_sigma

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.max_sigma`

6.2.4.5 median

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.median`

6.2.4.6 median_filter_size

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.median_filter_size`

6.2.4.7 min_sigma

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.min_sigma`

6.2.4.8 num_sigma

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.num_sigma`

6.2.4.9 overlap

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.overlap`

6.2.4.10 threshold

`SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.threshold`

6.2.4.11 verbose

```
SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection.verbose
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/clusterMethods/blob_detection.py

6.3 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.↩ boundary_analysis Class Reference

Public Member Functions

- None __init__ (self, **kwargs)
- directional_displacement_bulk (self, **kwargs)

Static Public Member Functions

- directional_displacement (collection_traj, cell_obj)
- plot_directional_displacements (**kwargs)

Public Attributes

- dataset

Static Protected Member Functions

- _xy_angle_from_drop (collection_traj, cell_obj)
- _track_to_closest_drop (x, y, drops)
- _directional_variableTracks (x, y, drops)
- _directional_displacement_utility (obj)

6.3.1 Detailed Description

```
TODO - make this better
class for storing analysis intermediates and boundary analysis
```

6.3.2 Constructor & Destructor Documentation

6.3.2.1 __init__()

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis.__init__ (
            self,
           ** kwargs)
```

6.3.3 Member Function Documentation

6.3.3.1 _directional_displacement_utility()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis._directional_←
displacement_utility (
              obj) [static], [protected]
```

6.3.3.2 _directional_variableTracks()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis._directional_←
variableTracks (
              x,
              y,
              drops) [static], [protected]
```

6.3.3.3 _track_to_closest_drop()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis._track_to_closest←
_drop (
              x,
              y,
              drops) [static], [protected]
```

```
for a track defined by x,y returns the closest circle it is from a collenction of circles [[d_x,d_y,d_r],...]
```

6.3.3.4 _xy_angle_from_drop()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis._xy_angle_from_drop
(
              collection_traj,
              cell_obj) [static], [protected]
```

6.3.3.5 directional_displacement()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis.directional_←
displacement (
              collection_traj,
              cell_obj) [static]
```

6.3.3.6 directional_displacement_bulk()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis.directional_←
displacement_bulk (
              self,
             ** kwargs)
```

```
return the directional_displacement vs distance from center with angles
```

6.3.3.7 plot_directional_displacements()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis.plot_directional_↩
displacements (
            ** kwargs)  [static]
```

6.3.4 Member Data Documentation

6.3.4.1 dataset

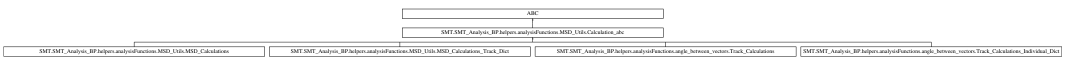
```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis.dataset
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/trajectory_analysis_script.py

6.4 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.↩ Calculation_abc Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc:



Public Member Functions

- None __init__ (self, float pixel_size, float frame_length, str pixel_unit, str frame_unit)
- pixel_size (self)
- frame_length (self)
- pixel_unit (self)
- frame_unit (self)
- combined_store (self)
- individual_store (self)

Public Attributes

- pixel_size
- frame_length
- pixel_unit
- frame_unit

Protected Member Functions

- _initialized_print_warning (self)

Protected Attributes

- _pixel_size
- _frame_length
- _pixel_unit
- _frame_unit

6.4.1 Detailed Description

```
Abstract base class for Calculations
Will only inforce pixel size, units and frame length, units
```

6.4.2 Constructor & Destructor Documentation

6.4.2.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.__init__ (
             self,
            float pixel_size,
            float frame_length,
            str pixel_unit,
            str frame_unit)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations, SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict, SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations, and SMT.SMT_Analysis_BP.helpers.analysisFuncti

6.4.3 Member Function Documentation

6.4.3.1 _initialized_print_warning()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc._initialized_print_↩
warning (
             self) [protected]
```

6.4.3.2 combined_store()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.combined_store (
             self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations, SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations, SMT.SMT_Analysis_BP.helpers.analy SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict, SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations, SMT.SMT_Analysis_BP.helpers.analysisFunctions. SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict, and SMT.SMT_Analysis_BP.helpers.an

6.4.3.3 frame_length()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.frame_length (
             self)
```

6.4.3.4 frame_unit()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.frame_unit (
              self)
```

6.4.3.5 individual_store()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.individual_store (
              self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations, SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations, SMT.SMT_Analysis_BP.helpers.analy
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict,
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations, SMT.SMT_Analysis_BP.helpers.analysisFunctions.
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict, and SMT.SMT_Analysis_BP.helpers.an

6.4.3.6 pixel_size()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.pixel_size (
              self)
```

6.4.3.7 pixel_unit()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.pixel_unit (
              self)
```

6.4.4 Member Data Documentation

6.4.4.1 _frame_length

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc._frame_length  [protected]
```

6.4.4.2 _frame_unit

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc._frame_unit  [protected]
```

6.4.4.3 _pixel_size

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc._pixel_size  [protected]
```

6.4.4.4 _pixel_unit

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc._pixel_unit  [protected]
```

6.4.4.5 frame_length

`SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.frame_length`

6.4.4.6 frame_unit

`SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.frame_unit`

6.4.4.7 pixel_size

`SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.pixel_size`

6.4.4.8 pixel_unit

`SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.pixel_unit`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/MSD_Utils.py

6.5 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell Class Reference

Public Member Functions

- __init__ (self, Cell_ID, Cell_Movie_Name, bounding_box=0, r_offset=0, cell_area=0, cell_center=0, cell_long_axis=0, cell_short_axis=0, cell_axis_lengths=0, cell_mask=0, Cell_Nucleoid_Mask=0)
- dict points_per_frame (self)
- None points_per_frame (self, dict points_per_frame)
- dict area_of_points_per_frame (self)
- None area_of_points_per_frame (self, dict area_of_points_per_frame)
- dict density_per_frame (self)
- float nucleoid_area (self)
- None nucleoid_area (self, float|int nucleoid_area)

Public Attributes

- Cell_ID
- Cell_Movie_Name
- Cell_Nucleoid_Mask
- cell_mask
- cell_area
- cell_center
- bounding_box
- r_offset
- cell_long_axis
- cell_short_axis
- cell_axis_lengths
- Trajectory_Collection
- No_Drops_Trajectory_Collection
- Drop_Collection
- Drop_Verbose
- All_Drop_Collection
- All_Drop_Verbose
- All_Tracjectories
- raw_tracks
- sorted_tracks_frame
- area_of_points_per_frame

Protected Member Functions

- _convert_viableDrop_list (self, subframes=5)

Protected Attributes

- _points_per_frame
- _area_of_points_per_frame
- _density_per_frame
- _nucleoid_area

6.5.1 Detailed Description

```
each cell class is built of two main things:
1) A dictionary of drops (x,y,r) identified by a label (0,1,...,n)
2) A collection of Trajectory class objects defining the trajectories in that Cell class object

Parameters
----------
__init__:
    Cell_ID: int
        unique identifier for each cell
    Cell_Movie_Name: string
        name of the movie the cell is in, used to find the movie. This is the name of the movie file!
    bounding_box: list of 4 ints
        coordinates of the bounding box of the cell
    r_offset: list of 2 ints
        coordinate of the top left corner of the bounding box
    cell_area: int
        area of the cell
    cell_center: list of 2 ints
        coordinates of the center of the cell
    cell_long_axis: int
```

```
            length of the long axis of the cell
        cell_short_axis: int
            length of the short axis of the cell
        cell_axis_lengths: list of 2 ints
            lengths of the long and short axis of the cell
        cell_mask: 2D array of bools
            mask of the cell
        Cell_Nucleoid_Mask: 2D array of bools
            mask of the nucleoid in the cell

    Methods:
    -----------
    __init__:
        Initialize the Cell class object
    _convert_viableDrop_list(self):
        converts the viableDrop_list to a dictionary of viable drops
```

6.5.2 Constructor & Destructor Documentation

6.5.2.1 __init__()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.__init__ (
              self,
              Cell_ID,
              Cell_Movie_Name,
              bounding_box = 0,
              r_offset = 0,
              cell_area = 0,
              cell_center = 0,
              cell_long_axis = 0,
              cell_short_axis = 0,
              cell_axis_lengths = 0,
              cell_mask = 0,
              Cell_Nucleoid_Mask = 0)
```

6.5.3 Member Function Documentation

6.5.3.1 _convert_viableDrop_list()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell._convert_viableDrop_list (
              self,
              subframes = 5)  [protected]
```

6.5.3.2 area_of_points_per_frame() [1/2]

```
dict SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.area_of_points_per_frame (
              self)
```

6.5.3.3 area_of_points_per_frame() [2/2]

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.area_of_points_per_frame (
              self,
             dict area_of_points_per_frame)
```

6.5.3.4 density_per_frame()

```
dict SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.density_per_frame (
              self)
```

6.5.3.5 nucleoid_area() [1/2]

```
float SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.nucleoid_area (
              self)
```

6.5.3.6 nucleoid_area() [2/2]

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.nucleoid_area (
              self,
             float|int nucleoid_area)
```

6.5.3.7 points_per_frame() [1/2]

```
dict SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.points_per_frame (
              self)
```

6.5.3.8 points_per_frame() [2/2]

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.points_per_frame (
              self,
             dict points_per_frame)
```

6.5.4 Member Data Documentation

6.5.4.1 _area_of_points_per_frame

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell._area_of_points_per_frame  [protected]
```

6.5.4.2 _density_per_frame

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell._density_per_frame  [protected]
```

6.5.4.3 _nucleoid_area

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell._nucleoid_area  [protected]
```

6.5.4.4 _points_per_frame

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell._points_per_frame  [protected]
```

6.5.4.5 All_Drop_Collection

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.All_Drop_Collection

6.5.4.6 All_Drop_Verbose

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.All_Drop_Verbose

6.5.4.7 All_Tracjectories

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.All_Tracjectories

6.5.4.8 area_of_points_per_frame

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.area_of_points_per_frame

6.5.4.9 bounding_box

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.bounding_box

6.5.4.10 cell_area

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_area

6.5.4.11 cell_axis_lengths

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_axis_lengths

6.5.4.12 cell_center

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_center

6.5.4.13 Cell_ID

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Cell_ID

6.5.4.14 cell_long_axis

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_long_axis

6.5.4.15 cell_mask

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_mask`

6.5.4.16 Cell_Movie_Name

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Cell_Movie_Name`

6.5.4.17 Cell_Nucleoid_Mask

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Cell_Nucleoid_Mask`

6.5.4.18 cell_short_axis

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.cell_short_axis`

6.5.4.19 Drop_Collection

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Drop_Collection`

6.5.4.20 Drop_Verbose

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Drop_Verbose`

6.5.4.21 No_Drops_Trajectory_Collection

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.No_Drops_Trajectory_Collection`

6.5.4.22 r_offset

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.r_offset`

6.5.4.23 raw_tracks

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.raw_tracks`

6.5.4.24 sorted_tracks_frame

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.sorted_tracks_frame`

6.5.4.25 Trajectory_Collection

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell.Trajectory_Collection`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/trajectory_analysis_script.py

6.6 SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls Class Reference

Public Member Functions

- __init__ (self, func)
- __call__ (self, ∗args, ∗∗kwargs)

Public Attributes

- func
- num_calls

6.6.1 Detailed Description

```
Count how many times a function is called
```

6.6.2 Constructor & Destructor Documentation

6.6.2.1 __init__()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls.__init__ (
              self,
              func)
```

6.6.3 Member Function Documentation

6.6.3.1 __call__()

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls.__call__ (
              self,
             * args,
             ** kwargs)
```

6.6.4 Member Data Documentation

6.6.4.1 func

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls.func
```

6.6.4.2 num_calls

```
SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls.num_calls
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
  BP/helpers/misc/decorators.py

6.7 utility_database.Counter_start_stop Class Reference

Public Member Functions

- __init__ (self, start, increment=1)
- __call__ (self)
- reset (self)

Public Attributes

- start
- increment
- counter

6.7.1 Constructor & Destructor Documentation

6.7.1.1 __init__()

```
utility_database.Counter_start_stop.__init__ (
        self,
        start,
        increment = 1)
```

6.7.2 Member Function Documentation

6.7.2.1 __call__()

```
utility_database.Counter_start_stop.__call__ (
        self)
```

6.7.2.2 reset()

```
utility_database.Counter_start_stop.reset (
              self)
```

6.7.3 Member Data Documentation

6.7.3.1 counter

```
utility_database.Counter_start_stop.counter
```

6.7.3.2 increment

```
utility_database.Counter_start_stop.increment
```

6.7.3.3 start

```
utility_database.Counter_start_stop.start
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/utilities/utility_database.py

6.8 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.↩ DatabaseOrderUtil Class Reference

Public Member Functions

- __init__ (self, list|None data_set_RA=None, float pixel_to_um=0.13, float frame_to_seconds=0.02, ∗∗kwargs)
- data_set_RA (self)
- data_set_RA (self, list data_set_RA)
- data_set_number (self)
- data_set_names (self)
- data_set_parameters (self)
- track_dict_bulk_list (self)
- combined_track_dict_bulk (self)
- pixel_to_um (self)
- pixel_to_um (self, float pixel_to_um)
- frame_to_seconds (self)
- frame_to_seconds (self, float frame_to_seconds)

Public Attributes

- data_set_RA
- pixel_to_um
- frame_to_seconds

Protected Member Functions

- _get_data_RA (self, list dataset)

Protected Attributes

- _data_set_RA
- _track_dict_bulk_list
- _combined_track_dict_bulk
- _pixel_to_um
- _frame_to_seconds

6.8.1 Detailed Description

```
lets create a generic MSD analysis class which will store all the MSD analysis for a single dataset or multipl
using encapsulation we will utilize smaller functions to do the analysis
```

6.8.2 Constructor & Destructor Documentation

6.8.2.1 __init__()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.__init__ (
              self,
             list|None data_set_RA = None,
             float pixel_to_um = 0.13,
             float frame_to_seconds = 0.02,
             ** kwargs)
```

```
Parameters:
-----------
data_set_RA: list
    list of tas.run_analysis objects
pixel_to_um: float
    pixel to um conversion
frame_to_seconds: float
    frame to seconds conversion
```

6.8.3 Member Function Documentation

6.8.3.1 _get_data_RA()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._get_data_RA (
              self,
             list dataset)  [protected]
```

6.8.3.2 combined_track_dict_bulk()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.combined_track_↩
dict_bulk (
              self)
```

6.8.3.3 data_set_names()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_names (
             self)
```

6.8.3.4 data_set_number()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_number (
             self)
```

6.8.3.5 data_set_parameters()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_parameters
(
             self)
```

6.8.3.6 data_set_RA() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_RA (
             self)
```

6.8.3.7 data_set_RA() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_RA (
             self,
            list data_set_RA)
```

6.8.3.8 frame_to_seconds() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.frame_to_seconds (
             self)
```

6.8.3.9 frame_to_seconds() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.frame_to_seconds (
             self,
            float frame_to_seconds)
```

6.8.3.10 pixel_to_um() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.pixel_to_um (
             self)
```

6.8.3.11 pixel_to_um() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.pixel_to_um (
              self,
             float pixel_to_um)
```

6.8.3.12 track_dict_bulk_list()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.track_dict_bulk_list
(
              self)
```

6.8.4 Member Data Documentation

6.8.4.1 _combined_track_dict_bulk

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._combined_track_↩
dict_bulk  [protected]
```

6.8.4.2 _data_set_RA

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._data_set_RA  [protected]
```

6.8.4.3 _frame_to_seconds

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._frame_to_seconds
[protected]
```

6.8.4.4 _pixel_to_um

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._pixel_to_um  [protected]
```

6.8.4.5 _track_dict_bulk_list

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil._track_dict_bulk_↩
list  [protected]
```

6.8.4.6 data_set_RA

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.data_set_RA
```

6.8.4.7 frame_to_seconds

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.frame_to_seconds
```

6.8.4.8 pixel_to_um

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil.pixel_to_um
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/MSD_Utils.py

6.9 SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_↩ mask.extract_mask_properties Class Reference

Public Member Functions

- None __init__ (self, masked_image, invert_axis)
- extract_properties (self)
- __dict__ (self)
- region_properties (self)
- region_properties (self, region_properties)
- area (self)
- bounding_box (self)
- centroid (self)
- r_offset (self)
- longest_axis (self)
- shortest_axis (self)
- coordinates (self)
- orientation (self)

Public Attributes

- masked_image
- region_properties
- area
- bounding_box
- centroid
- r_offset
- longest_axis
- shortest_axis
- coordinates

Protected Member Functions

- _populate_properties (self)

Protected Attributes

- _area
- _bounding_box
- _centroid
- _r_offset
- _longest_axis
- _shortest_axis
- _coordinates
- _orientation
- _region_properties

6.9.1 Constructor & Destructor Documentation

6.9.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
__init__ (
              self,
              masked_image,
              invert_axis)
```

```
Parameters:
-----------
masked_image: numpy array
    Masked image
invert_axis: bool
    If True, inverts the axis of the masked image
```

6.9.2 Member Function Documentation

6.9.2.1 __dict__()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.__↩
dict__ (
              self)
```

6.9.2.2 _populate_properties()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
populate_properties (
              self)  [protected]
```

6.9.2.3 area()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.area
(
              self)
```

```
Returns the area of the mask
```

6.9.2.4 bounding_box()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
bounding_box (
              self)
```

```
Returns the bounding box of the mask as a numpy array but in the form of the coordinates of the bounding box (
```

6.9.2.5 centroid()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
centroid (
              self)
```

```
Returns the centroid of the mask
```

6.9.2.6 coordinates()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
coordinates (
              self)
```

```
Returns the coordinates of the mask
```

6.9.2.7 extract_properties()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
extract_properties (
              self)
```

6.9.2.8 longest_axis()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
longest_axis (
              self)
```

```
Returns the longest axis of the mask
```

6.9.2.9 orientation()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
orientation (
              self)
```

```
Returns the orientation of the mask
```

6.9.2.10 r_offset()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.r_↩
offset (
              self)
```

Returns the r_offset of the mask

6.9.2.11 region_properties() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
region_properties (
              self)
```

Returns the region properties of the masked image

6.9.2.12 region_properties() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
region_properties (
              self,
              region_properties)
```

6.9.2.13 shortest_axis()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
shortest_axis (
              self)
```

Returns the shortest axis of the mask

6.9.3 Member Data Documentation

6.9.3.1 _area

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._area
[protected]
```

6.9.3.2 _bounding_box

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
bounding_box  [protected]
```

6.9.3.3 _centroid

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
centroid [protected]

6.9.3.4 _coordinates

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
coordinates [protected]

6.9.3.5 _longest_axis

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
longest_axis [protected]

6.9.3.6 _orientation

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
orientation [protected]

6.9.3.7 _r_offset

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._r_↩
offset [protected]

6.9.3.8 _region_properties

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
region_properties [protected]

6.9.3.9 _shortest_axis

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties._↩
shortest_axis [protected]

6.9.3.10 area

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.area

6.9.3.11 bounding_box

SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
bounding_box

6.9.3.12 centroid

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
centroid
```

6.9.3.13 coordinates

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
coordinates
```

6.9.3.14 longest_axis

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
longest_axis
```

6.9.3.15 masked_image

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
masked_image
```

6.9.3.16 r_offset

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.r_↩
offset
```

6.9.3.17 region_properties

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
region_properties
```

6.9.3.18 shortest_axis

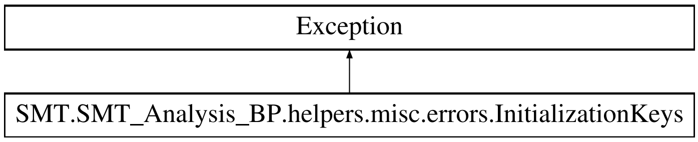
```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties.↩
shortest_axis
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/features_from_mask.py

6.10 SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationKeys Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationKeys:



6.10.1 Detailed Description

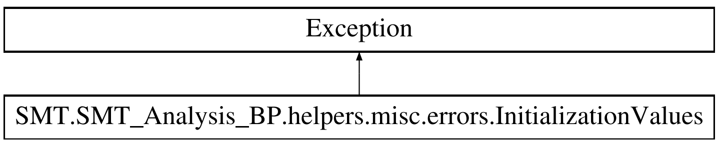
```
Error class for the initialization keys.
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/misc/errors.py

6.11 SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationValues Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationValues:



6.11.1 Detailed Description

```
Error class for the initialization values.
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/misc/errors.py

6.12 SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.IO_run_↩ analysis Class Reference

Public Member Functions

- None __init__ (self)

Static Protected Member Functions

- _save_sptanalysis_data (pp, test)
- _load_superSegger (cd, _string)

6.12.1 Constructor & Destructor Documentation

6.12.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.IO_run_analysis.__init__ (
              self)
```

6.12.2 Member Function Documentation

6.12.2.1 _load_superSegger()

```
SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.IO_run_analysis._load_superSegger (
              cd,
              _string)  [static], [protected]
```

6.12.2.2 _save_sptanalysis_data()

```
SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.IO_run_analysis._save_sptanalysis_data (
              pp,
              test)  [static], [protected]
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
BP/helpers/ioModule/SMT_converters.py

6.13 localization_setter.mask_localization Class Reference

Public Member Functions

- __init__ (self, path)
- make_loc (self)
- analysis_folder (self)
- analysis_loc_files (self)

Public Attributes

- cd
- path_structure

Protected Attributes

- _analysis_loc_files

6.13.1 Constructor & Destructor Documentation

6.13.1.1 __init__()

```
localization_setter.mask_localization.__init__ (
              self,
              path)
```

6.13.2 Member Function Documentation

6.13.2.1 analysis_folder()

```
localization_setter.mask_localization.analysis_folder (
              self)
```

6.13.2.2 analysis_loc_files()

```
localization_setter.mask_localization.analysis_loc_files (
              self)
```

6.13.2.3 make_loc()

```
localization_setter.mask_localization.make_loc (
              self)
```

6.13.3 Member Data Documentation

6.13.3.1 _analysis_loc_files

```
localization_setter.mask_localization._analysis_loc_files  [protected]
```

6.13.3.2 cd

```
localization_setter.mask_localization.cd
```

6.13.3.3 path_structure

```
localization_setter.mask_localization.path_structure
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/thunderSTORM/localization_setter.py

6.14 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.↩ Movie_frame Class Reference

Public Member Functions

- __init__ (self, Movie_ID, Movie_name, Movie_location=0, nucleoid_location=0)

Public Attributes

- Movie_ID
- Movie_name
- Movie_location
- Movie_nucleoid
- Cells

6.14.1 Detailed Description

```
Frame of reference for one movie

Parameters
----------
__init__:
    Movie_ID: int
        unique identifier for each movie
    Movie_name: string
        name of the movie, used to find the movie. This is the name of the movie file!
    Movie_location: string or list of strings, optional (size is the number of frames \n
        (i.e 5 for 5 subframes from a 5000 frame movie with 1000 per subframe))
        This is the sub segmented frames of the movie. This is just a list of strings that are the locatio
        nucleoid_location: string, optional
        location of the image that shows the nucleoid, by default 0
Cells: dictionary
    dictionary of Cell class objects belonging to this Movie, identified by a label (0,1,...,n)
```

6.14.2 Constructor & Destructor Documentation

6.14.2.1 __init__()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.__init__ (
              self,
              Movie_ID,
              Movie_name,
              Movie_location = 0,
              nucleoid_location = 0)
```

6.14.3 Member Data Documentation

6.14.3.1 Cells

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.Cells
```

6.14.3.2 Movie_ID

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.Movie_ID`

6.14.3.3 Movie_location

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.Movie_location`

6.14.3.4 Movie_name

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.Movie_name`

6.14.3.5 Movie_nucleoid

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame.Movie_nucleoid`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/trajectory_analysis_script.py

6.15 SMT.SMT_Analysis_BP.databases.directoryManipulator.format_↩ mask_structure.movie_mask_directory_structure_manager Class Reference

Public Member Functions

- None __init__ (self, full_path_to_mask_dir)
- full_path_to_mask_dir (self)
- mask_files (self)
- directory_structure_paths (self)
- base_files (self)

Public Attributes

- full_path_to_mask_dir
- mask_files

Protected Member Functions

- None _find_mask_files (self)
- None _make_directory_structure (self)

Protected Attributes

- _full_path_to_mask_dir
- _base_files
- _mask_files
- _directory_structure_paths

6.15.1 Constructor & Destructor Documentation

6.15.1.1 __init__()

```
None SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_↩
directory_structure_manager.__init__ (
              self,
              full_path_to_mask_dir)
```

6.15.2 Member Function Documentation

6.15.2.1 _find_mask_files()

```
None SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_↩
directory_structure_manager._find_mask_files (
              self)  [protected]
```

```
Finds the mask files (right now these are .npy files) in the directory, defined by cellpose output
This sets the mask_files attribute
```

6.15.2.2 _make_directory_structure()

```
None SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_↩
directory_structure_manager._make_directory_structure (
              self)  [protected]
```

```
Makes the directory structure for the Movies, cells and saves each mask inside it
this follows from the strucure described above
```

6.15.2.3 base_files()

```
SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.base_files (
              self)
```

6.15.2.4 directory_structure_paths()

```
SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.directory_structure_paths (
              self)
```

6.15.2.5 full_path_to_mask_dir()

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.full_path_to_mask_dir (
self)

6.15.2.6 mask_files()

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.mask_files (
self)

6.15.3 Member Data Documentation

6.15.3.1 _base_files

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager._base_files [protected]

6.15.3.2 _directory_structure_paths

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager._directory_structure_paths [protected]

6.15.3.3 _full_path_to_mask_dir

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager._full_path_to_mask_dir [protected]

6.15.3.4 _mask_files

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager._mask_files [protected]

6.15.3.5 full_path_to_mask_dir

SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.full_path_to_mask_dir

6.15.3.6 mask_files

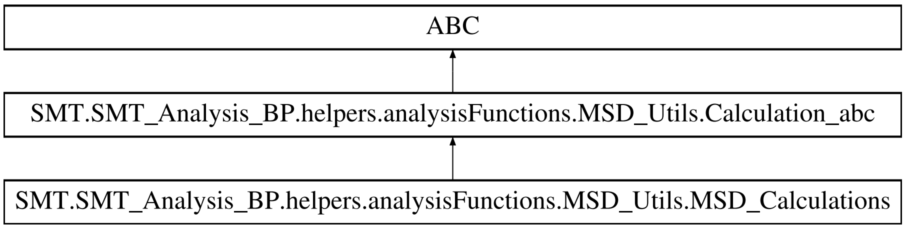
SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory↩
_structure_manager.mask_files

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
BP/databases/directoryManipulator/format_mask_structure.py

6.16 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations:



Public Member Functions

- None __init__ (self, list data_set_RA, float pixel_to_um=0.13, float frame_to_seconds=0.02, str frame_units="s", str pixel_units="um", **kwargs)
- combined_store (self)
- combined_store (self, combined_store)
- individual_store (self)
- individual_store (self, individual_store)

Public Attributes

- MSD_dataset

Protected Member Functions

- _build_MSD_Tracks_combined (self, **kwargs)
- _build_MSD_Tracks_individual (self, **kwargs)
- _build_MSD_Tracks (self, **kwargs)

Protected Attributes

- _combined_store
- _individual_store

6.16.1 Constructor & Destructor Documentation

6.16.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.__init__ (
             self,
             list data_set_RA,
             float pixel_to_um = 0.13,
             float frame_to_seconds = 0.02,
             str frame_units = "s",
             str pixel_units = "um",
             ** kwargs)
```

```
Parameters:
-----------
data_set_RA: list
    list of tas.run_analysis objects
pixel_to_um: float
    pixel to um conversion
frame_to_seconds: float
    frame to seconds conversion
frame_units: str
    frame units
pixel_units: str
    pixel units

KWARGS:
-------
min_track_length: int, Default = 1
    minimum track length to be considered.
    This is passed on to the af.MSD_Tracks() function
max_track_length: int, Default = 1000
    maximum track length to be considered.

Passed to af.MSD_Tracks() -> (bootstrap:bool=False,bootstrap_samples:float=0.1,bootstrap_percentile:float=0.95
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.16.2 Member Function Documentation

6.16.2.1 _build_MSD_Tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations._build_MSD_Tracks (
              self,
             ** kwargs)   [protected]
```

```
Parameters:
-----------
KWARGS:
-------
Passed to af.MSD_Tracks()
```

6.16.2.2 _build_MSD_Tracks_combined()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations._build_MSD_Tracks_↩
combined (
              self,
             ** kwargs)   [protected]
```

6.16.2.3 _build_MSD_Tracks_individual()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations._build_MSD_Tracks_↩
individual (
              self,
             ** kwargs)   [protected]
```

6.16.2.4 combined_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.combined_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.16.2.5 combined_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.combined_store (
              self,
              combined_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.16.2.6 individual_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.individual_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.16.2.7 individual_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.individual_store (
              self,
              individual_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.16.3 Member Data Documentation

6.16.3.1 _combined_store

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations._combined_store  [protected]
```

6.16.3.2 _individual_store

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations._individual_store
[protected]
```

6.16.3.3 MSD_dataset

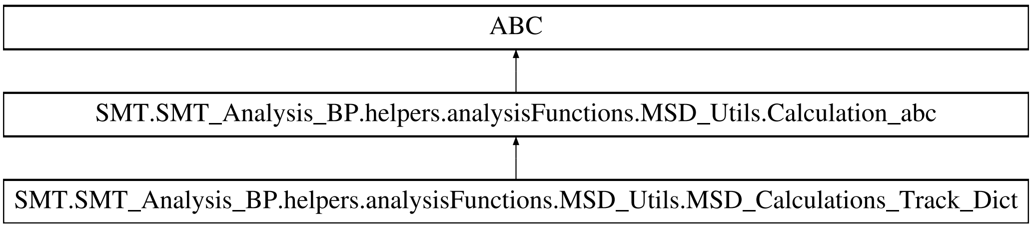
```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations.MSD_dataset
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/MSD_Utils.py

6.17 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD↩_Calculations_Track_Dict Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_↩Dict:



Public Member Functions

- None __init__ (self, track_dict, **kwargs)
- combined_store (self)
- combined_store (self, combined_store)
- individual_store (self)
- individual_store (self, individual_store)

Public Attributes

- track_dict
- pixel_to_um
- frame_to_seconds

Protected Member Functions

- _build_MSD_Tracks (self, **kwargs)

Protected Attributes

- _storage

6.17.1 Constructor & Destructor Documentation

6.17.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.__↩
init__ (
              self,
              track_dict,
             ** kwargs)
```

```
Parameters:
-----------
track_dict: dict
    dict of tracks in the form:
    {
    track_ID: [[x,y],...,[x,y]],
    .
    .
    .
    }
KWARGS:
-------
pixel_to_um: float
    pixel to um conversion
frame_to_seconds: float
    frame to seconds conversion
frame_units: str
    frame units
pixel_units: str
    pixel units
min_track_length: int, Default = 1
    minimum track length to be considered.
max_track_length: int, Default = 1000
    maximum track length to be considered.
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.17.2 Member Function Documentation

6.17.2.1 _build_MSD_Tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict._build_↩
MSD_Tracks (
              self,
             ** kwargs)   [protected]
```

6.17.2.2 combined_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.combined↩
_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.17.2.3 combined_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.combined↩
_store (
              self,
              combined_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.17.2.4 individual_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.individual←
_store (
            self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.17.2.5 individual_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.individual←
_store (
            self,
            individual_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.17.3 Member Data Documentation

6.17.3.1 _storage

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict._storage
[protected]
```

6.17.3.2 frame_to_seconds

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.frame_to←
_seconds
```

6.17.3.3 pixel_to_um

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.pixel_to←
_um
```

6.17.3.4 track_dict

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict.track_dict
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_←
BP/helpers/analysisFunctions/MSD_Utils.py

6.18 SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage Class Reference

Public Member Functions

- None __init__ (self, name, track_class_type, storage_data)
- ensemble_MSD (self)

  ensemble storage
- ensemble_MSD (self, ensemble_MSD)
- ensemble_MSD_error (self)
- ensemble_MSD_error (self, ensemble_MSD_error)
- ensemble_displacement (self)
- ensemble_displacement (self, ensemble_displacement)
- track_MSD (self)

  track storage
- track_MSD (self, track_MSD)
- track_MSD_error (self)
- track_MSD_error (self, track_MSD_error)
- track_displacement (self)
- track_displacement (self, track_displacement)
- track_displacement_r (self)

  we need to have a datatype which converts the displacement which are (n,d) where d is the dimension to a single r = distance
- ensemble_displacement_r (self)
- track_lengths (self)
- track_lengths (self, track_lengths)

Public Attributes

- name
- track_class_type
- storage_data

Protected Member Functions

- _store_data (self)

Protected Attributes

- _ensemble_MSD
- _ensemble_MSD_error
- _ensemble_displacement
- _track_MSD
- _track_MSD_error
- _track_displacement
- _track_displacement_r
- _ensemble_displacement_r
- _track_lengths

6.18.1 Constructor & Destructor Documentation

6.18.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.__init__ (
            self,
            name,
            track_class_type,
            storage_data)
```

6.18.2 Member Function Documentation

6.18.2.1 _store_data()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._store_data (
            self) [protected]
```

6.18.2.2 ensemble_displacement() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_displacement (
            self)
```

6.18.2.3 ensemble_displacement() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_displacement (
            self,
            ensemble_displacement)
```

6.18.2.4 ensemble_displacement_r()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_displacement_r (
            self)
```

6.18.2.5 ensemble_MSD() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_MSD (
            self)
```

ensemble storage

6.18.2.6 ensemble_MSD() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_MSD (
            self,
            ensemble_MSD)
```

6.18.2.7 ensemble_MSD_error() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_MSD_error (
              self)
```

6.18.2.8 ensemble_MSD_error() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.ensemble_MSD_error (
              self,
              ensemble_MSD_error)
```

6.18.2.9 track_displacement() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_displacement (
              self)
```

6.18.2.10 track_displacement() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_displacement (
              self,
              track_displacement)
```

6.18.2.11 track_displacement_r()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_displacement_r (
              self)
```

we need to have a datatype which converts the displacement which are (n,d) where d is the dimension to a single r = distance

6.18.2.12 track_lengths() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_lengths (
              self)
```

6.18.2.13 track_lengths() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_lengths (
              self,
              track_lengths)
```

6.18.2.14 track_MSD() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_MSD (
              self)
```

track storage

6.18.2.15 track_MSD() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_MSD (
              self,
              track_MSD)
```

6.18.2.16 track_MSD_error() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_MSD_error (
              self)
```

6.18.2.17 track_MSD_error() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_MSD_error (
              self,
              track_MSD_error)
```

6.18.3 Member Data Documentation

6.18.3.1 _ensemble_displacement

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._ensemble_displacement
[protected]
```

6.18.3.2 _ensemble_displacement_r

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._ensemble_displacement_r
[protected]
```

6.18.3.3 _ensemble_MSD

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._ensemble_MSD  [protected]
```

6.18.3.4 _ensemble_MSD_error

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._ensemble_MSD_error  [protected]
```

6.18.3.5 _track_displacement

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._track_displacement  [protected]
```

6.18.3.6 _track_displacement_r

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._track_displacement_↩
r [protected]

6.18.3.7 _track_lengths

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._track_lengths [protected]

6.18.3.8 _track_MSD

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._track_MSD [protected]

6.18.3.9 _track_MSD_error

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage._track_MSD_error [protected]

6.18.3.10 name

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.name

6.18.3.11 storage_data

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.storage_data

6.18.3.12 track_class_type

SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage.track_class_type

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
  BP/helpers/analysisFunctions/MSD_Utils.py

6.19 localization_setter.path_structure Class Reference

Public Member Functions

- __init__ (self, path)
- path (self)
- path_structure_dict (self)

Public Attributes

- cd

Protected Attributes

- _path_structure_dict

6.19.1 Constructor & Destructor Documentation

6.19.1.1 __init__()

```
localization_setter.path_structure.__init__ (
              self,
              path)
```

6.19.2 Member Function Documentation

6.19.2.1 path()

```
localization_setter.path_structure.path (
              self)
```

6.19.2.2 path_structure_dict()

```
localization_setter.path_structure.path_structure_dict (
              self)
```

6.19.3 Member Data Documentation

6.19.3.1 _path_structure_dict

```
localization_setter.path_structure._path_structure_dict  [protected]
```

6.19.3.2 cd

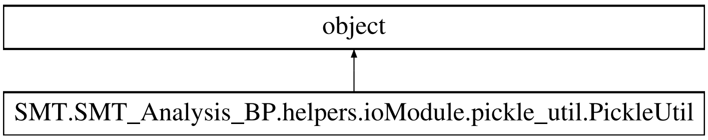
```
localization_setter.path_structure.cd
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/thunderSTORM/localization_setter.py

6.20 SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil:



Public Member Functions

- __init__ (self)
- save (self, str path, str name, str docs, any obj)
- obj (self)
- obj (self, obj)
- path (self)
- path (self, path)
- name (self)
- name (self, name)
- docs (self)
- docs (self, docs)

Static Public Member Functions

- load (str full_path_to_load)

Public Attributes

- obj
- path
- name
- docs

Protected Member Functions

- _update_class_vars (self, obj, path, name, docs)
- _update_outpkl (self)

Protected Attributes

- _obj
- _path
- _name
- _docs
- _outpkl

6.20.1 Constructor & Destructor Documentation

6.20.1.1 __init__()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.__init__ (
              self)
```

6.20.2 Member Function Documentation

6.20.2.1 _update_class_vars()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._update_class_vars (
              self,
              obj,
              path,
              name,
              docs)  [protected]
```

6.20.2.2 _update_outpkl()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._update_outpkl (
              self)  [protected]
```

6.20.2.3 docs() [1/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.docs (
              self)
```

6.20.2.4 docs() [2/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.docs (
              self,
              docs)
```

6.20.2.5 load()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.load (
             str full_path_to_load)  [static]
```

```
Docstring:
Load an object from a pickle file. This is the full path to the pickle file.

Parameters:
-----------
full_path_to_load: str
    The full path to the pickle file to load.

Returns:
--------
obj: any
    The object loaded from the pickle file.

Example:
--------
#create a PickleUtil object if you haven't already
pickle_util = PickleUtil()
#load the dict
dict_loaded = pickle_util.load('C:/Users/JohnDoe/Desktop/my_dict.pkl')
```

6.20.2.6 name() [1/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.name (
              self)
```

6.20.2.7 name() [2/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.name (
              self,
              name)
```

6.20.2.8 obj() [1/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.obj (
              self)
```

6.20.2.9 obj() [2/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.obj (
              self,
              obj)
```

6.20.2.10 path() [1/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.path (
              self)
```

6.20.2.11 path() [2/2]

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.path (
              self,
              path)
```

6.20.2.12 save()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.save (
              self,
             str path,
             str name,
             str docs,
             any obj)
```

```
Docstring:
Save an object to a pickle file. The object will be saved to the path/name.pkl file. The docs will be saved to

Parameters:
-----------
path: str
    The path to the directory where the object will be saved. This must be the full path to the directory.
name: str
    The name of the pickle file. This should not include the .pkl extension.
docs: str
    A string describing the object. This will be saved to the path/name_docs.txt file.
obj: any
    The object to be saved. This can be any object that can be pickled.

Returns:
--------
None

Example:
--------
#create a PickleUtil object
pickle_util = PickleUtil()
#create a dict to save
dict_to_save = {'a':1, 'b':2}
#save the dict
pickle_util.save(path='C:/Users/JohnDoe/Desktop', name='my_dict', docs='This is a dict I want to save', obj=di
```

6.20.3 Member Data Documentation

6.20.3.1 _docs

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._docs [protected]

6.20.3.2 _name

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._name [protected]

6.20.3.3 _obj

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._obj [protected]

6.20.3.4 _outpkl

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._outpkl [protected]

6.20.3.5 _path

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil._path [protected]

6.20.3.6 docs

SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.docs

6.20.3.7 name

`SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.name`

6.20.3.8 obj

`SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.obj`

6.20.3.9 path

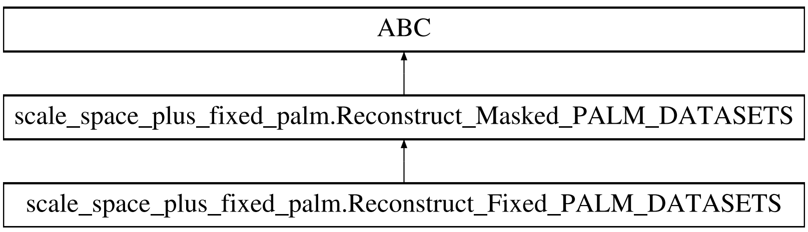
`SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil.path`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/ioModule/pickle_util.py

6.21 scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_↩ DATASETS Class Reference

Inheritance diagram for scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS:



Public Member Functions

- __init__ (self, cd, blob_parameters, fitting_parameters, rescale_pixel_size=10, pixel_size=130, loc_error=30, include_all=True, callable localization_loader=load_localizations, callable unique_localization_getter=get_unique_localizations)

Protected Member Functions

- _load_localizations (self, ∗∗kwargs)

Protected Attributes

- _localization_loader

6.21.1 Constructor & Destructor Documentation

6.21.1.1 __init__()

```
scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS.__init__ (
              self,
              cd,
              blob_parameters,
              fitting_parameters,
              rescale_pixel_size = 10,
              pixel_size = 130,
              loc_error = 30,
              include_all = True,
             callable  localization_loader = load_localizations,
             callable  unique_localization_getter = get_unique_localizations)
```

Reimplemented from scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.

6.21.2 Member Function Documentation

6.21.2.1 _load_localizations()

```
scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS._load_localizations (
              self,
             ** kwargs)  [protected]
```

Reimplemented from scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.

6.21.3 Member Data Documentation

6.21.3.1 _localization_loader

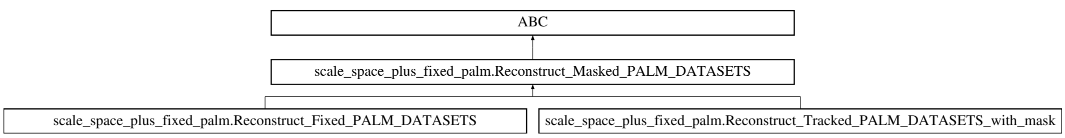
```
scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS._localization_loader  [protected]
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/reconstructionScripts/scale_space_plus_fixed_palm.py

6.22 scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_↩ DATASETS Class Reference

Inheritance diagram for scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS:



Public Member Functions

- __init__ (self, str cd, dict blob_parameters, dict fitting_parameters, rescale_pixel_size=10, pixel_size=130, loc_error=30, include_all=True, callable unique_localization_getter=get_unique_localizations)
- reconstruct (self)
- path_structure_dict (self)
- state_parameters (self)

Public Attributes

- cd
- blob_parameters
- fitting_parameters
- rescale_pixel_size
- pixel_size
- loc_error
- include_all

Protected Member Functions

- _load_localizations (self)
- _print_message (self)
- _store_parameters (self)
- None _save_reconstruction_parameters (self, str full_path)
- None _check_directory_structure (self)
- None _check_if_previous_analysis_has_occured (self)

Protected Attributes

- _unique_localization_getter
- _state_parameters
- _path_structure_dict

6.22.1 Constructor & Destructor Documentation

6.22.1.1 __init__()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.__init__ (
              self,
             str cd,
             dict blob_parameters,
             dict fitting_parameters,
              rescale_pixel_size = 10,
              pixel_size = 130,
              loc_error = 30,
              include_all = True,
             callable  unique_localization_getter = get_unique_localizations)
```

Reimplemented in scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS, and scale_space_plus_fixed_palm.Reconst

6.22.2 Member Function Documentation

6.22.2.1 _check_directory_structure()

```
None scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._check_directory_structure (
            self) [protected]
```

6.22.2.2 _check_if_previous_analysis_has_occured()

```
None scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._check_if_previous_analysis←
_has_occured (
            self) [protected]
```

6.22.2.3 _load_localizations()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._load_localizations (
            self) [protected]
```

Reimplemented in scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS, and scale_space_plus_fixed_palm.Reconst

6.22.2.4 _print_message()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._print_message (
            self) [protected]
```

6.22.2.5 _save_reconstruction_parameters()

```
None scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._save_reconstruction_←
parameters (
            self,
           str full_path) [protected]
```

6.22.2.6 _store_parameters()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._store_parameters (
            self) [protected]
```

6.22.2.7 path_structure_dict()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.path_structure_dict (
            self)
```

6.22.2.8 reconstruct()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.reconstruct (
              self)
```

```
Reconstruct the localizations in each cell in each movie
```

6.22.2.9 state_parameters()

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.state_parameters (
              self)
```

6.22.3 Member Data Documentation

6.22.3.1 _path_structure_dict

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._path_structure_dict  [protected]
```

6.22.3.2 _state_parameters

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._state_parameters  [protected]
```

6.22.3.3 _unique_localization_getter

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS._unique_localization_getter  [protected]
```

6.22.3.4 blob_parameters

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.blob_parameters
```

6.22.3.5 cd

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.cd
```

6.22.3.6 fitting_parameters

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.fitting_parameters
```

6.22.3.7 include_all

```
scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.include_all
```

6.22.3.8 loc_error

`scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.loc_error`

6.22.3.9 pixel_size

`scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.pixel_size`

6.22.3.10 rescale_pixel_size

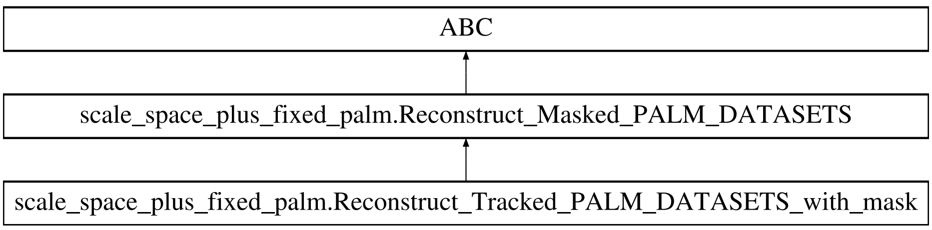
`scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.rescale_pixel_size`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/reconstructionScripts/scale_space_plus_fixed_palm.py

6.23 scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_↩ DATASETS_with_mask Class Reference

Inheritance diagram for scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask:



Public Member Functions

- __init__ (self, cd, blob_parameters, fitting_parameters, rescale_pixel_size=10, pixel_size=130, loc_error=30, include_all=True, callable localization_loader=load_localizations, callable unique_localization_getter=get_unique_localizations)
- reconstructTime (self, int subsample_frequency=500, int total_frames=5000)

Public Attributes

- include_all

Protected Member Functions

- _load_localizations (self, ∗∗kwargs)

Protected Attributes

- _localization_loader

6.23.1 Detailed Description

```
For the masked version of the tracked PALM data, this is different from scale_space_plus_database_tracked.segm
since it inforces a cell mask for each cell in a movie and also expects a different file structure. (Cellpose
File structure is the same as the Fixed cell PALM data.
```

6.23.2 Constructor & Destructor Documentation

6.23.2.1 __init__()

```
scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask.__init__ (
        self,
        cd,
        blob_parameters,
        fitting_parameters,
        rescale_pixel_size = 10,
        pixel_size = 130,
        loc_error = 30,
        include_all = True,
        callable localization_loader = load_localizations,
        callable unique_localization_getter = get_unique_localizations)
```

Reimplemented from scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.

6.23.3 Member Function Documentation

6.23.3.1 _load_localizations()

```
scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask._load_localizations (
        self,
        ** kwargs) [protected]
```

Reimplemented from scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS.

6.23.3.2 reconstructTime()

```
scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask.reconstructTime (
        self,
        int subsample_frequency = 500,
        int total_frames = 5000)
```

```
For each cell we will now make a reconstruction (only, no scale and dbscan analysis) for subsampling
```

6.23.4 Member Data Documentation

6.23.4.1 _localization_loader

```
scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask._localization_loader
[protected]
```

6.23.4.2 include_all

```
scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask.include_all
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/reconstructionScripts/scale_space_plus_fixed_palm.py

6.24 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_↩ analysis Class Reference

Public Member Functions

- __init__ (self, wd, t_string, sim=False, unique_name="")
- run_flow (self, masked_movies=False)
- run_flow_sim (self, cd, t_string)
- read_track_data_masked_method (self, wd, t_string, **kwargs)
- read_parameters (self, frame_step=1000, frame_total=5000, t_len_l=10, t_len_u=1000, MSD_avg_threshold=0.↩ 0001, upper_bp=0.99, lower_bp=0.50, max_track_decomp=1.0, conversion_p_nm=130, minimum_tracks_per_drop=3, minimum_percent_per_drop_in=1.0, cluster_t_len_l=7)
- get_blob_parameters (self, threshold=1e-4, median=False, overlap=0.5, num_sigma=500, min_sigma=1, max_sigma=3, log_scale=False, detection_name='bp')
- get_fitting_parameters (self, kwargs={})
- type_of_blob (self)
- type_of_blob (self, value)
- dict track_durations (self)
- bool isempty (self)
- dict parameter_storage (self)
- path_structure_dict (self)

Public Attributes

- my_name
- a_file_style

    LOADING TRACK DATA#####.
- sim
- pixel_to_nm
- pixel_to_um
- total_experiments
- wd
- t_string
- mat_path_dir
- frame_step
- frame_total
- t_len_l
- t_len_u
- blob_t_len_l
- MSD_avg_threshold
- upper_bp
- lower_bp
- max_track_decomp
- minimum_tracks_per_drop
- minimum_percent_per_drop_in
- frames
- threshold_blob

    blob detection parameters
- overlap_blob
- min_sigma_blob
- max_sigma_blob
- num_sigma_blob
- blob_median_filter
- detection_name
- log_scale
- type_of_blob
- blob_parameters
- fitting_parameters
- overwrite_cell_localizations

    -—–Load Track Data-—–##
- Movie

    condensed analysis data Cells in the specific movie being analysed
- baljyot_idiot_factor

    forgot to change scale on some images before trackmate now i need to convert the scale from um to pixel so this all doesn't break
- Cells

    condensed analysis data Cells in the specific movie being analysed
- track_collection
- track_durations

Protected Member Functions

- _read_track_data_nocells (self, wd, t_string, **kwargs)
- _read_track_data (self, wd, t_string, **kwargs)
- _analyse_cell_tracks (self)
- _map_TrackstoDrops (self, i, k, sorted_tracks)
- _make_TrueDrop (self, i, k, drop_ID_list, list_drop_track, sorted_tracks)
- _makeTrackCls (self, temp, which_type, drop_ID, sorted_tracks, kk, l)
- _analyse_cell_tracks_utility (self, i, k, sorted_tracks)
- _blob_detection_utility (self, seg_files, movie_ID, plot=False, kwargs={})
- _read_supersegger (self, sorted_cells)
- _load_segmented_image_locations (self, pp, cd, t_string, max_tag, min_tag, seg_name="TRACKMATE", analysis_name="TRACKMATE")
- _load_segmented_image_data (self, drop_files, use_cols=(0, 1, 2), skiprows=0)
- _get_movie_path (self, movie_ID, frame)
- _get_frame_cell_mask (self, mask, frame, movie_ID)
- _get_nucleoid_path (self, movie_ID, cell_ID, full_path=False)
- _load_track_data (self, track_file, skiprows=4)
- _load_track_data_as_PD (self, track_file, skiprows=4)
- _Analysis_path_util (self)
- _Segmentation_path_util (self)
- None _check_directory_structure (self)
- _convert_track_frame (self, track_set, **kwargs)
- None _convert_track_data_for_cell (self, path, path_structure, cell_ID, movie_ID)
- _convert_to_track_dict_bulk (self, Movie=None, track_name_original=True)
- list _track_collection_utility (self)
- _store_combined_SMAUG_files (self, combined_dir_name, Movie=None)
- None _make_SMAUG_files (self, Movie=None, dir_name="SMAUG")
- _store_combined_NOBIAS_files (self, combined_dir_name, Movie=None)
- None _make_NOBIAS_files (self, Movie=None, taus=1, dir_name="NOBIAS")
- None _pickle_this_object (self)
- _find_nucleoid (self, movie_ID, cell_ID, img=0)
- _set_nucleoid_area_bulk (self)
- _reinitalizeVariables (self)

Protected Attributes

- _type_of_blob
- _track_durations
- _parameter_storage
- _path_structure_dict

6.24.1 Detailed Description

```
Define a class for each dataset to analyse
Contains multiple frames of view for movies

Parameters;
-----------
wd : str
    working directory of the stored data
t_string : str
    unique string identifier for dataset
sim : bool
    if True, this is a simulated dataset
```

```
Methods:
--------
get_fitting_parameters(): get the fitting parameters for the dataset
get_blob_parameters(): get the blob detection parameters for the dataset
read_parameters(): read the global parameters for the dataset
run_flow(): run the analysis for the dataset to build the mappings in self.Cells, and self.movie


_analyse_cell_tracks_utility(): utility function for analyse_cell_tracks
_makeTrackCls(): make the track class for a given trajectory
_make_TrueDrop(): make the true drop class for a given drop
_map_TrackstoDrops(): map the trajectories to the drops
_analyse_cell_tracks(): analyse the cell tracks and make the mappings
_convert_track_frame(): reorder the tracks by subframe rather than the original linking
_find_nucleoid(): find the nucleoid in a given cell
_read_track_data(): read the track data
_load_segmented_image_data(): load the segmented image data
_load_segmented_image_locations(): load the segmented image locations
_read_supersegger(): read the supersegger data
_blob_detection_utility(): utility function for blob detection
_get_nucleoid_path(): get the path to the nucleoid data
_get_frame_cell_mask(): get the cell mask for a given frame
_get_movie_path(): get the path to the movie data
_reinitalizeVariables(): reinitalize the variables for a new dataset
```

6.24.2 Constructor & Destructor Documentation

6.24.2.1 __init__()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.__init__ (
self,
wd,
t_string,
sim = False,
unique_name = "")

```
Parameters:
-----------
wd : str
    working directory of the stored data
t_string : str
    unique string identifier for dataset
sim : bool
    if True, this is a simulated dataset

self.Cells : list
    list of cells in the dataset
self.movie : list
    list of movies in the dataset
```

6.24.3 Member Function Documentation

6.24.3.1 _analyse_cell_tracks()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._analyse_cell_tracks (
self) [protected]

```
Helper function to create mapping of Movie.Cell.Drop.Trajectory
```

6.24.3.2 _analyse_cell_tracks_utility()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._analyse_cell_tracks_↩
utility (
    self,
    i,
    k,
    sorted_tracks) [protected]

```
Main function that:
    1) Identifies viable drops
    2) Classifies trajecotries based on 1)
```

6.24.3.3 _Analysis_path_util()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._Analysis_path_util (
    self) [protected]

6.24.3.4 _blob_detection_utility()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._blob_detection_utility
(
    self,
    seg_files,
    movie_ID,
    plot = False,
    kwargs = {}) [protected]

```
Utility function for the use of blob_dections to find the candidate spots

Parameteres
-----------
seg_files : array-like of img locations (str)
    location of the images
plot : bool
    if true plot the images with the circles ontop
    else don't plot and don't print the possible drops
movie_ID : str
    key identifier for the frame of reference, i.e the movie in this whole dataset
kwarg : dict
    keyword arguments for the blob_detection function


KWARGS:
-------
threshold : float
    threshold for the blob detection
overlap : float
    overlap for the blob detection
median : bool
    if true then apply a median filter to the image
min_sigma : float
    minimum sigma for the blob detection
max_sigma : float
    maximum sigma for the blob detection
num_sigma : int
    number of sigmas for the blob detection
detection : str
    which detection method to use
```

```
log_scale : bool
    if true then use a log scale for the blob detection


Returns
-------
array-like
    for each seg_file find the possible blobs and return the center coordinates and radius
    [len(seg_files),# circles identified, 3 ([x,y,r])]
```

6.24.3.5 _check_directory_structure()

None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._check_directory_↩
structure (
self) [protected]

```
Returns error if Movies is not in the directory structure
Returns True if localizations.csv have been built for all cells
Returns False if localizations.csv have not been built for all cells
```

6.24.3.6 _convert_to_track_dict_bulk()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._convert_to_track_dict↩
_bulk (
self,
Movie = None,
track_name_original = True) [protected]

```
Docstring for _convert_to_track_dict_bulk
       Purpose: convert the Movie object into a dictionary of tracks for the bulk analysis of MSD

       Parameters:
       -----------
       Movie: Movie object, default None
           Movie object to convert to a dictionary of tracks

       Returns:
       --------
       track_dict: dictionary
           dictionary of tracks with keys "IN","OUT","IO","ALL" and values being a dictionary of tracks with
```

6.24.3.7 _convert_track_data_for_cell()

None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._convert_track_↩
data_for_cell (
self,
path,
path_structure,
cell_ID,
movie_ID) [protected]

```
Converts the raw data files from TRACKMATE into the same format .csv but now only considering points i

Parameters:
-----------
path : str
    path to the raw data file from TRACKMATE
path_structure : dict
    dictionary of the directory structure (same as self.path_structure, but a copy is passed)
cell_ID : str
    key identifier for the cell of interest
movie_ID : str
    key identifier for the frame of reference, i.e the movie in this whole dataset
```

6.24.3.8 _convert_track_frame()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._convert_track_frame (
             self,
             track_set,
            ** kwargs) [protected]
```

```
This function preps the data such that the tracks satisfy a length
and segregates the data in respect to the frame step.

Parameters
----------
track_set : array-like
    the set of tracks for one specific frame of reference from TrackMate (unfiltered)
    This is a 2D array with the following columns: [track_ID,frame_ID,x,y,intensity]
**kwargs : dict
    frame_total : int
        the total number of frames in the movie
    frame_step : int
        the step size for the frame
    track_len_upper : int
        the upper limit of the track length
    track_len_lower : int
        the lower limit of the track length
    order : tuple
        the order of the data in track_set
    conversion : float
        the conversion factor for the data in track_set


Returns
-------
array-like : [track_n,x_n,y_n,i_n,f_n]
    track_n : array-like of ints
        track_IDs from TrackMate
    x_n : array-like of floats
        x coordinates of the localization belonging to index of track_ID
    y_n : array-like of floats
        y coordinates of the localization belonging to index of track_ID
    i_n : array-like of floats
        intensity of the localization belonging to index of track_ID
    f_n : array-like of floats
        frame of the movie the localization belonging to index of track_ID
```

6.24.3.9 _find_nucleoid()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._find_nucleoid (
             self,
             movie_ID,
             cell_ID,
             img = 0) [protected]
```

```
This function finds the nucleoid for a given cell. This is done by using the
segmented image of the nucleoid and finding the largest blob in the image.

Parameters:
-----------
movie_ID : int
    the movie ID number
cell_ID : int
    the cell ID number
img : array-like
    the image to use for nucleoid detection. If not provided, the function will
    load the image from the Movie object.
```

```
Returns:
--------
feature_mask : array-like
    the mask of the nucleoid with pixel labels = 1
regions : regionprops object
    the regionprops object for the nucleoid detections, see skimage.measure.regionprops and nucleoid_c
```

6.24.3.10 _get_frame_cell_mask()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._get_frame_cell_mask (
self,
mask,
frame,
movie_ID) [protected]

6.24.3.11 _get_movie_path()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._get_movie_path (
self,
movie_ID,
frame) [protected]

```
Gives the path of the specific time projected frame (0-4) of the movie (reference frame)

Parameters
----------
movie_ID : str
    key identifier for the frame of reference, i.e the movie in this whole dataset
frame : int, or array-like of ints
    the specific time projected subframe of the movie

Returns
-------
string, or array-like of strings
    if frame is a single integer then returns the path to that specific subframe
    if frame is a set of integers defining the subframes then array of paths of length frame

Note
----
This function only works if the run_flow() method has already been applied to an instance of the run_a
```

6.24.3.12 _get_nucleoid_path()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._get_nucleoid_path (
self,
movie_ID,
cell_ID,
full_path = False) [protected]

```
Returns the gfp image location or the image used to nuceloid segmentation
```

6.24.3.13 _load_segmented_image_data()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._load_segmented_image_←
data (
              self,
              drop_files,
              use_cols = (0,1,2),
              skiprows = 0)  [protected]
```

6.24.3.14 _load_segmented_image_locations()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._load_segmented_image_←
locations (
              self,
              pp,
              cd,
              t_string,
              max_tag,
              min_tag,
              seg_name = "TRACKMATE",
              analysis_name = "TRACKMATE")  [protected]
```

6.24.3.15 _load_track_data()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._load_track_data (
              self,
              track_file,
              skiprows = 4)  [protected]
```

6.24.3.16 _load_track_data_as_PD()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._load_track_data_as_PD (
              self,
              track_file,
              skiprows = 4)  [protected]
```

6.24.3.17 _make_NOBIAS_files()

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._make_NOBIAS_files
(
              self,
              Movie = None,
              taus = 1,
              dir_name = "NOBIAS")  [protected]
```

6.24.3.18 _make_SMAUG_files()

```
None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._make_SMAUG_files (
              self,
              Movie = None,
              dir_name = "SMAUG")  [protected]
```

6.24.3.19 _make_TrueDrop()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._make_TrueDrop (
self,
i,
k,
drop_ID_list,
list_drop_track,
sorted_tracks) [protected]

6.24.3.20 _makeTrackCls()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._makeTrackCls (
self,
temp,
which_type,
drop_ID,
sorted_tracks,
kk,
l) [protected]

6.24.3.21 _map_TrackstoDrops()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._map_TrackstoDrops (
self,
i,
k,
sorted_tracks) [protected]

6.24.3.22 _pickle_this_object()

None SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._pickle_this_object
(
self) [protected]

6.24.3.23 _read_supersegger()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._read_supersegger (
self,
sorted_cells) [protected]

```
Reads the structured cell data from supersegger and returns a nested array with the structure

Parameters
----------
sorted_cells : array-like of strings of directories paths
    the directories of the different frames of reference that are segemented

Returns
-------
array-like of structured data for each parameter is read, see below
```

6.24.3.24 _read_track_data()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._read_track_data (
              self,
              wd,
              t_string,
             ** kwargs) [protected]
```

```
        TODO: full explination

        Parameters
        ----------
        wd : str
            directory location of the dataset
        t_string : str
            unique identifier string for the dataset. Eg. NUSA, nusA, rpoC, RPOC etc.

        Returns
        -------
        array-like : [tracks,drops,blob_total]
            tracks : array-like
                all raw tracks from the dataset of trajectories from TrackMate
            drops : array-like
                drop statistics from TrackMate on time projected images
            blob_total
                drop statistics from blob_detection on time projected images

        Notes
        -----
        This function does more than just the returns.
        It also sets up the class substructure for the Movie.Cell.Drop.Trajectory mapping and updates many of
```

6.24.3.25 _read_track_data_nocells()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._read_track_data_nocells
(
              self,
              wd,
              t_string,
             ** kwargs) [protected]
```

```
Docstring
        Alternative to _read_track_data for cases when there is no cell segmentation via the supersegger metho

        Parameters:
        -----------
        wd : str
            directory location of the dataset
        t_string : str
            unique identifier string for the dataset. Eg. NUSA, nusA, rpoC, RPOC etc.

        Returns:
        --------
        array-like : [tracks,drops,blob_total]
            tracks : array-like
                all raw tracks from the dataset of trajectories from TrackMate
            drops : array-like
                drop statistics from TrackMate on time projected images
            blob_total
                drop statistics from blob_detection on time projected images
```

6.24.3.26 _reinitalizeVariables()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._reinitalizeVariables (
self) [protected]

6.24.3.27 _Segmentation_path_util()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._Segmentation_path_util
(
self) [protected]

6.24.3.28 _set_nucleoid_area_bulk()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._set_nucleoid_area_bulk
(
self) [protected]

```
This function sets the nucleoid area for each cell in the movie.
```

6.24.3.29 _store_combined_NOBIAS_files()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._store_combined_NOBIAS↩
_files (
self,
combined_dir_name,
Movie = None) [protected]

```
Store the NOBIAS style data to a combined directory which will contain data from multiple run_analysis
```

6.24.3.30 _store_combined_SMAUG_files()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._store_combined_SMAUG_↩
files (
self,
combined_dir_name,
Movie = None) [protected]

```
Store the SMAUG style data to a combined directory which will contain data from multiple run_analysis

Parameters:
-----------
combined_dir_name: string, default "SMAUG_COMBINED"
    name of the directory to store the combined SMAUG files
Movie: Movie object, default None
    Movie object to convert to a dictionary of tracks
```

6.24.3.31 _track_collection_utility()

```
list SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._track_collection↩
_utility (
              self)  [protected]
```

6.24.3.32 get_blob_parameters()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.get_blob_parameters (
              self,
              threshold = 1e-4,
              median = False,
              overlap = 0.5,
              num_sigma = 500,
              min_sigma = 1,
              max_sigma = 3,
              log_scale = False,
              detection_name = 'bp')
```

```
_summary_

        Parameters
        ----------
        threshold : _type_, optional
            _description_, by default 1e-4
        median : bool, optional
            _description_, by default False
        overlap : float, optional
            _description_, by default 0.5
        num_sigma : int, optional
            _description_, by default 500
        min_sigma : int, optional
            _description_, by default 1
        max_sigma : int, optional
            _description_, by default 3
        log_scale : bool, optional
            _description_, by default False
        detection_name : str, optional
            _description_, by default 'bp'
```

6.24.3.33 get_fitting_parameters()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.get_fitting_parameters (
              self,
              kwargs = {})
```

```
        Updates the fitting_parameters to be used in each iteration of this class object

        Kwargs
        ------
        mask_size: int
            when fitting the image with a function this is size of square round a reference point to use for f
        residual_func: functional
            function to use when defining the residuals for the fitting
        fit_method: string, default 'least squares'
            method of the fitting to use
        radius_func: functional, default numpy.mean
            function to use as a method to take two sigams and convert to one radius
        plot_fit: bool
```

```
        if True, plots each fit with the fit statistics
    centroid_range: int or float-like
        controls the bounds on the fit for the centroid (x,y). Ie: the min fit is x-centroid_range, and ma
        same for y.
    sigma_range: int or float-like
        controls the bounds on the fit for the sigmas (s_x,s_y). Ie: the min fit is s_x-sigma_range, and m
        same for y.
    fitting_image: string
        if "Original" use the original image to fit function
        else use the Laplacian image created with the sigma that maximized the laplacian

    Notes
    -----
    Some of these expect a certain type to work. This is not fully coded yet and might break if you give i
    to it.
```

6.24.3.34 isempty()

```
bool SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.isempty (
              self)
```

6.24.3.35 parameter_storage()

```
dict SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.parameter_storage (
              self)
```

6.24.3.36 path_structure_dict()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.path_structure_dict (
              self)
```

6.24.3.37 read_parameters()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.read_parameters (
              self,
              frame_step = 1000,
              frame_total = 5000,
              t_len_l = 10,
              t_len_u = 1000,
              MSD_avg_threshold = 0.0001,
              upper_bp = 0.99,
              lower_bp = 0.50,
              max_track_decomp = 1.0,
              conversion_p_nm = 130,
              minimum_tracks_per_drop = 3,
              minimum_percent_per_drop_in = 1.0,
              cluster_t_len_l = 7)
```

```
Reads in the parameters needed for the analysis

Parameters:
----------
frame_step : int
    Number of subframes used in the analysis
frame_total : int
    Total number of frames in the movies
t_len_l : int
    Lower bound for the length of the tracks
t_len_u : int
    Upper bound for the length of the tracks
MSD_avg_threshold : float
    Lower bound threshold for the MSD average, to determine if the track is a valid track and not auto
upper_bp : float
    Upper bound proportion threshold for determining if in_out track or out only.
lower_bp : float
    Lower bound proportion threshold for determining if in_out track or out only.
max_track_decomp : float
    Maximum track decomposition value
conversion_p_nm : float
    Conversion factor from pixels to nanometers
minimum_tracks_per_drop : int
    Minimum number of tracks per drop to be considered a valid drop
minimum_percent_per_drop_in : float
    Minimum percentage of tracks per drop that are in tracks to be considered a valid drop
cluster_t_len_l : int
    Minimum length of track to be used in defining the cluster

Notes:
-----
This function reads in variables and assigns them to the attributed of this class instance
```

6.24.3.38 read_track_data_masked_method()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.read_track_data_masked↩
_method (
self,
wd,
t_string,
** *kwargs*)

```
This is a repeat of _read_track_data but now with integration of masks for each cell and a new directo
The structure needs to be as follows (not counting other files and folders):
wd
    -\gfp
    -\Movies
        -\Movie_<movie_ID>
            -\Cell_<cell_ID>
                -\mask.tif
The analysis or analysis_new folders are as before.
Essentially the movie and cell ID are determined by the folder structure. The mask defines the propert
After wich we need to determine which spots occur in which cell.
Then the rest of the analysis is the same.
```

6.24.3.39 run_flow()

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.run_flow (
self,
masked_movies = False)

```
Controls the flow of this dataset analysis
```

6.24.3.40 run_flow_sim()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.run_flow_sim (
              self,
              cd,
              t_string)
```

6.24.3.41 track_durations()

```
dict SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.track_durations (
              self)
```

6.24.3.42 type_of_blob() [1/2]

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.type_of_blob (
              self)
```

6.24.3.43 type_of_blob() [2/2]

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.type_of_blob (
              self,
              value)
```

6.24.4 Member Data Documentation

6.24.4.1 _parameter_storage

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._parameter_storage  [protected]
```

6.24.4.2 _path_structure_dict

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._path_structure_dict
[protected]
```

6.24.4.3 _track_durations

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._track_durations  [protected]
```

6.24.4.4 _type_of_blob

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis._type_of_blob  [protected]
```

6.24.4.5 a_file_style

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.a_file_style`

LOADING TRACK DATA#####.

6.24.4.6 baljyot_idiot_factor

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.baljyot_idiot_factor`

forgot to change scale on some images before trackmate now i need to convert the scale from um to pixel so this all doesn't break

6.24.4.7 blob_median_filter

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.blob_median_filter`

6.24.4.8 blob_parameters

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.blob_parameters`

6.24.4.9 blob_t_len_l

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.blob_t_len_l`

6.24.4.10 Cells

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.Cells`

condensed analysis data Cells in the specific movie being analysed

6.24.4.11 detection_name

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.detection_name`

6.24.4.12 fitting_parameters

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.fitting_parameters`

6.24.4.13 frame_step

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.frame_step`

6.24.4.14 frame_total

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.frame_total

6.24.4.15 frames

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.frames

6.24.4.16 log_scale

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.log_scale

6.24.4.17 lower_bp

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.lower_bp

6.24.4.18 mat_path_dir

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.mat_path_dir

6.24.4.19 max_sigma_blob

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.max_sigma_blob

6.24.4.20 max_track_decomp

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.max_track_decomp

6.24.4.21 min_sigma_blob

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.min_sigma_blob

6.24.4.22 minimum_percent_per_drop_in

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.minimum_percent_per_↩
drop_in

6.24.4.23 minimum_tracks_per_drop

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.minimum_tracks_per_drop

6.24.4.24 Movie

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.Movie`

condensed analysis data Cells in the specific movie being analysed

6.24.4.25 MSD_avg_threshold

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.MSD_avg_threshold`

6.24.4.26 my_name

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.my_name`

6.24.4.27 num_sigma_blob

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.num_sigma_blob`

6.24.4.28 overlap_blob

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.overlap_blob`

6.24.4.29 overwrite_cell_localizations

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.overwrite_cell_localizations`

-—Load Track Data-—##

6.24.4.30 pixel_to_nm

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.pixel_to_nm`

6.24.4.31 pixel_to_um

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.pixel_to_um`

6.24.4.32 sim

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.sim`

6.24.4.33 t_len_l

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.t_len_l

6.24.4.34 t_len_u

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.t_len_u

6.24.4.35 t_string

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.t_string

6.24.4.36 threshold_blob

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.threshold_blob

blob detection parameters

6.24.4.37 total_experiments

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.total_experiments

6.24.4.38 track_collection

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.track_collection

6.24.4.39 track_durations

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.track_durations

6.24.4.40 type_of_blob

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.type_of_blob

6.24.4.41 upper_bp

SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.upper_bp

6.24.4.42 wd

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis.wd
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
  BP/databases/trajectory_analysis_script.py

6.25 SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.run_↩ analysis_plotting Class Reference

Public Member Functions

- None __init__ (self)

Static Public Member Functions

- draw_item (which_object, plots=1, all_tracks=False, movie_ID='0', cell_ID=['0', '1'], movie_frame_index=3)
- plot_img (which_object, plots=1, movie_ID='0', cell_ID='0', movie_frame_index=3)

6.25.1 Constructor & Destructor Documentation

6.25.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.run_analysis_plotting.__init__ (
              self)
```

6.25.2 Member Function Documentation

6.25.2.1 draw_item()

```
SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.run_analysis_plotting.draw_item (
              which_object,
              plots = 1,
              all_tracks = False,
              movie_ID = '0',
              cell_ID = ['0','1'],
              movie_frame_index = 3)  [static]
```

```
Plot the projected frame (movie_frame_index) of a movie (movie_ID) with specific cells (cell_ID, can be
marray of cells).
If plots == 1, plot only one subfigure, else plot a hard coded identicle set of subplots (2,3)
If all_tracks == True use the raw_tracks variable for each cell (all possible localization)


Parameters
----------
which_object : run_analysis object from trajectory_analysis_script.py
    eg. rp_ez,nusa_ez,ll_ez
plots : int, tuple (n,m)
    number of total subplots
    if 1 plot only one subplot
    else plot (n,m)
all_tracks : bool
    if true use all raw_tracks localizations
    else use only "viable" tracks
movie_ID : str
    key identifier of the movie in this dataset
cell_ID : str, array-like of str
    key identifier of the cell in this movie
    if array plot multiple cell attributes
movie_frame_index : int
    the subframe of the movie (usually 0-4 for 5 total subframes)

RETURNS
-------

Array-like
    [x,y,fig,ax]
    x : float
        x coordinates of all tracks used
    y : float
        y coordinates of all tracks used
    fig : figure object
        the figure object which defines the plotting
    ax :  Axes object
        All the sub_plot ax (if plots == 1, this is a single ax, else it is of shape (n,m))
```

6.25.2.2 plot_img()

SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.run_analysis_plotting.plot_img (
which_object,
plots = 1,
movie_ID = '0',
cell_ID = '0',
movie_frame_index = 3) [static]

```
Given the location of the image in our dataset, plot it given the plotting rules and return the figure/axis ob

Parameters
----------
which_object : run_analysis object from trajectory_analysis_script.py
    eg. rp_ez,nusa_ez,ll_ez
plots : int, tuple (n,m)
    number of total subplots
    if 1 plot only one subplot
    else plot (n,m)
movie_ID : str
    key identifier of the movie in this dataset
cell_ID : str, array-like of str
    key identifier of the cell in this movie
    if array plot multiple cell attributes
movie_frame_index : int
    the subframe of the movie (usually 0-4 for 5 total subframes)

Returns
```

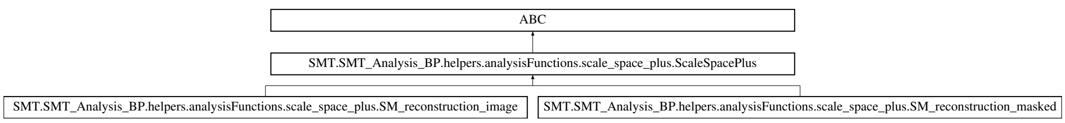
```
-------
array-like of figure,ax objects
    returns the object of the figure and axis created by the plotting of the image

Notes
-----
squeeze is used in plt.subplots(... ,squeeze) to change the shape of the ax objects created


squeeze : bool, default: True
    - If True, extra dimensions are squeezed out from the returned
    array of `~matplotlib.axes.Axes`:
    - if only one subplot is constructed (nrows=ncols=1), the
        resulting single Axes object is returned as a scalar.
    - for Nx1 or 1xM subplots, the returned object is a 1D numpy
        object array of Axes objects.
    - for NxM, subplots with N>1 and M>1 are returned as a 2D array.
    - If False, no squeezing at all is done: the returned Axes object is
    always a 2D array containing Axes instances, even if it ends up
    being 1x1.
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/ioModule/plotting_functions.py

6.26 SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_↩ plus.ScaleSpacePlus Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus:



Public Member Functions

- None __init__ (self)
- make_reconstruction (self)
- saving_image (self)
- print_state (self)

6.26.1 Constructor & Destructor Documentation

6.26.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.__init__ (
              self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image, and SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.

6.26.2 Member Function Documentation

6.26.2.1 make_reconstruction()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.make_reconstruction
(
              self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image, and SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.

6.26.2.2 print_state()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.print_state (
              self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image, and SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.

6.26.2.3 saving_image()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.saving_image (
              self)
```

Reimplemented in SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image, and SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/scale_space_plus.py

6.27 scale_space_plus_database_tracked.segmentation_scale_space Class Reference

Public Member Functions

- __init__ (self, cd, t_string, blob_parameters, fitting_parameters, img_dim, rescale_pixel_size=10, type_analysis_file="new", total_frames=5000, subframes=5, pixel_size=130, loc_error=30, include_all=True)
- main_run (self)
- SMT_Analysis_path (self)
- segmented_scale_space_plus_path (self)
- SM_reconstruction_Analysis_path (self)
- SM_DBSCAN_Analysis_Path (self)

Public Attributes

- cd
- t_string
- blob_parameters
- fitting_parameters
- img_dim
- rescale_pixel_size
- type_analysis_file
- total_frames
- subframes
- pixel_size
- loc_error
- include_all
- SMT_Analysis_path
- segmented_scale_space_plus_path

Protected Member Functions

- _save_parameters (self)

Protected Attributes

- _SMT_Analysis_path
- _segmented_scale_space_plus_path
- _SM_reconstruction_Analysis_path
- _SM_DBSCAN_Analysis_Path

6.27.1 Constructor & Destructor Documentation

6.27.1.1 __init__()

```
scale_space_plus_database_tracked.segmentation_scale_space.__init__ (
              self,
              cd,
              t_string,
              blob_parameters,
              fitting_parameters,
              img_dim,
              rescale_pixel_size = 10,
              type_analysis_file = "new",
              total_frames = 5000,
              subframes = 5,
              pixel_size = 130,
              loc_error = 30,
              include_all = True)
```

6.27.2 Member Function Documentation

6.27.2.1 _save_parameters()

```
scale_space_plus_database_tracked.segmentation_scale_space._save_parameters (
              self) [protected]
```

6.27.2.2 main_run()

```
scale_space_plus_database_tracked.segmentation_scale_space.main_run (
             self)
```

6.27.2.3 segmented_scale_space_plus_path()

```
scale_space_plus_database_tracked.segmentation_scale_space.segmented_scale_space_plus_path (
             self)
```

6.27.2.4 SM_DBSCAN_Analysis_Path()

```
scale_space_plus_database_tracked.segmentation_scale_space.SM_DBSCAN_Analysis_Path (
             self)
```

6.27.2.5 SM_reconstruction_Analysis_path()

```
scale_space_plus_database_tracked.segmentation_scale_space.SM_reconstruction_Analysis_path (
             self)
```

6.27.2.6 SMT_Analysis_path()

```
scale_space_plus_database_tracked.segmentation_scale_space.SMT_Analysis_path (
             self)
```

6.27.3 Member Data Documentation

6.27.3.1 _segmented_scale_space_plus_path

```
scale_space_plus_database_tracked.segmentation_scale_space._segmented_scale_space_plus_path
[protected]
```

6.27.3.2 _SM_DBSCAN_Analysis_Path

```
scale_space_plus_database_tracked.segmentation_scale_space._SM_DBSCAN_Analysis_Path  [protected]
```

6.27.3.3 _SM_reconstruction_Analysis_path

```
scale_space_plus_database_tracked.segmentation_scale_space._SM_reconstruction_Analysis_path
[protected]
```

6.27.3.4 _SMT_Analysis_path

```
scale_space_plus_database_tracked.segmentation_scale_space._SMT_Analysis_path  [protected]
```

6.27.3.5 blob_parameters

`scale_space_plus_database_tracked.segmentation_scale_space.blob_parameters`

6.27.3.6 cd

`scale_space_plus_database_tracked.segmentation_scale_space.cd`

6.27.3.7 fitting_parameters

`scale_space_plus_database_tracked.segmentation_scale_space.fitting_parameters`

6.27.3.8 img_dim

`scale_space_plus_database_tracked.segmentation_scale_space.img_dim`

6.27.3.9 include_all

`scale_space_plus_database_tracked.segmentation_scale_space.include_all`

6.27.3.10 loc_error

`scale_space_plus_database_tracked.segmentation_scale_space.loc_error`

6.27.3.11 pixel_size

`scale_space_plus_database_tracked.segmentation_scale_space.pixel_size`

6.27.3.12 rescale_pixel_size

`scale_space_plus_database_tracked.segmentation_scale_space.rescale_pixel_size`

6.27.3.13 segmented_scale_space_plus_path

`scale_space_plus_database_tracked.segmentation_scale_space.segmented_scale_space_plus_path`

6.27.3.14 SMT_Analysis_path

`scale_space_plus_database_tracked.segmentation_scale_space.SMT_Analysis_path`

6.27.3.15 subframes

`scale_space_plus_database_tracked.segmentation_scale_space.subframes`

6.27.3.16 t_string

`scale_space_plus_database_tracked.segmentation_scale_space.t_string`

6.27.3.17 total_frames

`scale_space_plus_database_tracked.segmentation_scale_space.total_frames`

6.27.3.18 type_analysis_file

`scale_space_plus_database_tracked.segmentation_scale_space.type_analysis_file`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/databases/reconstructionScripts/scale_space_plus_database_tracked.py

6.28 SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_↩ Localization_Image Class Reference

Public Member Functions

- None __init__ (self, image, np.ndarray candidate_peaks=None)
- fit (self, callable fit_model_residual, dict fit_model_params, dict fit_model_params_bounds, dict prune_↩ direction=None, **kwargs)
- image (self)
- img_shape (self)
- img_background_mean (self)
- img_background_std (self)
- np.ndarray candidate_peaks (self)
- candidate_peaks (self, np.ndarray peaks)
- list fit_results (self)
- fit_results (self, list fit_results)
- lmfit_model (self)
- lmfit_model (self, model)
- fit_parameters (self)
- fit_parameters (self, fit_parameters)
- fit_results_df (self)

Public Attributes

- plot_fit_results
- candidate_peaks
- lmfit_model
- fit_results
- img_background_mean
- fit_parameters

Protected Member Functions

- _initialize_properties (self, np.ndarray image)
- _update_lmfit_model (self, callable model)
- _find_candidate_peaks (self, **kwargs)
- _fit_peaks (self, callable fit_model_residual, dict fit_model_params, dict fit_model_params_bounds)
- _get_roi_around_peak (self, np.ndarray peak, int roi_size=5)
- _fit_model_to_roi (self, np.ndarray roi, np.ndarray peak, callable fit_model_residual, dict fit_model_params, dict fit_model_params_bounds)
- _get_model_params (self, dict fit_model_params, dict fit_model_params_bounds)
- _get_roi_coordinates (self, np.ndarray roi, np.ndarray peak)
- _fit_model_to_data (self, callable fit_model_residual, Parameters params, np.ndarray x, np.ndarray y, np.←
ndarray data)
- pd.DataFrame _convert_fit_result_pandas (self)
- _prune_fit_results (self, list params_to_prune, list params_thresholds)

Protected Attributes

- _image
- _img_shape
- _candidate_peaks
- _fit_results
- _fit_results_df
- _image_background_mean
- _image_background_std
- _lmfit_model
- _fit_parameters

6.28.1 Constructor & Destructor Documentation

6.28.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.__init__ (
              self,
              image,
             np.ndarray candidate_peaks = None)
```

6.28.2 Member Function Documentation

6.28.2.1 _convert_fit_result_pandas()

```
pd.DataFrame SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._convert_↩
fit_result_pandas (
              self)  [protected]
```

```
Converts the fit results to a pandas dataframe with each row corresponding to a peak,
and columns corresponding to the fit parameters and extra columns for the fit errors from the least squares fi

Returns:
--------
fit_results_df: pandas.DataFrame
    dataframe of the fit results
```

6.28.2.2 _find_candidate_peaks()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._find_candidate_peaks (
              self,
             ** kwargs)  [protected]
```

```
Private method to find candidate peaks in the image

Parameters:
-----------
kwargs: dict
    dictionary of keyword arguments to pass to find_peaks

Returns:
--------
candidate_peaks: numpy array
    array of candidate peaks

Keyword Arguments:
------------------
min_distance: int
    minimum distance in pixels between peaks
threshold_abs: int
    minimum intensity of peaks
exclude_border: int
    number of pixels to exclude from the border of the image
Others are passed to skimage.feature.peak_local_max
```

6.28.2.3 _fit_model_to_data()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_model_to_data (
              self,
             callable fit_model_residual,
             Parameters params,
             np.ndarray x,
             np.ndarray y,
             np.ndarray data)  [protected]
```

```
Fits the passed model to the passed data

Parameters:
-----------
fit_model_residual: callable
    callable residual function for the model
params: Parameters
    parameters for the model
x: numpy array
    x coordinates of the data
y: numpy array
    y coordinates of the data
data: numpy array
    data to fit the model to

Returns:
--------
fit_results: lmfit.minimizer.MinimizerResult
    results of the fit
```

6.28.2.4 _fit_model_to_roi()

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_model_to_roi (
self,
np.ndarray *roi*,
np.ndarray *peak*,
callable *fit_model_residual*,
dict *fit_model_params*,
dict *fit_model_params_bounds*) [protected]

```
Fits the passed model to the passed roi

Parameters:
-----------
roi: numpy array
    region of interest to fit the model to
peak: numpy array
    peak to fit the model to
fit_model_residual: callable
    callable residual function for the model
fit_model_params: dict
    dictionary of initial parameters for the model
fit_model_params_bounds: dict
    dictionary of bounds for the parameters of the model

Returns:
--------
fit_results: lmfit.minimizer.MinimizerResult
    results of the fit in the form of a lmfit MinimizerResult object
```

6.28.2.5 _fit_peaks()

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_peaks (
self,
callable *fit_model_residual*,
dict *fit_model_params*,
dict *fit_model_params_bounds*) [protected]

```
Fits the peaks in the image to the passed model

Parameters:
-----------

fit_model_residual: callable
    callable residual function for the model
fit_model_params: dict
    dictionary of initial parameters for the model
fit_model_params_bounds: dict
    dictionary of bounds for the parameters of the model
```

6.28.2.6 _get_model_params()

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._get_model_params (
self,
dict *fit_model_params*,
dict *fit_model_params_bounds*) [protected]

```
Gets the initial parameters for the model

Parameters:
-----------
fit_model_params: dict
    dictionary of initial parameters for the model
fit_model_params_bounds: dict
    dictionary of bounds for the parameters of the model
```

6.28.2.7 _get_roi_around_peak()

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._get_roi_around_peak (
self,
np.ndarray *peak*,
int *roi_size* = 5) [protected]

```
Gets the region of interest around a peak

Parameters:
-----------
peak: numpy array
    peak to get the roi around
```

6.28.2.8 _get_roi_coordinates()

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._get_roi_coordinates (
self,
np.ndarray *roi*,
np.ndarray *peak*) [protected]

```
Gets the x and y coordinates of the roi

Parameters:
-----------
roi: numpy array
    region of interest to fit the model to
peak: numpy array
    peak to fit the model to
```

6.28.2.9 _initialize_properties()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._initialize_properties (
             self,
             np.ndarray image)  [protected]
```

6.28.2.10 _prune_fit_results()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._prune_fit_results (
             self,
             list params_to_prune,
             list params_thresholds)  [protected]
```

```
Prune the fit results based on the passed parameters and thresholds

Parameters:
-----------
params_to_prune: list of keys of the parameters to prune
    list of parameters to prune
params_thresholds: list of tuples
    list of tuples of the form (lower_threshold,upper_threshold) for each parameter in params_to_prune

Returns:
--------
fit_results_pruned: list
    list of pruned fit results
Also updates the fit_results property
```

6.28.2.11 _update_lmfit_model()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._update_lmfit_model (
             self,
             callable model)  [protected]
```

6.28.2.12 candidate_peaks() [1/2]

```
np.ndarray SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.candidate_peaks
(
             self)
```

6.28.2.13 candidate_peaks() [2/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.candidate_peaks (
             self,
             np.ndarray peaks)
```

6.28.2.14 fit()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit (
              self,
             callable fit_model_residual,
             dict fit_model_params,
             dict fit_model_params_bounds,
             dict prune_direction = None,
             ** kwargs)
```

```
Finds candidate peaks in the image and fits them to the passed model, supports only gaussian models for now

Parameters:
-----------
fit_model_residual: callable
    callable residual function for the model
fit_model_params: dict
    dictionary of initial parameters for the model
fit_model_params_bounds: dict
    dictionary of bounds for the parameters of the model
prune_direction: dict, optional
    dictionary of parameters to prune and the direction to prune them in
    This is a dictionary of the form {parameter_name:prune_direction} where prune_direction is a tuple of the
    the parameter_name is a string matching the key in the fit_model_params dictionary
kwargs: dict
    dictionary of keyword arguments to pass to find_peaks
```

6.28.2.15 fit_parameters() [1/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_parameters (
              self)
```

6.28.2.16 fit_parameters() [2/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_parameters (
              self,
              fit_parameters)
```

6.28.2.17 fit_results() [1/2]

```
list SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_results (
              self)
```

6.28.2.18 fit_results() [2/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_results (
              self,
             list fit_results)
```

6.28.2.19 fit_results_df()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_results_df (
              self)
```

6.28.2.20 image()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.image (
              self)
```

6.28.2.21 img_background_mean()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.img_background_mean (
              self)
```

6.28.2.22 img_background_std()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.img_background_std (
              self)
```

6.28.2.23 img_shape()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.img_shape (
              self)
```

6.28.2.24 lmfit_model() [1/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.lmfit_model (
              self)
```

6.28.2.25 lmfit_model() [2/2]

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.lmfit_model (
              self,
              model)
```

6.28.3 Member Data Documentation

6.28.3.1 _candidate_peaks

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._candidate_peaks  [protected]
```

6.28.3.2 _fit_parameters

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_parameters  [protected]
```

6.28.3.3 _fit_results

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_results  [protected]
```

6.28.3.4 _fit_results_df

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._fit_results_df [protected]

6.28.3.5 _image

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._image [protected]

6.28.3.6 _image_background_mean

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._image_background_mean [protected]

6.28.3.7 _image_background_std

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._image_background_std [protected]

6.28.3.8 _img_shape

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._img_shape [protected]

6.28.3.9 _lmfit_model

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image._lmfit_model [protected]

6.28.3.10 candidate_peaks

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.candidate_peaks

6.28.3.11 fit_parameters

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_parameters

6.28.3.12 fit_results

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.fit_results

6.28.3.13 img_background_mean

SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.img_background_mean

6.28.3.14 lmfit_model

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.lmfit_model
```

6.28.3.15 plot_fit_results

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image.plot_fit_results
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/misc/guassian_fit.py

6.29 SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization↩ _movie Class Reference

Public Member Functions

- None __init__ (self, movie)
- fit (self, callable fit_model_residual, dict fit_model_params, dict fit_model_params_bounds, dict prune_↩ direction=None, List[np.ndarray] candidate_peaks_per_frame=None, **kwargs)
- np.ndarray movie (self)
- tuple movie_shape (self)
- float movie_background_mean (self)
- float movie_background_std (self)
- dict fit_parameters (self)
- list fit_results (self)
- pd.DataFrame fit_results_df (self)

Public Attributes

- fit_results
- fit_results_df
- movie

Protected Member Functions

- None _initialize_properties (self, np.ndarray movie)
- pd.DataFrame _convert_fit_result_pandas (self)
- None _save_dataframe (self, str path)

Protected Attributes

- _movie
- _movie_shape
- _fit_results_df
- _fit_parameters
- _fit_results
- _movie_background_mean
- _movie_background_std

6.29.1 Detailed Description

```
Extension of the SM_Localization_Image class to handle movies in which each frame is a 2D image and is fit to
contains utility function to convert to a final pandas dataframe
```

6.29.2 Constructor & Destructor Documentation

6.29.2.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.__init__ (
              self,
              movie)
```

6.29.3 Member Function Documentation

6.29.3.1 _convert_fit_result_pandas()

```
pd.DataFrame SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._convert_↩
fit_result_pandas (
              self)  [protected]
```

```
Converts the fit results to a pandas dataframe with each row corresponding to a peak,
and columns corresponding to the fit parameters and extra columns for the fit errors from the least squares fi
We also add 2 more columns for the frame number and a unique peak number in the frame to identify each peak (S

Returns:
--------
fit_results_df: pandas.DataFrame
    dataframe of the fit results
```

6.29.3.2 _initialize_properties()

```
None SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._initialize_properties
(
              self,
             np.ndarray movie)  [protected]
```

6.29.3.3 _save_dataframe()

```
None SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._save_dataframe (
              self,
             str path)  [protected]
```

```
Saves the fit results dataframe to a csv file

Parameters:
-----------
path: str
    path to save the dataframe to (needs to be an absolute path)
```

6.29.3.4 fit()

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit (
              self,
             callable fit_model_residual,
             dict fit_model_params,
             dict fit_model_params_bounds,
             dict prune_direction = None,
             List[np.ndarray] candidate_peaks_per_frame = None,
             ** kwargs)
```

```
Finds candidate peaks in the image and fits them to the passed model, supports only gaussian models for now

Parameters:
-----------
fit_model_residual: callable
    callable residual function for the model
fit_model_params: dict
    dictionary of initial parameters for the model
fit_model_params_bounds: dict
    dictionary of bounds for the parameters of the model
prune_direction: dict, optional
    dictionary of parameters to prune and the direction to prune them in
    This is a dictionary of the form {parameter_name:prune_direction} where prune_direction is a tuple of the
    the parameter_name is a string matching the key in the fit_model_params dictionary
candidate_peaks_per_frame: numpy array, optional
    numpy array of candidate peaks for each frame, if not passed, the peaks are found using find_peaks
    These need to be [x,y] coordinates
kwargs: dict
    dictionary of keyword arguments to pass to find_peaks
```

6.29.3.5 fit_parameters()

```
dict SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit_parameters (
              self)
```

6.29.3.6 fit_results()

```
list SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit_results (
              self)
```

6.29.3.7 fit_results_df()

```
pd.DataFrame SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit_results←↩
_df (
              self)
```

6.29.3.8 movie()

```
np.ndarray SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.movie (
              self)
```

6.29.3.9 movie_background_mean()

```
float SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.movie_background_↩
mean (
              self)
```

6.29.3.10 movie_background_std()

```
float SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.movie_background_std
(
              self)
```

6.29.3.11 movie_shape()

```
tuple SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.movie_shape (
              self)
```

6.29.4 Member Data Documentation

6.29.4.1 _fit_parameters

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._fit_parameters  [protected]
```

6.29.4.2 _fit_results

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._fit_results  [protected]
```

6.29.4.3 _fit_results_df

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._fit_results_df  [protected]
```

6.29.4.4 _movie

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._movie  [protected]
```

6.29.4.5 _movie_background_mean

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._movie_background_mean
[protected]
```

6.29.4.6 _movie_background_std

```
SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._movie_background_std
[protected]
```

6.29.4.7 _movie_shape

`SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie._movie_shape [protected]`

6.29.4.8 fit_results

`SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit_results`

6.29.4.9 fit_results_df

`SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.fit_results_df`

6.29.4.10 movie

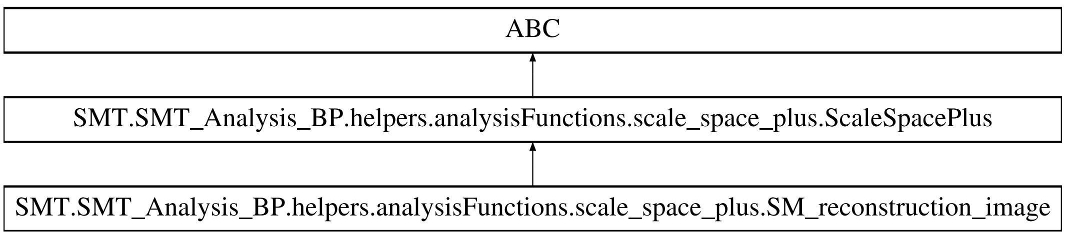
`SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie.movie`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/misc/guassian_fit.py

6.30 SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_↩ plus.SM_reconstruction_image Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction↩ _image:



Public Member Functions

- None __init__ (self, tuple|list img_dims_normal, int|float pixel_size_normal=130, int rescale_pixel_size=10)
- print_state (self)
- make_reconstruction (self, np.ndarray localizations, np.ndarray|float localization_error)
- saving_image (self, str full_path, name, str type)
- img_dims (self)
- img_dims (self, img_dims)
- img_space (self)
- img_space (self, img_space)
- domain (self)
- domain (self, domain)
- df_localizations (self)
- df_localizations (self, df_localizations)
- total_localizations (self)

Public Attributes

- img_dims_normal
- pixel_size_normal
- rescale_pixel_size
- img_dims
- domain
- df_localizations
- img_space

Protected Attributes

- _img_dims
- _img_space
- _domain
- _df_localizations

6.30.1 Constructor & Destructor Documentation

6.30.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.←
__init__ (
            self,
            tuple|list img_dims_normal,
            int|float pixel_size_normal = 130,
            int rescale_pixel_size = 10)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.30.2 Member Function Documentation

6.30.2.1 df_localizations() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.df_←
localizations (
            self)
```

6.30.2.2 df_localizations() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.df_←
localizations (
            self,
            df_localizations)
```

6.30.2.3 domain() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.domain
(
            self)
```

6.30.2.4 domain() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.domain
(
              self,
              domain)
```

6.30.2.5 img_dims() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
dims (
              self)
```

6.30.2.6 img_dims() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
dims (
              self,
              img_dims)
```

6.30.2.7 img_space() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
space (
              self)
```

6.30.2.8 img_space() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
space (
              self,
              img_space)
```

6.30.2.9 make_reconstruction()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.make_↩
reconstruction (
              self,
             np.ndarray localizations,
             np.ndarray|float localization_error)
```

```
Parameters:
-----------
localizations: np.ndarray
    Array of localizations in the form of (x,y) in pixels (original scale)
localization_error: np.ndarray or float
    Array of localization error in nm or a scalar

Returns:
--------
img_space: np.ndarray
    Image space of the reconstruction
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.30.2.10 print_state()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.print←
_state (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.30.2.11 saving_image()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.←
saving_image (
              self,
             str full_path,
              name,
             str type)
```

```
Parameters:
-----------
full_path: str
    Full path to save the image
name: str
    Name of the image
type: str
    Type of the image. Supported:
        - png
        - jpg
        - tif
        - svg
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.30.2.12 total_localizations()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.total←
_localizations (
              self)
```

6.30.3 Member Data Documentation

6.30.3.1 _df_localizations

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image._df_←
localizations  [protected]
```

6.30.3.2 _domain

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image._domain
[protected]
```

6.30.3.3 _img_dims

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image._img_↩
dims [protected]

6.30.3.4 _img_space

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image._img_↩
space [protected]

6.30.3.5 df_localizations

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.df_↩
localizations

6.30.3.6 domain

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.domain

6.30.3.7 img_dims

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
dims

6.30.3.8 img_dims_normal

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
dims_normal

6.30.3.9 img_space

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.img_↩
space

6.30.3.10 pixel_size_normal

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.pixel↩
_size_normal

6.30.3.11 rescale_pixel_size

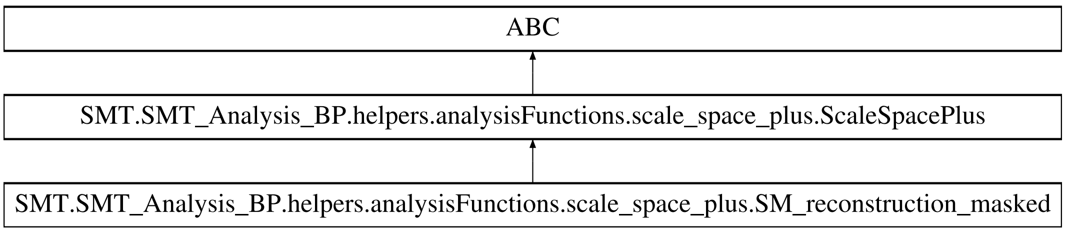
```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image.↩
rescale_pixel_size
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/scale_space_plus.py

6.31 SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_↩ plus.SM_reconstruction_masked Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction↩ _masked:



Public Member Functions

- None __init__ (self, tuple|list img_dims_normal, int|float pixel_size_normal=130, int rescale_pixel_size=10)
- print_state (self)
- make_reconstruction (self, localizations, localization_error, masked_img)
- make_uniform_reconstruction (self, localizations, localization_error, masked_img)
- saving_image (self, np.ndarray img, str full_path, str type=None)
- coordinate_conversion (self, np.ndarray spatial_dim, np.ndarray radius, str conversion_type)
- masked_img_space (self)
- img_dims (self)
- masked_domain (self)
- bounding_box (self)
- df_localizations (self)
- df_localizations (self, df_localizations)

Public Attributes

- img_dims_normal
- pixel_size_normal
- rescale_pixel_size
- normal_domain
- df_localizations

Protected Member Functions

- _get_uniform_localization (self, masked_domain, num_localizations)
- None _setup_masked_domain (self, int mask_value, np.ndarray masked_img_space)
- None _setup_bounding_box (self)

Protected Attributes

- _img_dims
- _masked_img_space
- _masked_domain
- _bounding_box
- _df_localizations

6.31.1 Constructor & Destructor Documentation

6.31.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
__init__ (
              self,
             tuple|list img_dims_normal,
             int|float pixel_size_normal = 130,
             int rescale_pixel_size = 10)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.31.2 Member Function Documentation

6.31.2.1 _get_uniform_localization()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._get↩
_uniform_localization (
              self,
              masked_domain,
              num_localizations)  [protected]
```

6.31.2.2 _setup_bounding_box()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
_setup_bounding_box (
              self)  [protected]
```

```
Sets up the bounding box for the reconstruction. This is the bounding box of the masked domain.
Sets:
-----
self._bounding_box: np.ndarray
    The bounding box of the masked domain. The format is:
    [[x_min,y_min],[x_max,y_max]]
```

6.31.2.3 _setup_masked_domain()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
_setup_masked_domain (
              self,
             int mask_value,
             np.ndarray masked_img_space)  [protected]
```

```
Setups the masked domain for the reconstruction. This is the domain of the image space which represents a cell
Parameters:
-----------
mask_value: int
    The value in the masked_img_space which represents the cell area (usually 1)
masked_img_space: np.ndarray
    The masked image space. If None then the attribute masked_img_space is used. If the attribute does not exi
    This is a 2D array defining the frame of view of the whole img

Sets:
-----
self._masked_domain: np.ndarray
    The domain of the masked image space which represents the cell area in which the localizations are locatec
    The format is:
    [[x,y],[x,y],...,[x,y]] where x,y represent the index and hence the pixel location in the masked image spa
```

6.31.2.4 bounding_box()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
bounding_box (
              self)
```

6.31.2.5 coordinate_conversion()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
coordinate_conversion (
              self,
             np.ndarray spatial_dim,
             np.ndarray radius,
             str conversion_type)
```

```
Converts the spatial dimension of the reconstruction image to the original image space.
Parameters:
-----------
spatial_dim: ndarray
    The spatial dimension to convert. This is the dimension of the reconstruction image space.
radius: ndarray
    The radius of the reconstruction image space.
conversion_type: str
    The type of conversion to perform. Supported:
        - RC_to_Original: converts the reconstruction image space to the original image space
        - original_to_RC: converts the original image space to the reconstruction image space

Returns:
--------
converted_dim: ndarray
    The converted spatial dimension
convert_radius: ndarray
    The converted radius
```

6.31.2.6 df_localizations() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.df_↩
localizations (
              self)
```

6.31.2.7 df_localizations() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.df_↩
localizations (
              self,
              df_localizations)
```

6.31.2.8 img_dims()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.img_↩
dims (
              self)
```

6.31.2.9 make_reconstruction()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.make↩
_reconstruction (
              self,
              localizations,
              localization_error,
              masked_img)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.31.2.10 make_uniform_reconstruction()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.make↩
_uniform_reconstruction (
              self,
              localizations,
              localization_error,
              masked_img)
```

```
We will now use the number of localizations to uniformly make a reconstruction image on the masked domain.
```

6.31.2.11 masked_domain()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
masked_domain (
              self)
```

6.31.2.12 masked_img_space()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
masked_img_space (
              self)
```

6.31.2.13 print_state()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
print_state (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.31.2.14 saving_image()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
saving_image (
              self,
             np.ndarray img,
             str full_path,
             str type = None)
```

```
Save the given image to the full path with the given name and type.

Parameters:
-----------
img: np.ndarray
    The image to save
full_path: str
    Full path to save the image (this includes the name)
type: str
    Type of the image. Supported:
        - png
        - jpg
        - tif
        - svg
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus.

6.31.3 Member Data Documentation

6.31.3.1 _bounding_box

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._↩
bounding_box  [protected]
```

6.31.3.2 _df_localizations

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._df_↩
localizations  [protected]
```

6.31.3.3 _img_dims

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._img↩
_dims [protected]

6.31.3.4 _masked_domain

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._↩
masked_domain [protected]

6.31.3.5 _masked_img_space

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked._↩
masked_img_space [protected]

6.31.3.6 df_localizations

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.df_↩
localizations

6.31.3.7 img_dims_normal

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.img_↩
dims_normal

6.31.3.8 normal_domain

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
normal_domain

6.31.3.9 pixel_size_normal

SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
pixel_size_normal

6.31.3.10 rescale_pixel_size

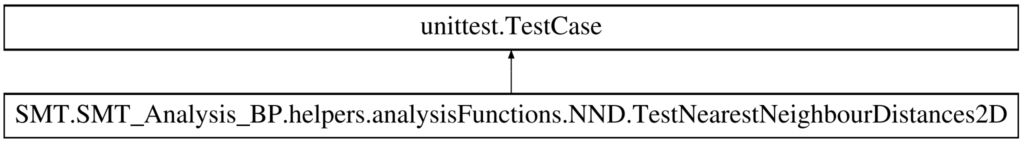
SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked.↩
rescale_pixel_size

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
  BP/helpers/analysisFunctions/scale_space_plus.py

6.32 SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.Test↩ NearestNeighbourDistances2D Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestNearestNeighbourDistances2D↩ :



Public Member Functions

- test_nearest_neighbour_distances_2d (self)

6.32.1 Member Function Documentation

6.32.1.1 test_nearest_neighbour_distances_2d()

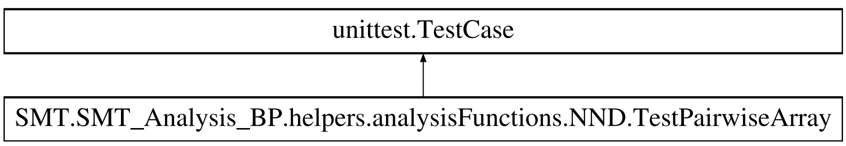
```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestNearestNeighbourDistances2D.test_↩
nearest_neighbour_distances_2d (
              self)
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/NND.py

6.33 SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.Test↩ PairwiseArray Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestPairwiseArray:



Public Member Functions

- test_pairwise_array (self)

6.33.1 Member Function Documentation

6.33.1.1 test_pairwise_array()

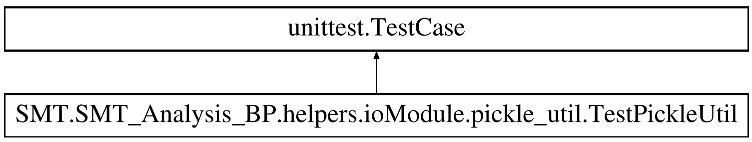
```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestPairwiseArray.test_pairwise_array (
              self)
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/NND.py

6.34 SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil:



Public Member Functions

- setUp (self)
- test_save_and_load (self)
- tearDown (self)

Public Attributes

- pickle_util

6.34.1 Member Function Documentation

6.34.1.1 setUp()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil.setUp (
              self)
```

6.34.1.2 tearDown()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil.tearDown (
              self)
```

6.34.1.3 test_save_and_load()

```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil.test_save_and_load (
            self)
```

6.34.2 Member Data Documentation

6.34.2.1 pickle_util

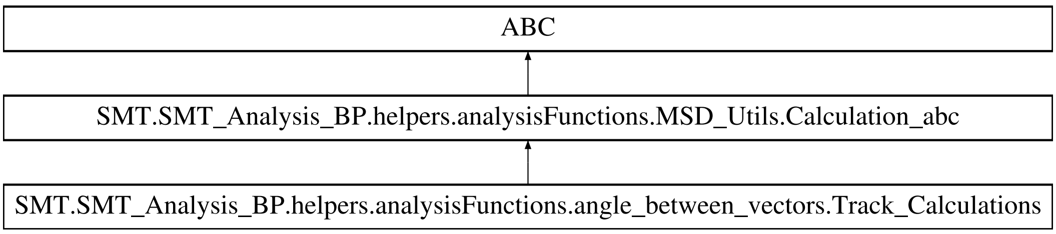
```
SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil.pickle_util
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/ioModule/pickle_util.py

6.35 SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between↩ _vectors.Track_Calculations Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_↩ Calculations:



Public Member Functions

- None __init__ (self, list data_set_RA, float pixel_to_um=0.13, float frame_to_seconds=0.02, str frame_↩ units="s", str pixel_units="um", ∗∗kwargs)
- combined_store (self)
- combined_store (self, combined_store)
- individual_store (self)
- individual_store (self, individual_store)

Public Attributes

- track_dataset

Protected Member Functions

- _build_Tracks_combined (self, ∗∗kwargs)
- _build_Tracks_individual (self, ∗∗kwargs)
- _build_Tracks (self, ∗∗kwargs)

Protected Attributes

- _combined_store
- _individual_store

6.35.1 Constructor & Destructor Documentation

6.35.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.↵
__init__ (
             self,
             list data_set_RA,
             float pixel_to_um = 0.13,
             float frame_to_seconds = 0.02,
             str frame_units = "s",
             str pixel_units = "um",
             ** kwargs)
```

```
Parameters:
-----------
data_set_RA: list
    list of tas.run_analysis objects
pixel_to_um: float
    pixel to um conversion
frame_to_seconds: float
    frame to seconds conversion
frame_units: str
    frame units
pixel_units: str
    pixel units

KWARGS:
-------
min_track_length: int, Default = 1
    minimum track length to be considered.
max_track_length: int, Default = 1000
    maximum track length to be considered.
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.35.2 Member Function Documentation

6.35.2.1 _build_Tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations._↵
build_Tracks (
             self,
             ** kwargs)   [protected]
```

```
Parameters:
-----------
KWARGS:
-------
Passed to af.MSD_Tracks()
```

6.35.2.2 _build_Tracks_combined()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations._←↩
build_Tracks_combined (
              self,
             ** kwargs)  [protected]
```

6.35.2.3 _build_Tracks_individual()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations._←↩
build_Tracks_individual (
              self,
             ** kwargs)  [protected]
```

6.35.2.4 combined_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.←↩
combined_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.35.2.5 combined_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.←↩
combined_store (
              self,
              combined_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.35.2.6 individual_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.←↩
individual_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.35.2.7 individual_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.←↩
individual_store (
              self,
              individual_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.35.3 Member Data Documentation

6.35.3.1 _combined_store

SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations._combined_store [protected]

6.35.3.2 _individual_store

SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations._individual_store [protected]

6.35.3.3 track_dataset

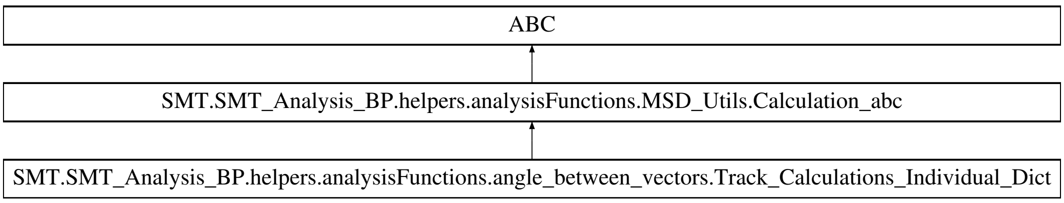
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations.track_dataset

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysisFunctions/angle_between_vectors.py

6.36 SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict Class Reference

Inheritance diagram for SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict:



Public Member Functions

- None __init__ (self, track_dict, **kwargs)
- combined_store (self)
- combined_store (self, combined_store)
- individual_store (self)
- individual_store (self, individual_store)

Public Attributes

- track_dict
- pixel_to_um
- frame_to_seconds

Protected Member Functions

- _build_Angle_Tracks (self, **kwargs)

Protected Attributes

- _storage

6.36.1 Constructor & Destructor Documentation

6.36.1.1 __init__()

```
None SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.__init__ (
              self,
              track_dict,
             ** kwargs)
```

```
Parameters:
-----------
track_dict: dict
    dict of tracks in the form:
    {
    track_ID: [[x,y],...,[x,y]],
    .
    .
    .
    }
KWARGS:
-------
pixel_to_um: float
    pixel to um conversion
frame_to_seconds: float
    frame to seconds conversion
frame_units: str
    frame units
pixel_units: str
    pixel units
min_track_length: int, Default = 1
    minimum track length to be considered.
max_track_length: int, Default = 1000
    maximum track length to be considered.
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.36.2 Member Function Documentation

6.36.2.1 _build_Angle_Tracks()

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict._build_Angle_Tracks (
              self,
             ** kwargs)   [protected]
```

6.36.2.2 combined_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.combined_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.36.2.3 combined_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.combined_store (
              self,
              combined_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.36.2.4 individual_store() [1/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.individual_store (
              self)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.36.2.5 individual_store() [2/2]

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.individual_store (
              self,
              individual_store)
```

Reimplemented from SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc.

6.36.3 Member Data Documentation

6.36.3.1 _storage

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict._storage  [protected]
```

6.36.3.2 frame_to_seconds

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.frame_to_seconds
```

6.36.3.3 pixel_to_um

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.pixel_to_um
```

6.36.3.4 track_dict

```
SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_↩
Individual_Dict.track_dict
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩ BP/helpers/analysisFunctions/angle_between_vectors.py

6.37 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.↩ Trajectory Class Reference

Public Member Functions

- __init__ (self, Track_ID, Frame_number, X, Y, Classification, Drop_Identifier, Frames, MSD_total_um=None, **kwargs)

Public Attributes

- Track_ID
- Frame_number
- Frames
- X
- Y
- Intensity
- Classification
- Drop_Identifier
- MSD_total_um
- distance_from_drop

6.37.1 Detailed Description

```
Trajectory attribute class

Parameters
----------
__init__ :
    Track_ID : int
        unique identifier for each trajectory
    Frame_number : int
        frame number of the trajectory (based on the sub segmented frames) (i.e 0,1,2,3,4 if subframes = 5
    X : list or np.array
        x coordinates of the trajectory
    Y : list or np.array
        y coordinates of the trajectory
    Classification : str
        "IN" or "OUT" or "IO", for In Drop, Out Drop, In and Out Drop
    Drop_Identifier : str
        ID of the drop that the trajectory belongs to
    Frames : list or np.array
        frame numbers of the trajectory (based on the original frames)
    Intensity : list or np.array
        intensity of the trajectory (same length as X and Y and Frames)
    MSD_total_um : float, default = None
        total MSD of the trajectory

    Kwargs:
    -------
    distance_from_drop : float
        distance from the drop center to the trajectory
```

6.37.2 Constructor & Destructor Documentation

6.37.2.1 __init__()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.__init__ (
              self,
              Track_ID,
              Frame_number,
              X,
              Y,
              Classification,
              Drop_Identifier,
              Frames,
              MSD_total_um = None,
             ** kwargs)
```

6.37.3 Member Data Documentation

6.37.3.1 Classification

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Classification`

6.37.3.2 distance_from_drop

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.distance_from_drop`

6.37.3.3 Drop_Identifier

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Drop_Identifier`

6.37.3.4 Frame_number

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Frame_number`

6.37.3.5 Frames

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Frames`

6.37.3.6 Intensity

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Intensity`

6.37.3.7 MSD_total_um

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.MSD_total_um`

6.37.3.8 Track_ID

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Track_ID`

6.37.3.9 X

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.X`

6.37.3.10 Y

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory.Y`

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_↩
BP/databases/trajectory_analysis_script.py

6.38 SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.↩ Trajectory_Drop_Mapping Class Reference

Public Member Functions

- __init__ (self, Drop_ID)

Public Attributes

- Drop_ID
- IN_Trajectory_Collection
- OUT_Trajectory_Collection
- IO_Trajectory_Collection

6.38.1 Detailed Description

```
create a mapping for each viable drop to store all the Trajectory instances that belong to it in terms of

Parameters
----------
__init__ :
    Drop_ID : str
        unique identifier for each viable drop (i.e "0,1" for the first drop in the first sub-frame)
        Note that the first number is the sub-frame number and the second number is the drop index in that
        See notes for more information

IN_Trajectory_Collection : dict
    dictionary of all the IN trajectories that belong to the viable drop
OUT_Trajectory_Collection : dict
    dictionary of all the OUT trajectories that belong to the viable drop
IO_Trajectory_Collection : dict
    dictionary of all the IN and OUT trajectories that belong to the viable drop

Notes:
------
1. Each dictionary is of the form (i,j) -> (frame,trajectory index) where i is the frame number and j is t
where the above represent the keys, the values are instances of the Trajectory class
2. The frame number is based on the sub segmented frames (i.e 0,1,2,3,4 if subframes = 5)
3. The trajectory index is the index of the trajectory in the raw_tracks list of the Cell class object
4. The viable drop index is the index of the detected drop in the Drop_Collection dictionary of the Cell c
5. 4) shows that the viable drop index is the same as the drop index in the raw_tracks list of the Cell cl
(i.e the drop index is determined by the blob detection. After the viability criterion is applied the non-
(For a collection of drops with IDs (0,1),(0,2),(0,3), if (0,2) is not viable then the viable drops are: (
```

6.38.2 Constructor & Destructor Documentation

6.38.2.1 __init__()

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping.__init__ (
            self,
            Drop_ID)
```

6.38.3 Member Data Documentation

6.38.3.1 Drop_ID

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping.Drop_ID`

6.38.3.2 IN_Trajectory_Collection

`SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping.IN_Trajectory↩ _Collection`

6.38.3.3 IO_Trajectory_Collection

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping.IO_Trajectory←
_Collection
```

6.38.3.4 OUT_Trajectory_Collection

```
SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping.OUT_Trajectory←
_Collection
```

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

- /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_← BP/databases/trajectory_analysis_script.py

Chapter 7

File Documentation

7.1 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/__init__.py File Reference

Namespaces

- namespace SMT

7.2 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP

7.3 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases

7.4 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/directory↩ Manipulator/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.directoryManipulator

7.5 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers

7.6 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysisFunctions/_↩ _init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions

7.7 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/clusterMethods/__↩ init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.clusterMethods

7.8 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule

7.9 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/misc/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.misc

7.10 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/Parameter_Store/__init__.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.Parameter_Store

7.11 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/data_path_↩ container.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.data_path_container

Variables

- dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_ez_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_m9_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_hex5_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_ez_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_m9_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.laci_laco_hex5_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_rif_paths
- dict SMT.SMT_Analysis_BP.databases.data_path_container.rpoc_ez_cluster_tracking_paths
- dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_ez_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_m9_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_hex5_paths_keywords
- dict SMT.SMT_Analysis_BP.databases.data_path_container.nusa_rif_paths_keywords
- list SMT.SMT_Analysis_BP.databases.data_path_container.rpoc

  movie paths in volumes
- list SMT.SMT_Analysis_BP.databases.data_path_container.ll

7.12 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/databases/directoryManipulator/format_mask_structure.py File Reference

Classes

- class SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.movie_mask_directory_structure_manag

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.directoryManipulator
- namespace SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure

Functions

- SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.read_npy_file (path, correct_dtype=True)
- dict SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.obtain_masks_npy (npy_output_file)
- None SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure._reorder_file_names (file_paths, end_string=None)

Variables

- list SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.path

  testing
- SMT.SMT_Analysis_BP.databases.directoryManipulator.format_mask_structure.mask_dir = movie_mask_directory_structure_r

7.13 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/databases/directoryManipulator/tifanal.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.directoryManipulator
- namespace SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal

Variables

- dict SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.SEGMENT_TYPE
- int SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.STACK_STEP = 5
- int SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.CONVERT_NAME = 1
- str SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.DIR_PATH = "/Volumes/Baljyot_HD/SMT_Olympus/RIF_TREATMET_LIVE/20230528/Movie"
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.root = tk.Tk()
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.filez = fd.askopenfilenames(parent=root, title='Choose a file', initialdir=DIR_PATH)
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.root_dir = os.path.dirname(filez[0])
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.sorted_a_files = sorted(filez,key=lambda x: int(x.split("/")[-1].split(".")[0].split("_")[-1]))
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.temp_im = io.imread(sorted_a_files[i])
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.temp_del = temp_im[:]
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.length = int(len(temp_del)/STACK_STEP)
- list SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.hold_img = [ ]
- list SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.hold_name = [ ]
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.movie_name = sorted_a_files[i].split("/")[-1].split(".")[0]
- SMT.SMT_Analysis_BP.databases.directoryManipulator.tifanal.updated_movie_name = movie_name.split("_")[:-1]

7.14 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/databases/reconstructionScripts/scale_space_plus_database_tracked.py File Reference

Classes

- class scale_space_plus_database_tracked.segmentation_scale_space

Namespaces

- namespace scale_space_plus_database_tracked

Variables

- int scale_space_plus_database_tracked.CORRECTION_FACTOR = 1.
- str scale_space_plus_database_tracked.LOCALIZATION_UNIQUE_TYPE = "mean"
- list scale_space_plus_database_tracked.cds
- list scale_space_plus_database_tracked.t_strings
- dict scale_space_plus_database_tracked.blob_parameters
- dict scale_space_plus_database_tracked.fitting_parameters
- list scale_space_plus_database_tracked.img_dims
- list scale_space_plus_database_tracked.rescale_pixel_size
- list scale_space_plus_database_tracked.type_analysis_file
- list scale_space_plus_database_tracked.total_frames
- list scale_space_plus_database_tracked.subframes
- list scale_space_plus_database_tracked.pixel_size
- list scale_space_plus_database_tracked.loc_error
- list scale_space_plus_database_tracked.include_all
- scale_space_plus_database_tracked.batch

7.15 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/reconstruction↩ Scripts/scale_space_plus_fixed_palm.py File Reference

Classes

- class scale_space_plus_fixed_palm.Reconstruct_Masked_PALM_DATASETS
- class scale_space_plus_fixed_palm.Reconstruct_Fixed_PALM_DATASETS
- class scale_space_plus_fixed_palm.Reconstruct_Tracked_PALM_DATASETS_with_mask

Namespaces

- namespace scale_space_plus_fixed_palm

Functions

- scale_space_plus_fixed_palm.load_localizations (localizations_path, skiprows=4)
- scale_space_plus_fixed_palm.load_localizations_TS (localizations_path, skiprows=0)
- pd.DataFrame scale_space_plus_fixed_palm.get_unique_localizations (pd.DataFrame localizations_df, str unique_loc_type="first")
- pd.DataFrame scale_space_plus_fixed_palm.get_unique_localizations_TS (pd.DataFrame localizations_df, str unique_loc_type="first")
- scale_space_plus_fixed_palm.rescale_scale_space_blob_detection (blobs, callable rescaling_func, **kwargs)

Variables

- int scale_space_plus_fixed_palm.CORRECTION_FACTOR = 1.
- str scale_space_plus_fixed_palm.LOCALIZATION_UNIQUE_TYPE = "mean"
- list scale_space_plus_fixed_palm.XY_NAMES = ['x','y']
- list scale_space_plus_fixed_palm.global_path
- dict scale_space_plus_fixed_palm.blob_parameters
- dict scale_space_plus_fixed_palm.fitting_parameters
- scale_space_plus_fixed_palm.sm_rec

7.16 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/structure_↩ storage.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.structure_storage

Variables

- dict SMT.SMT_Analysis_BP.databases.structure_storage.SEGMENTATION_FOLDER_TYPES

  FOLDER STRUCTURES ########.
- dict SMT.SMT_Analysis_BP.databases.structure_storage.ANALYSIS_FOLDER_TYPES
- dict SMT.SMT_Analysis_BP.databases.structure_storage.LOADING_DROP_BLOB_TYPES

7.17 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/thunder↩ STORM/localization_merger.py File Reference

Namespaces

- namespace localization_merger

Functions

- pd.DataFrame localization_merger.merge_localization (pd.DataFrame tracks, max_dist=1, max_frame_↩ gap=1)

Variables

- list localization_merger.COL_NAMES_THUNDERSTORM = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma [nm]', 'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]']
- list localization_merger.NEW_COL_NAMES = ['id', 'frame', 'x [nm]', 'y [nm]', 'sigma [nm]', 'intensity [photon]', 'offset [photon]', 'bkgstd [photon]', 'chi2', 'uncertainty [nm]', 'merged']

7.18 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/thunder↩ STORM/localization_setter.py File Reference

Classes

- class localization_setter.path_structure
- class localization_setter.mask_localization

Namespaces

- namespace localization_setter

Variables

- str localization_setter.RELATIVE_ANALYSIS_FOLDER = "TS_Analysis"
- int localization_setter.BOUNDING_BOX_EXTRA_BORDER = 2
- list localization_setter.paths
- localization_setter.ml = mask_localization(path)

7.19 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/trajectory_↩ analysis_script.py File Reference

Classes

- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.run_analysis
- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Movie_frame
- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Cell
- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory_Drop_Mapping
- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.Trajectory
- class SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.boundary_analysis

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.databases
- namespace SMT.SMT_Analysis_BP.databases.trajectory_analysis_script

Variables

- list SMT.SMT_Analysis_BP.databases.trajectory_analysis_script.TRACK_TYPES

7.20 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/databases/utilities/utility_↩ database.py File Reference

Classes

- class utility_database.Counter_start_stop

Namespaces

- namespace utility_database

Variables

- list utility_database.ALLOWED_START_TYPES = [int,float]

7.21 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/BP_TRACKING.py File Reference

Namespaces

- namespace BP_TRACKING

Functions

- BP_TRACKING.main ()
- BP_TRACKING.tracking_plus_save (directory_path, dir_save, file_path, file_counter)
- BP_TRACKING.sorted_alphanumeric (data)

Variables

- str BP_TRACKING.DIRECTORY_MOVIES = "/Volumes/Baljyot_HD/SMT_Olympus/RIF_TREATMET_↩ LIVE/20230528/Movie"
- str BP_TRACKING.MOVIE_BASE_NAME = "nusa_rif"
- str BP_TRACKING.DIRECTORY_SAVE = "Analysis_new"
- dict BP_TRACKING.LINKING_PARAMETERS
- dict BP_TRACKING.LOCALIZATION_PARAMETERS
- dict BP_TRACKING.FILTERING_PARAMETERS
- dict BP_TRACKING.OUTPUT_COLUMNS
- list BP_TRACKING.OUTPUT_COLUMNS_ORDER
- int BP_TRACKING.PAD_ROWS = 3
- BP_TRACKING.model = Model()
- BP_TRACKING.settings = Settings(imp)
- BP_TRACKING.detectorFactory
- BP_TRACKING.detectorSettings
- BP_TRACKING.trackerFactory
- BP_TRACKING.trackerSettings
- BP_TRACKING.trackmate = TrackMate(model, settings)
- BP_TRACKING.ok = trackmate.checkInput()
- BP_TRACKING.ds = DisplaySettingsIO.readUserDefault()
- BP_TRACKING.selectionModel = SelectionModel(model)
- BP_TRACKING.displayer = HyperStackDisplayer(model, selectionModel, imp,ds)
- BP_TRACKING.spt_m = model.getSpots()
- BP_TRACKING.tracks_found = model.getTrackModel().trackIDs(True)
- BP_TRACKING.tot_spts = spt_m.getNSpots(True)
- BP_TRACKING.fm = model.getFeatureModel()
- list BP_TRACKING.header_row = [header_name for header_name in OUTPUT_COLUMNS_ORDER]
- list BP_TRACKING.collection_spots_per_track = [header_row]
- BP_TRACKING.track = model.getTrackModel().trackSpots(id)
- int BP_TRACKING.spot_counter = 0
- BP_TRACKING.sid = spot.ID()

- int BP_TRACKING.spot_label = spot_counter
- BP_TRACKING.spot_ID = sid
- BP_TRACKING.track_ID = id
- BP_TRACKING.spot_quality = spot.getFeature('QUALITY')
- BP_TRACKING.spot_x = spot.getFeature('POSITION_X')
- BP_TRACKING.spot_y = spot.getFeature('POSITION_Y')
- BP_TRACKING.spot_z = spot.getFeature('POSITION_Z')
- BP_TRACKING.spot_t = spot.getFeature('POSITION_T')
- BP_TRACKING.spot_frame = spot.getFeature('FRAME')
- BP_TRACKING.spot_radius = spot.getFeature('RADIUS')
- BP_TRACKING.spot_visibility = spot.getFeature('VISIBILITY')
- BP_TRACKING.spot_manual_spot_color = spot.getFeature('MANUAL_SPOT_COLOR')
- BP_TRACKING.spot_mean_intensity_ch1 = spot.getFeature('MEAN_INTENSITY_CH1')
- BP_TRACKING.spot_median_intensity_ch1 = spot.getFeature('MEDIAN_INTENSITY_CH1')
- BP_TRACKING.spot_min_intensity_ch1 = spot.getFeature('MIN_INTENSITY_CH1')
- BP_TRACKING.spot_max_intensity_ch1 = spot.getFeature('MAX_INTENSITY_CH1')
- BP_TRACKING.spot_total_intensity_ch1 = spot.getFeature('TOTAL_INTENSITY_CH1')
- BP_TRACKING.spot_std_intensity_ch1 = spot.getFeature('STD_INTENSITY_CH1')
- BP_TRACKING.spot_contrast_ch1 = spot.getFeature('CONTRAST_CH1')
- BP_TRACKING.spot_snr_ch1 = spot.getFeature('SNR_CH1')
- BP_TRACKING.writer = csv.writer(f,delimiter=',')
- BP_TRACKING.start_time = time.time()

7.22 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/OLD_METHODS/testing_new_script.py File Reference

Namespaces

- namespace testing_new_script

Variables

- str testing_new_script.dir_tiff = '/Volumes/Baljyot_HD/SMT_Olympus/Baljyot_temp/12/rpoc_m9'
- testing_new_script.files = glob.glob(dir_tiff + '/' +'*seg.tif')
- str testing_new_script.root = dir_tiff
- str testing_new_script.save_analysis_dir = dir_tiff + '/' + 'Analysis_test'
- testing_new_script.str_name_fil = files[z]
- testing_new_script.imp = IJ.openImage(str_name_fil)
- testing_new_script.dims = imp.getDimensions();
- testing_new_script.model = Model()
- testing_new_script.logger = Logger.IJ_LOGGER
- testing_new_script.settings = Settings(imp)
- testing_new_script.detectorFactory
- testing_new_script.detectorSettings
- testing_new_script.trackerFactory
- testing_new_script.trackerSettings
- testing_new_script.initialSpotFilterValue
- testing_new_script.trackmate = TrackMate(model, settings)
- testing_new_script.ok = trackmate.checkInput()
- testing_new_script.selectionModel = SelectionModel(model)

- testing_new_script.displayer = HyperStackDisplayer(model, selectionModel, imp)
- int testing_new_script.go = 0
- testing_new_script.fm = model.getFeatureModel()
- testing_new_script.a = model.getSpots().iterator(True)
- str testing_new_script.cd = root
- testing_new_script.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- testing_new_script.track = model.getTrackModel().trackSpots(id)
- testing_new_script.sid = spot.ID()
- testing_new_script.x = spot.getFeature('POSITION_X')
- testing_new_script.y = spot.getFeature('POSITION_Y')
- testing_new_script.t = spot.getFeature('FRAME')
- testing_new_script.rad = spot.getFeature('RADIUS')
- testing_new_script.q = spot.getFeature('QUALITY')
- testing_new_script.snr = spot.getFeature('SNR')
- testing_new_script.mean = spot.getFeature('MEAN_INTENSITY')
- str testing_new_script.dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] + '.tif_spots' +'.csv'
- testing_new_script.spamWriter = csv.writer(f, delimiter=',')

7.23 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/OLD_METHODS/tracking↩ _tif_jpy.py File Reference

Namespaces

- namespace tracking_tif_jpy

Variables

- str tracking_tif_jpy.dir_tiff = '/Users/baljyot/Documents/2019-2020/RNAP_PAPER/Baljyot_EXP_RPOC/DATA/new↩ _days/20190527/ll_ez/segmented'
- list tracking_tif_jpy.files = [fi for fi in files if fi.endswith("seg.tif")]
- tracking_tif_jpy.num_files = len(files)
- str tracking_tif_jpy.save_analysis_dir = dir_tiff + '/' + 'Analysis'
- str tracking_tif_jpy.str_name_fil = root + '/' + files [z]
- tracking_tif_jpy.imp = IJ.openImage(str_name_fil)
- tracking_tif_jpy.model = Model()
- tracking_tif_jpy.settings = Settings()
- tracking_tif_jpy.detectorFactory
- tracking_tif_jpy.detectorSettings
- tracking_tif_jpy.trackerFactory
- tracking_tif_jpy.trackerSettings
- tracking_tif_jpy.trackmate = TrackMate(model, settings)
- tracking_tif_jpy.ok = trackmate.checkInput()
- tracking_tif_jpy.selectionModel = SelectionModel(model)
- tracking_tif_jpy.displayer = HyperStackDisplayer(model, selectionModel, imp)
- int tracking_tif_jpy.go = 0
- tracking_tif_jpy.fm = model.getFeatureModel()
- tracking_tif_jpy.a = model.getSpots().iterator(True)
- str tracking_tif_jpy.cd = "D:\\Baljyot_Experiments\\20190524\\rpoc\\segmented"
- tracking_tif_jpy.x = i.getFeature("POSITION_X")
- tracking_tif_jpy.y = i.getFeature("POSITION_Y")
- tracking_tif_jpy.std = i.getFeature("STANDARD_DEVIATION")
- tracking_tif_jpy.rad = i.getFeature("RADIUS")
- tracking_tif_jpy.ed = i.getFeature("ESTIMATED_DIAMETER")
- str tracking_tif_jpy.dir_name_save_inten = save_analysis_dir + '/' + files[z] + '_' + 'spots' +'.csv'
- tracking_tif_jpy.spamWriter = csv.writer(f, delimiter=',')

7.24 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/OLD_METHODS/tracking_tif_jpy_track.py File Reference

Namespaces

- namespace tracking_tif_jpy_track

Variables

- str tracking_tif_jpy_track.dir_tiff = '/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_data'
- list tracking_tif_jpy_track.files = ["Hurst_0.5_Diff_1e-2_seg.tiff"]
- str tracking_tif_jpy_track.root = dir_tiff
- str tracking_tif_jpy_track.save_analysis_dir = dir_tiff + '/' + 'Analysis'
- str tracking_tif_jpy_track.str_name_fil = root + '/' + files[z]
- tracking_tif_jpy_track.imp = IJ.openImage(str_name_fil)
- tracking_tif_jpy_track.dims = imp.getDimensions();
- tracking_tif_jpy_track.model = Model()
- tracking_tif_jpy_track.settings = Settings()
- tracking_tif_jpy_track.detectorFactory
- tracking_tif_jpy_track.detectorSettings
- tracking_tif_jpy_track.trackerFactory
- tracking_tif_jpy_track.trackerSettings
- tracking_tif_jpy_track.initialSpotFilterValue
- tracking_tif_jpy_track.trackmate = TrackMate(model, settings)
- tracking_tif_jpy_track.ok = trackmate.checkInput()
- tracking_tif_jpy_track.selectionModel = SelectionModel(model)
- tracking_tif_jpy_track.displayer = HyperStackDisplayer(model, selectionModel, imp)
- int tracking_tif_jpy_track.go = 0
- tracking_tif_jpy_track.fm = model.getFeatureModel()
- tracking_tif_jpy_track.a = model.getSpots().iterator(True)
- str tracking_tif_jpy_track.cd = "/Users/baljyot/Documents/2022-2023/PhD Thesis/Random_data"
- tracking_tif_jpy_track.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- tracking_tif_jpy_track.track = model.getTrackModel().trackSpots(id)
- tracking_tif_jpy_track.sid = spot.ID()
- tracking_tif_jpy_track.x = spot.getFeature('POSITION_X')
- tracking_tif_jpy_track.y = spot.getFeature('POSITION_Y')
- tracking_tif_jpy_track.t = spot.getFeature('FRAME')
- tracking_tif_jpy_track.rad = spot.getFeature('RADIUS')
- tracking_tif_jpy_track.q = spot.getFeature('QUALITY')
- tracking_tif_jpy_track.snr = spot.getFeature('SNR')
- tracking_tif_jpy_track.mean = spot.getFeature('MEAN_INTENSITY')
- str tracking_tif_jpy_track.dir_name_save_inten = save_analysis_dir + '/' + files[z][:-4] + '.tif_spots' +'.csv'
- tracking_tif_jpy_track.spamWriter = csv.writer(f, delimiter=',')

7.25 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/OLD_METHODS/trackmate_exp.py File Reference

Namespaces

- namespace trackmate_exp

Variables

- trackmate_exp.imp = IJ.openImage('/Users/baljyot/Desktop/Baljyot_EXP_RPOC/Scripts/0.tif')
- trackmate_exp.model = Model()
- trackmate_exp.settings = Settings()
- trackmate_exp.detectorFactory
- trackmate_exp.detectorSettings
- trackmate_exp.trackerFactory
- trackmate_exp.trackerSettings
- trackmate_exp.initialSpotFilterValue
- trackmate_exp.trackmate = TrackMate(model, settings)
- trackmate_exp.ok = trackmate.checkInput()
- trackmate_exp.selectionModel = SelectionModel(model)
- trackmate_exp.displayer = HyperStackDisplayer(model, selectionModel, imp)
- trackmate_exp.fm = model.getFeatureModel()
- trackmate_exp.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- trackmate_exp.track = model.getTrackModel().trackSpots(id)
- trackmate_exp.sid = spot.ID()
- trackmate_exp.x = spot.getFeature('POSITION_X')
- trackmate_exp.y = spot.getFeature('POSITION_Y')
- trackmate_exp.t = spot.getFeature('FRAME')
- trackmate_exp.q = spot.getFeature('QUALITY')
- trackmate_exp.snr = spot.getFeature('SNR')
- trackmate_exp.mean = spot.getFeature('MEAN_INTENSITY')

7.26 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/fiji/OLD_↩ METHODS/trackmate_scripting.py File Reference

Namespaces

- namespace trackmate_scripting

Variables

- trackmate_scripting.imp = IJ.openImage('https://fiji.sc/samples/FakeTracks.tif')
- trackmate_scripting.model = Model()
- trackmate_scripting.settings = Settings(imp)
- trackmate_scripting.detectorFactory
- trackmate_scripting.detectorSettings
- trackmate_scripting.trackerFactory
- trackmate_scripting.trackerSettings
- trackmate_scripting.initialSpotFilterValue
- trackmate_scripting.trackmate = TrackMate(model, settings)
- trackmate_scripting.ok = trackmate.checkInput()
- trackmate_scripting.sm = SelectionModel(model)
- trackmate_scripting.ds = DisplaySettingsIO.readUserDefault()
- trackmate_scripting.displayer = HyperStackDisplayer(model, sm, imp, ds)
- trackmate_scripting.fm = model.getFeatureModel()
- trackmate_scripting.v = fm.getTrackFeature(id, 'TRACK_MEAN_SPEED')
- trackmate_scripting.track = model.getTrackModel().trackSpots(id)

- trackmate_scripting.sid = spot.ID()
- trackmate_scripting.x = spot.getFeature('POSITION_X')
- trackmate_scripting.y = spot.getFeature('POSITION_Y')
- trackmate_scripting.t = spot.getFeature('FRAME')
- trackmate_scripting.q = spot.getFeature('QUALITY')
- trackmate_scripting.snr = spot.getFeature('SNR_CH1')
- trackmate_scripting.mean = spot.getFeature('MEAN_INTENSITY_CH1')

7.27 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysisFunctions/Analysis_functions.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.non_linear_curvefit (func, xdata, ydata, p0=None, method='lm', bounds=None)

  RANDOM FITTING FUNCTIONS ##.
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.linear_fitting (xdata, ydata, deg=1)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaus1D (x, a, b, c)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaus2D (x, a, b, c, a1, b1, c1)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.gaussian_fit (x, p0, p1, p2)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.Thompson_localization_precision (float psf_sigma, float pixel_size, float|np.ndarray num_photons, float background_photons)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rayleigh_corr (x, corr, sigma, A)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.nnd_correction_rayleigh (x, sigma, xc, w, a1, a2, a3)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.cum_sum (data, binz=10)

  RANDOM UTILITY FUNCTIONS ##.
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rescale (x, a, b)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dif_dis (x, y)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dist (x, y, c1, c2)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.d_to_rad (deg_)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rad_to_d (rad_)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.cm_normal (x, y)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.con_pix_si (data, con_nm=0.130, con_ms=20., which=0)
- float SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.radius_of_gyration (*args)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.photon_conversion_from_AUD (float|np.ndarray AUD, float|int photon_conversion_factor, float|int quantum_efficiency, float|int dark_offset)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.bin_ndarray (ndarray, new_shape, operation='sum')
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.bin_img (img, bin=2, operation='sum')
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convert_3d_to_2d (a)

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_inside_circle2D (circle, point)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.reshape_col2d (arr, permutations)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.range_distance (a, b)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rt_to_xy (r, theta)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.pad_array (subarray, shape, top_left↩_coord, pad=0)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.sorted_alphanumeric (data)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.subarray2D (arr, mask, full=True, transpose=True)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.flatten (t)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.rescale_range (x, min_x, max_x, a, b)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.dic_union_two (dic_1, dic_2)

    MSD calculations for sim data format of dict ##############################.

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg1 (x, y, f, f_inc=False)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg (x, y, f, f_inc=False)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.MSD_tavg_single (x, f, f_inc=False)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.track_decomp (x, y, f, max_track_↩decomp)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD_loc_err (t, p_0, p_1, p_2)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD (t, p_0, p_1, p_2)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.fit_MSD_Linear (t, p_0, p_1)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.find_diffusion_coefficient (time, distance, dim)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.find_static_localization_error_MSD (sigma, dim)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions._random_starting_point (start, end)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.squared_mean_difference (a)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_per_frame_difference (true_↩points_per_frame, extracted_points_per_frame)

    Track percent identity functions ###.

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.percent_error (true, estimate, abs=True)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions._point_identity (point_true, track_↩estimate, distance_threshold)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.identity_tracks (track_true, track_↩estimate, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.identity_track_matrix (tracks_true, tracks_estimate, verbose=True, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_error_detection (true_points, extracted_points, threshold=0.5)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.points_per_frame_convert (tracks)
- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.points_per_frame_bulk_sort (np.ndarray x, np.ndarray y, np.ndarray t)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convert_point_pairs (tracks)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.point_pair_error_detection (true_↩point_pairs, extracted_point_pairs, threshold=0.5)
- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.area_points_per_frame (dict points_per_frame, callable area_func=radius_of_gyration)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.Analysis_functions.convex_hull_area (points)

7.28 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/angle_between_vectors.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_Storage
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Track_Calculations_Individual_Dict

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors

Functions

- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.Angle_track (dict tracks, conversion_factor=None, tau_conversion_factor=None, min_track_length=3, max_track_length=100, ∗∗kwargs)
- np.ndarray SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.trajectory_angles (np.ndarray trajectory)
- float SMT.SMT_Analysis_BP.helpers.analysisFunctions.angle_between_vectors.asymmetry_metric (np.↩ ndarray angle_distribution, np.ndarray forward_angle_range, np.ndarray backward_angle_range)

7.29 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/bootstrap_util.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_hist (data, bins, n_bootstraps=1000, bootsize=None, bootfunc=np.mean)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_mean_std (values, n_bootstraps, bootsize, log_values=False)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.bootstrap_statistic (values, n_bootstraps, bootsize, log_values=False, statistic="mean")

Variables

- list SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.BOOTSTRAP_PARAMS_NAMES
- list SMT.SMT_Analysis_BP.helpers.analysisFunctions.bootstrap_util.BOOTSTRAP_PARAMS_DEFAULTS

7.30 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/dir_invert_images.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_images

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_images.save_invert_images (path, **kwargs)

Variables

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.dir_invert_images.dir_path = str(sys.argv[1])

7.31 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/features_from_mask.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.extract_mask_properties

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask

Variables

- str SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.path = '/Users/baljyot/Documents/SMT↩
_Movies/testing_SM_recon/Movies/Movie_1/Cell_1/mask.tif'
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.mask = io.imread(path)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.prop_obj = extract_mask_properties(mask)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.fig
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.ax
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.color
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.features_from_mask.label

7.32 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysisFunctions/↩ MSD_Utils.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.Calculation_abc
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.DatabaseOrderUtil
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_storage
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Calculations_Track_Dict

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.msd_avgerage_utility (dict displacements, bool bootstrap=False, float bootstrap_samples=0.1, float bootstrap_percentile=0.95, bootstrap_num=100, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_Tracks (tracks, permutation=True, conversion_factor=None, tau_conversion_factor=None, min_track_length=1, max_track_length=10, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.radius_of_confinement (t, r_sqr, D, loc_msd)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.radius_of_confinement_xy (t, r_sqr, D, loc_↩ msd_x, loc_msd_y)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.power_law_xy (t, alpha, D, loc_msd_x, loc_↩ msd_y)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.power_law (t, alpha, D, loc_msd)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.linear_MSD_fit (t, a, b)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.combine_track_dicts (dicts)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils._msd_tau_utility_all (x, y, tau)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils._msd_tau_utility_single (x, y, tau)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_tau_utility (x, y, tau=1, permutation=True)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.MSD_Utils.MSD_tau (x, y, permutation=True)

7.33 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysisFunctions/↩ NND.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestPairwiseArray
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.TestNearestNeighbourDistances2D

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.pairwise_array (n)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.NND.nearest_neighbour_distances_2d (x0, y0, x1, y1, verbose_return=False, conversion_factor=0.13)

7.34 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/nucleoid_detection.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.find_nuc (img, str typee, regions=True, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.get_training_set (img)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.get_region (image, type=regionprops, connectivity=2, ∗∗kawrgs)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.plot_regions (regions, fig, ax, colorbar_mappable, plot=False)

Variables

- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.nucleoid_detection.TESTED_DICT

7.35 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/scale_space_plus.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.ScaleSpacePlus
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_image
- class SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.SM_reconstruction_masked

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.get_gaussian (mu, sigma, domain=[list(range(10)), list(range(10))])

Variables

- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.KEY_IMAGE
- int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.MASK_VALUE = 255
- int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.BOUNDING_BOX_PADDING = 5
- dict SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.CONVERSION_TYPES = {'RC_↩ to_Original':0,'original_to_RC':1}
- int SMT.SMT_Analysis_BP.helpers.analysisFunctions.scale_space_plus.RANDOM_SEED = 666

7.36 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/analysis↩ Functions/smallestenclosingcircle.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions
- namespace SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle

Functions

- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_circle (points)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._make_circle_one_point (points, p)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._make_circle_two_points (points, p, q)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_diameter (a, b)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.make_circumcircle (a, b, c)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle.is_in_circle (c, p)
- SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._cross_product (x0, y0, x1, y1, x2, y2)

Variables

- int SMT.SMT_Analysis_BP.helpers.analysisFunctions.smallestenclosingcircle._MULTIPLICATIVE_EPSILON = 1 + 1e-14

7.37 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/cluster↩ Methods/blob_detection.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.blob_detection

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.clusterMethods
- namespace SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection

Functions

- SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.identity (x)
- SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.iso_gaus (p, x, y, z)
- SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.residuals_gaus2d (p, x, y, z, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.gaussian2D (x, y, cen_x, cen_y, sig_x, sig_y, offset, height, kwargs={})

Variables

- int SMT.SMT_Analysis_BP.helpers.clusterMethods.blob_detection.FWHM_FACTOR = 2.∗(np.log(2.+np.↩ sqrt(3)))

7.38 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/clusterMethods/clustering_methods.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.clusterMethods
- namespace SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods

Functions

- SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.scale_space_plus_blob_detection (img, blob_parameters, fitting_parameters, show=False)
- SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.perfrom_DBSCAN_Cluster (localizations, D, minP, show=False)
- SMT.SMT_Analysis_BP.helpers.clusterMethods.clustering_methods.perform_HDBSCAN_Cluster (localizations, min_cluster_size, min_samples, show=False)

7.39 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/import_functions.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule
- namespace SMT.SMT_Analysis_BP.helpers.ioModule.import_functions

Functions

- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.read_data (path, delimiter=',', skiprow=1, **kwargs)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.read_file (file_loc)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.combine_path (root, path)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.find_image (path, ends_with='.tif', full_path=False)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.name_sorter (strings, keyword)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.find_files (path, extension, keyword=None)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.invert_I16u (img, array=False)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.invert_img (path)
- SMT.SMT_Analysis_BP.helpers.ioModule.import_functions.save_img (object, path)

7.40 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/logging_↩ and_print_util.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule
- namespace SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util

Functions

- SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print (∗args, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print_dict (dict dict_to_print, ∗∗kwargs)
- SMT.SMT_Analysis_BP.helpers.ioModule.logging_and_print_util.beautiful_print_list (list list_to_print, ∗∗kwargs)

7.41 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/pickle_↩ util.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.PickleUtil
- class SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util.TestPickleUtil

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule
- namespace SMT.SMT_Analysis_BP.helpers.ioModule.pickle_util

7.42 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/plotting_↩ functions.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.run_analysis_plotting

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule
- namespace SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions

Functions

- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.circles (x, y, s, c='b', vmin=None, vmax=None, **kwargs)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_circle_obj (dims, fill=False)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_box_plot (box_data, tick_list, y_label="", x_label="", y_lim=(), title="", show=False)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.read_imag (path, fig=False, ax=False, show=True)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.contour_intens (img, fig=False, ax=False, show=True, seg=True, perc=95)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.spacialplot_msd (op, fig=False, ax=False, show=True)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.other_plot (op, fig=False, ax=False, show=True)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.animate (i, ax)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.circular_hist (ax, x, bins=16, density=True, offset=0, gaps=True, **kwargs)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.create_circular_mask (h, w, center=None, radius=None)
- SMT.SMT_Analysis_BP.helpers.ioModule.plotting_functions.plot_stacked_bar (data, series_labels, category_labels=None, show_values=False, value_format="{}", y_label=None, colors=None, grid=True, reverse=False)

7.43 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/ioModule/SMT_converters.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.IO_run_analysis

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.ioModule
- namespace SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters

Functions

- list SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.convert_track_data_SMAUG_format (dict track_data)
- list SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters.convert_track_data_NOBIAS_format_global (dict track_data, int max_tau=1)
- SMT.SMT_Analysis_BP.helpers.ioModule.SMT_converters._convert_track_data_NOBIAS_format_tau (displacement_dict, tau, bool include_cor_obs=False)

7.44 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/misc/decorators.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.misc.decorators.CountCalls

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.misc
- namespace SMT.SMT_Analysis_BP.helpers.misc.decorators

Functions

- SMT.SMT_Analysis_BP.helpers.misc.decorators.deprecated (reason)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.timer (func)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.debug (func)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.slow_down (_func=None, ∗, rate=1)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.repeat (_func=None, ∗, num_times=2)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.singleton (cls)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.cache (func)
- SMT.SMT_Analysis_BP.helpers.misc.decorators.set_unit (unit)

Variables

- tuple SMT.SMT_Analysis_BP.helpers.misc.decorators.string_types = (type(b''), type(u''))

7.45 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/misc/diff_mw.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.misc
- namespace SMT.SMT_Analysis_BP.helpers.misc.diff_mw

Functions

- SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_to_diff (mw, n, T=310.15, micron=True)

Variables

- int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_RPOC = 155160
- int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_NUSA = 54871
- int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_LACI = 38590
- int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.mw_RNAP = 350000
- int SMT.SMT_Analysis_BP.helpers.misc.diff_mw.vis_ecoli = 950
- float SMT.SMT_Analysis_BP.helpers.misc.diff_mw.vis_cyto_ecoli = 2.82
- SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_RPOC = mw_to_diff(mw_RPOC,vis_cyto_ecoli)
- SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_NUSA = mw_to_diff(mw_NUSA,vis_cyto_ecoli)
- SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_LACI = mw_to_diff(mw_LACI,vis_cyto_ecoli)
- SMT.SMT_Analysis_BP.helpers.misc.diff_mw.dif_RNAP = mw_to_diff(mw_RNAP,vis_cyto_ecoli)

7.46 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/misc/errors.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationKeys
- class SMT.SMT_Analysis_BP.helpers.misc.errors.InitializationValues

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.misc
- namespace SMT.SMT_Analysis_BP.helpers.misc.errors

7.47 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/helpers/misc/guassian_fit.py File Reference

Classes

- class SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_Localization_Image
- class SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.SM_localization_movie

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.helpers
- namespace SMT.SMT_Analysis_BP.helpers.misc
- namespace SMT.SMT_Analysis_BP.helpers.misc.guassian_fit

Functions

- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D (x, y, cen_x, cen_y, sig_x, sig_y, offset, height, kwargs={})

  define some gaussian models for fitting
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_theta (x, y, cen_x, cen_y, sig_x, sig_y, theta, offset, height, kwargs={})
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian1D (x, cen_x, sig_x, offset, height, kwargs={})
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_residual (params, x, y, data, kwargs={})

  define some residual functions for fitting
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian2D_theta_residual (params, x, y, data, kwargs={})
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.gaussian1D_residual (params, x, data, kwargs={})
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.find_peaks (image, ∗∗kwargs)

  define functions to find candidate peaks in a signal for a 2D signal (image)
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.save_dataframe (pd.DataFrame df, str path)

Variables

- str SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.path = "/Volumes/Baljyot_HD/SMT_Olympus/Baljyot↩
_temp/20190527/rpoc_ez/Movie/rpoc_ez_6.tif"
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.image = imread(path)
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.sm_localization_movie = SM_localization_movie(image)
- SMT.SMT_Analysis_BP.helpers.misc.guassian_fit.fit_results_df

7.48 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/Matlab/batch_convert_↩ single_fluorescence_BW.m File Reference

Functions

- imwrite (rd2{i, 1}, filename, 'WriteMode', 'append')

Variables

- clear a = which('rp_ez_fixed_01.vsi')
- give it an initial file to start with filelist = dir([fileparts(a) filesep 'rp_ez_fixed_∗.vsi'])
- fileNames = {filelist.name}
- number_of_files =100
- pick the number of files to convert mkdir Movie mkdir gfp for k
- rd2 =rd{1,1}
- for i

7.48.1 Function Documentation

7.48.1.1 imwrite()

```
imwrite (
              rd2{i, 1} ,
              filename ,
              'WriteMode' ,
              'append' )
```

7.48.2 Variable Documentation

7.48.2.1 a

```
clear a = which('rp_ez_fixed_01.vsi')
```

7.48.2.2 filelist

```
give it an initial file to start with filelist = dir([fileparts(a) filesep 'rp_ez_fixed_↩
*.vsi'])
```

7.48.2.3 fileNames

```
fileNames = {filelist.name}
```

7.48.2.4 i

```
for i
```

Initial value:

```
=1:length(rd2(:,1))

filename=sprintf('rp_ez_fixed_%d.tif',k)
```

7.48.2.5 k

```
pick the number of files to convert mkdir Movie mkdir gfp for k
```

Initial value:

```
=1:1:number_of_files
    rd=bfopen(fileNames{k})
```

7.48.2.6 number_of_files

```
number_of_files =100
```

7.48.2.7 rd2

```
rd2 =rd{1,1}
```

7.49 /Users/baljyot/Documents/CODE/GitHub_t2/PHD/Baljyot_EXP_↩ RPOC/Scripts/SMT/SMT_Analysis_BP/Parameter_Store/global_↩ params.py File Reference

Namespaces

- namespace SMT
- namespace SMT.SMT_Analysis_BP
- namespace SMT.SMT_Analysis_BP.Parameter_Store
- namespace SMT.SMT_Analysis_BP.Parameter_Store.global_params

Variables

- dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.PIXELSIZES
- dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.PHOTON_CONVERSION_FACTORS
- dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.READOUT_NOISE
- dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.DARK_OFFSET
- dict SMT.SMT_Analysis_BP.Parameter_Store.global_params.QUANTUM_EFFICIENCY_561

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