Python Documentation

version

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Welcome to moseq2-extract's documentation!

moseq2_extract package

CLI Module

moseq2-extract

```
moseq2-extract [OPTIONS] COMMAND [ARGS]...
```

aggregate-results

Copies all extracted results (h5, yaml, avi) files from all extracted sessions to a new directory,

```
moseq2-extract aggregate-results [OPTIONS]
```

Options

-i, --input-dir <input_dir>
Directory to find h5 files [default: /Users/aymanzeine/Desktop/moseq/moseq2-extract/docs]

-f, --format <format>
New file name formats from resepective metadata [default: {start_time}_{session_name}_{subject_name}]

-o, --output-dir <output_dir>
Location for storing all results together [default: /Users/aymanzeine/Desktop/moseq/moseq2-extract/docs/aggregate_results/]

convert-raw-to-avi

Converts/Compresses a raw depth file into an avi file (with depth values) that is 8x smaller.

```
moseq2-extract convert-raw-to-avi [OPTIONS] INPUT_FILE
```

Options

-t, --threads <threads>
Number of threads for encoding [default: 3]

--delete
Delete raw file if encoding is sucessful [default: False]

--fps <fps>
Video FPS [default: 30]

-b, --chunk-size <chunk_size>
Chunk size [default: 3000]

-o, --output-file <output_file>
Path to output file

-v, --verbose <verbose>
Verbosity level out batch encoding. [0-1] [default: 0]

Arguments

INPUT_FILE
Required argument

copy-slice

Copies a segment of an input depth recording into a new video file.

```
moseq2-extract copy-slice [OPTIONS] INPUT_FILE
```

Options

-t, --threads <threads>
Number of threads for encoding [default: 3]

--delete
Delete raw file if encoding is sucessful [default: False]

--fps <fps>
Video FPS [default: 30]

-b, --chunk-size <chunk_size>
Chunk size [default: 3000]

-o, --output-file <output_file>
Path to output file

-c, --copy-slice <copy_slice>
Slice to copy [default: 0, 1000]

Arguments

INPUT_FILE
Required argument

download-flip-file

Downloads Flip-correction model that helps with orienting the mouse during extraction.

```
moseq2-extract download-flip-file [OPTIONS] [CONFIG_FILE]
```

Options

--output-dir <output_dir>
Temp storage [default: /Users/aymanzeine/moseq2]

Arguments

CONFIG_FILE
Optional argument

extract

Processes raw input depth recordings to output a cropped and oriented video of the mouse and saves the output+metadata to h5 files in the given output directory.

```
moseq2-extract extract [OPTIONS] INPUT_FILE
```

Options

--config-file <config_file>

--use-plane-bground
Use a plane fit for the background. Useful for mice that don't move much [default: False]

--output-dir <output_dir>
Output directory to save the results h5 file

--dilate-iterations <dilate_iterations>
Number of dilation iterations to increase bucket floor size. [default: 1]

--bg-sort-roi-by-position-max-rois <bg_sort_roi_by_position_max_rois>
Max original ROIs to sort by position [default: 2]

--bg-sort-roi-by-position <bg_sort_roi_by_position>
Sort ROIs by position [default: False]

--bg-roi-fill-holes <bg_roi_fill_holes>
Fill holes in ROI [default: True]

--bg-roi-gradient-kernel <bg_roi_gradient_kernel>
Kernel size for Sobel gradient filtering [default: 7]

--bg-roi-gradient-threshold <bg_roi_gradient_threshold>
Gradient must be < this to include points [default: 3000]

--bg-roi-gradient-filter <bg_roi_gradient_filter>
Exclude walls with gradient filtering [default: False]

--bg-roi-depth-range <bg_roi_depth_range>
Range to search for floor of arena (in mm) [default: 650, 750]

--bg-roi-weights <bg_roi_weights>
ROI feature weighting (area, extent, dist) [default: 1, 0.1, 1]

--bg-roi-index <bg_roi_index>
Index of which background mask(s) to use [default: 0]

--bg-roi-shape <bg_roi_shape>
Shape to use to dilate roi (ellipse or rect) [default: ellipse]

--bg-roi-dilate <bg_roi_dilate>
Size of strel to dilate roi [default: 10, 10]

-c, --crop-size <crop_size>
Width and height of cropped mouse image [default: 80, 80]

--min-height <min_height>
Min mouse height from floor (mm) [default: 10]

--max-height <max_height>
Max mouse height from floor (mm) [default: 100]

--detected-true-depth <detected_true_depth>
Option to override automatic depth estimation during extraction. Either "auto" or a int value. [default: auto]

--fps <fps>
Frame rate of camera [default: 30]

--flip-classifier <flip_classifier>
Location of the flip classifier used to properly orient the mouse (.pkl file)

--flip-classifier-smoothing <flip_classifier_smoothing>
Number of frames to smooth flip classifier probabilities [default: 51]

--use-tracking-model <use_tracking_model>
Use an expectation-maximization style model to aid mouse tracking. Useful for data with cables [default: False]

--tracking-model-ll-threshold <tracking_model_ll_threshold>
Threshold on log-likelihood for pixels to use for update during tracking [default: -100]

--tracking-model-mask-threshold <tracking_model_mask_threshold>
Threshold on log-likelihood to include pixels for centroid and angle calculation [default: -16]

--tracking-model-ll-clip <tracking_model_ll_clip>
Clip log-likelihoods below this value [default: -100]

--tracking-model-segment <tracking_model_segment>
Segment likelihood mask from tracking model [default: True]

--tracking-model-init <tracking_model_init>
Method for tracking model initialization [default: raw]

--cable-filter-iters <cable_filter_iters>
Number of cable filter iterations [default: 0]

--cable-filter-shape <cable_filter_shape>
Cable filter shape (rectangle or ellipse) [default: rectangle]

--cable-filter-size <cable_filter_size>
Cable filter size (in pixels) [default: 5, 5]

--tail-filter-iters <tail_filter_iters>
Number of tail filter iterations [default: 1]

--tail-filter-size <tail_filter_size>

Tail filter size [default: 9, 9]

--tail-filter-shape <tail_filter_shape>
Tail filter shape [default: ellipse]

-s, --spatial-filter-size <spatial_filter_size>
Space prefilter kernel (median filter, must be odd) [default: 3]

-t, --temporal-filter-size <temporal_filter_size>
Time prefilter kernel (median filter, must be odd) [default: 0]

--chunk-size <chunk_size>
Number of frames for each processing iteration [default: 1000]

--chunk-overlap <chunk_overlap>
Frames overlapped in each chunk. Useful for cable tracking [default: 0]

--write-movie <write_movie>
Write a results output movie including an extracted mouse [default: True]

--frame-dtype <frame_dtype>
Data type for processed frames [default: uint8]

Options: uint8|uint16

--centroid-hampel-span <centroid_hampel_span>
Hampel filter span [default: 0]

--centroid-hampel-sig <centroid_hampel_sig>
Hampel filter sig [default: 3]

--angle-hampel-span <angle_hampel_span>
Angle filter span [default: 0]

--angle-hampel-sig <angle_hampel_sig>
Angle filter sig [default: 3]

--model-smoothing-clips <model_smoothing_clips>
Model smoothing clips [default: 0, 0]

--frame-trim <frame_trim>
Frames to trim from beginning and end of data [default: 0, 0]

--compress <compress>
Convert .dat to .avi after successful extraction [default: False]

--compress-chunk-size <compress_chunk_size>
Chunk size for .avi compression [default: 3000]

--compress-threads <compress_threads>
Number of threads for encoding [default: 3]

--verbose <verbose>
Level of verbosity during extraction process. [0-2] [default: 0]

Arguments

INPUT_FILE
Required argument

find-roi

Finds the ROI and background distance to subtract from frames when extracting.

```
moseq2-extract find-roi [OPTIONS] INPUT_FILE
```

Options

--config-file <config_file>

--use-plane-bground
Use a plane fit for the background. Useful for mice that don't move much [default: False]

--output-dir <output_dir>
Output directory to save the results h5 file

--dilate-iterations <dilate_iterations>
Number of dilation iterations to increase bucket floor size. [default: 1]

--bg-sort-roi-by-position-max-rois <bg_sort_roi_by_position_max_rois>
Max original ROIs to sort by position [default: 2]

--bg-sort-roi-by-position <bg_sort_roi_by_position>
Sort ROIs by position [default: False]

--bg-roi-fill-holes <bg_roi_fill_holes>
Fill holes in ROI [default: True]

--bg-roi-gradient-kernel <bg_roi_gradient_kernel>
Kernel size for Sobel gradient filtering [default: 7]

--bg-roi-gradient-threshold <bg_roi_gradient_threshold>
Gradient must be < this to include points [default: 3000]

--bg-roi-gradient-filter <bg_roi_gradient_filter>
Exclude walls with gradient filtering [default: False]

--bg-roi-depth-range <bg_roi_depth_range>
Range to search for floor of arena (in mm) [default: 650, 750]

--bg-roi-weights <bg_roi_weights>
ROI feature weighting (area, extent, dist) [default: 1, 0.1, 1]

--bg-roi-index <bg_roi_index>
Index of which background mask(s) to use [default: 0]

--bg-roi-shape <bg_roi_shape>
Shape to use to dilate roi (ellipse or rect) [default: ellipse]

--bg-roi-dilate <bg_roi_dilate>
Size of strel to dilate roi [default: 10, 10]

Arguments

INPUT_FILE
Required argument

generate-config

Generates a configuration file that holds editable options for extraction parameters.

```
moseq2-extract generate-config [OPTIONS]
```

Options

-o, --output-file <output_file>
[default: config.yaml]

generate-index

Generates an index YAML file containing all extracted session metadata.

```
moseq2-extract generate-index [OPTIONS]
```

Options

-i, --input-dir <input_dir>
Directory to find h5 files [default: /Users/aymanzeine/Desktop/moseq/moseq2-extract/docs]

-p, --pca-file <pca_file>
Path to PCA results [default: /Users/aymanzeine/Desktop/moseq/moseq2-extract/docs/_pca/pca_scores.h5]

-o, --output-file <output_file>
Location for storing index [default: /Users/aymanzeine/Desktop/moseq/moseq2-extract/docs/moseq2-index.yaml]

-f, --filter <filter>
Regex filter for metadata

-a, --all-uuids <all_uuids>
Use all uuids [default: False]

--subpath <subpath>
Path substring to regulate paths included in an index file. [default: /proc/]

version

Print version number

```
moseq2-extract version [OPTIONS]
```

GUI Module

moseq2_extract.gui.**aggregate_extract_results_command** (input_dir, format, output_dir, subpath='/proc/', output_directory=None)
Finds all extracted h5, yaml and avi files and copies them all to a new directory relabeled with their respective session names. Also generates the index file.

Parameters:
- **input_dir (str)** (*path to base directory to recursively search for h5s*)
- **format (str)** (*filename format for info to include in filenames*)
- **output_dir (str)** (*path to directory to save all aggregated results*)
- **output_directory (str)** (*alternate path to save results*)

Returns: **indexpath (str)**

Return type: path to newly generated index file.

moseq2_extract.gui.**check_progress** (base_dir, progress_filepath, output_directory=None)
Checks whether progress file exists and prompts user input on whether to overwrite, load old, or generate a new one.

Parameters:
- **base_dir (str)** (*path to directory to create/find progress file*)
- **progress_filepath (str)** (*path to progress filename*)
- **output_directory (str)** (*optional alternative output directory path.*)

Returns:

Return type: All restored variables or None.

moseq2_extract.gui.**download_flip_command** (output_dir, config_file='', selection=1)
Downloads flip classifier and saves its path in the inputted config file

Parameters:
- **output_dir (str)** (*path to output directory to save flip classifier*)
- **config_file (str)** (*path to config file*)
- **selection (int)** (*index of which flip file to download (default is Adult male C57 classifer)*)

Returns:

Return type: None

moseq2_extract.gui.**extract_command** (input_file, output_dir, config_file, num_frames=None, skip=False)
Command to extract a full depth file

Parameters:
- **input_file (str)** (*path to depthfile*)
- **output_dir (str)** (*path to output directory*)
- **config_file (str)** (*path to config file*)
- **num_frames (int)** (*number of frames to extract. All if None.*)
- **skip (bool)** (*skip already extracted file.*)

Returns:

Return type: None

`moseq2_extract.gui.`**`extract_found_sessions`** (input_dir, config_file, ext, extract_all=True, skip_extracted=False, output_directory=None)

Searches for all depth files within input_directory with selected extension

Parameters:
- **input_dir (str)** (*path to directory containing all session folders*)
- **config_file (str)** (*path to config file*)
- **ext (str)** (*file extension to search for*)
- **extract_all (bool)** (*if True, auto searches for all sessions, else, prompts user to select sessions individually.*)
- **skip_extracted (bool)** (*indicates whether to skip already extracted session.*)
- **output_directory (str)** (*optional alternative output_directory.*)

Returns:

Return type: None

`moseq2_extract.gui.`**`find_roi_command`** (input_dir, config_file, exts=['dat', 'mkv', 'avi'], output_directory=None)

Computes ROI files given depth file. Will list out all available sessions to process and prompts user to input a corresponding session index to process.

Parameters:
- **input_dir (str)** (*path to directory containing depth file*)
- **config_file (str)** (*path to config file*)
- **exts (list)** (*list of supported extensions*)
- **output_directory (str)** (*alternate output path*)

Returns: **images (list of 2d arrays)** (*list of 2d array images to graph in Notebook.*) **filenames (list)** (*list of paths to respective image paths*)

`moseq2_extract.gui.`**`generate_config_command`** (output_file)

Generates configuration file to use throughout pipeline.

Parameters: **output_file (str)** (*path to saved config file.*)

Returns: **(str)**

Return type: status message.

`moseq2_extract.gui.`**`generate_index_command`** (input_dir, pca_file, output_file, filter, all_uuids, subpath='/proc/')

Generates Index File based on aggregated sessions

Parameters:
- **input_dir (str)** (*path to aggregated_results/ dir*)
- **pca_file (str)** (*path to pca file*)
- **output_file (str)** (*index file name*)
- **filter (list)** (*keys to filter through*)
- **all_uuids (list)** (*all extracted session uuids*)

Returns: **output_file (str)**

Return type: path to index file.

`moseq2_extract.gui.`**`get_found_sessions`** (data_dir='', exts=['dat', 'mkv', 'avi'])
Find all depth recording sessions (with given extensions) to work on given base directory.

Parameters:
- **data_dir (str)** (*path to directory containing all session folders*)
- **exts (list)** (*list of depth file extensions to search for*)

Returns: **data_dir (str)** (*path to base_dir to save in progress file*) **found_sessions (int)** (*number of found sessions with given extensions*)

`moseq2_extract.gui.`**`restore_progress_vars`** (progress_file)
Restore all saved progress variables to Jupyter Notebook.

Parameters: **progress_file (str)** (*path to progress file*)

Returns:

Return type: All progress file variables

`moseq2_extract.gui.`**`sample_extract_command`** (input_dir, config_file, nframes, output_directory=None, exts=['dat', 'mkv', 'avi'])
Test extract command to extract a subset of the video.

Parameters:
- **input_dir (str)** (*path to directory containing depth file to extract*)
- **config_file (str)** (*path to config file*)
- **nframes (int)** (*number of frames to extract*)
- **output_directory (str)** (*path to alternative directory*)
- **exts (list)** (*list of supported depth file extensions.*)

Returns: **output_dir (str)**

Return type: path to directory containing sample extraction results.

`moseq2_extract.gui.`**`update_progress`** (progress_file, varK, varV)
Updates progress file with new notebook variable

Parameters:
- **progress_file (str)** (*path to progress file*)
- **varK (str)** (*key in progress file to update*)
- **varV (str)** (*updated value to write*)

Returns:

Return type: None

`moseq2_extract.gui.`**`view_extraction`** (extractions)
Prompts user to select which extracted video(s) to preview.

Parameters: **extractions (list)** (*list of paths to all extracted avi videos.*)

Returns: **extractions (list)**

Return type: list of selected extractions.

General Utilities Module

`moseq2_extract.util.`**`build_path`** (keys: dict, format_string: str, snake_case=True) → str
Produce a new file name using keys collected from extraction h5 files. The format string must be using python's formatting specification, i.e. '{subject_name}_{session_name}'.

Parameters:
- **keys (dict)** (*dictionary specifying which keys used to produce the new file name*)
- **format_string (str)** (the string to reformat using the *keys* dictionary)
- **snake_case (bool)** (*whether to save the files with snake_case*)

Returns: **out (str)**

Return type: a newly formatted filename useable with any operating system

`moseq2_extract.util.`**`camel_to_snake`** (s)
Converts CamelCase to snake_case

Parameters: **s (str)** (*CamelCase string to convert to snake_case.*)
Returns: **(str)**
Return type: string in snake_case

`moseq2_extract.util.`**`clean_dict`** (dct)
Standardizes types of dict value.

Parameters: **dct (dict)** (*dict object with mixed type value objects.*)
Returns: **dct (dict)**
Return type: dict object with list value objects.

`moseq2_extract.util.`**`clean_file_str`** (file_str: str, replace_with: str = '-') → str
Removes invalid characters for a file name from a string.

Parameters:
- **file_str (str)** (*filename substring to replace*)
- **replace_with (str)** (*value to replace str with*)

Returns: **out (str)**
Return type: cleaned file string

`moseq2_extract.util.`**`click_param_annot`** (click_cmd)
Given a click.Command instance, return a dict that maps option names to help strings. Currently skips click.Arguments, as they do not have help strings.

Parameters: **click_cmd (click.Command)** (*command to introspect*)
Returns: **annotations (dict)**
Return type: click.Option.human_readable_name as keys; click.Option.help as values

`moseq2_extract.util.`**`command_with_config`** (config_file_param_name)

`moseq2_extract.util.`**`convert_pxs_to_mm`** (coords, resolution=512, 424, field_of_view=70.6, 60, true_depth=673.1)
Converts x, y coordinates in pixel space to mm.
http://stackoverflow.com/questions/17832238/kinect-intrinsic-parameters-from-field-of-view/18199938#18199938
http://www.imaginativeuniversal.com/blog/post/2014/03/05/quick-reference-kinect-1-vs-kinect-2.aspx
http://smeenk.com/kinect-field-of-view-comparison/

Parameters:
- **coords (list)** (*list of x,y pixel coordinates*)
- **resolution (tuple)** (*image dimensions*)
- **field_of_view (tuple)** (*width and height scaling params*)
- **true_depth (float)** (*detected true depth*)

Returns: **new_coords (list)**
Return type: x,y coordinates in mm

`moseq2_extract.util.`**`convert_raw_to_avi_function`** (input_file, chunk_size=2000, fps=30, delete=False, threads=3)
Converts depth file to avi file.

Parameters:
- **input_file (str)** (*path to depth file*)
- **chunk_size (int)** (*size of chunks to process at a time*)
- **fps (int)** (*frames per second*)
- **delete (bool)** (*whether to delete original depth file*)
- **threads (int)** (*number of threads to write video.*)

Returns:

Return type: None

`moseq2_extract.util.`**`dict_to_h5`** (h5, dic, root='/', annotations=None)

Save an dict to an h5 file, mounting at root. Keys are mapped to group names recursively.

Parameters:

- **h5 (h5py.File instance)** (*h5py.file object to operate on*)
- **dic (dict)** (*dictionary of data to write*)
- **root (string)** (*group on which to add additional groups and datasets*)
- **annotations (dict)** (*annotation data to add to corresponding h5 datasets. Should contain same keys as dic.*)

Returns:

Return type: None

`moseq2_extract.util.`**`escape_path`** (path)

Given current path, will return a path to return to original base directory. (Used in recursive h5 search, etc.)

Parameters: **path (str)** (*path to current working dir*)

Returns: **path (str)**

Return type: path to original base_dir

`moseq2_extract.util.`**`gen_batch_sequence`** (nframes, chunk_size, overlap, offset=0)

Generates batches used to chunk videos prior to extraction.

Parameters:

- **nframes (int)** (*total number of frames*)
- **chunk_size (int)** (*desired chunk size*)
- **overlap (int)** (*number of overlapping frames*)
- **offset (int)** (*frame offset*)

Returns:

Return type: Yields list of batches

`moseq2_extract.util.`**`get_bucket_center`** (img, true_depth, threshold=650)

https://stackoverflow.com/questions/19768508/python-opencv-finding-circle-sun-coordinates-of-center-the-circle-from-pictu Finds Centroid coordinates of circular bucket.

Parameters:

- **img (2d np.ndaarray)** (*original background image.*)
- **true_depth (float)** (*distance value from camera to bucket floor (automatically pre-computed)*)
- **threshold (float)** (*distance values to accept region into detected circle. (used to reduce fall noise interference)*)

Returns: **cX (int)** (*x-coordinate of circle centroid*) **cY (int)** (*y-coordinate of circle centroid*)

`moseq2_extract.util.`**`graduate_dilated_wall_area`** (bground_im, config_data, strel_dilate, true_depth, output_dir)

Creates a gradient to represent the dilated (now visible) bucket wall regions. Only is used if background is dilated to capture larger rodents in convex shaped buckets (_/). This is done to handle noise attributed by bucket walls being slanted, and thus being picked up as large noise depth values. Moreover, to appropriately subtract the background from input images during extraction without obscuring the rodent, or including unwanted wall regions. :Parameters: * **bground_im (2d np.ndarray)** (*the bucket floor image computed as the median distance throughout the session.*)

- **config_data (dict)** (*dictionary containing helper user configuration parameters.*)
- **strel_dilate (cv2.structuringElement)** (*dilation structuring element used to dilate background image.*)
- **true_depth (float)** (*median distance computed throughout recording.*)
- **output_dir (str)** (*path to save newly computed background to use.*)

Returns: **bground_im (2d np.ndarray)**

Return type: the new background image with a gradient around the floor from high to low depth values.

`moseq2_extract.util.`**`h5_to_dict`** (h5file, path) → dict
Loads h5 contents to dictionary object.

Parameters:
- **h5file (str or h5py.File)** (*file path to the given h5 file or the h5 file handle*)
- **path (str)** (*path to the base dataset within the h5 file*)

Returns: **out (dict)**

Return type: a dict with h5 file contents with the same path structure

`moseq2_extract.util.`**`load_metadata`** (metadata_file)
Loads metadata.

Parameters: **metadata_file (str)** (*path to metadata file*)

Returns:

Return type: metadata (dict)

`moseq2_extract.util.`**`load_textdata`** (`data_file`, `dtype=<class 'numpy.float32'>`)
Loads timestamp from txt/csv file

Parameters:
- **data_file (str)** (*path to timestamp file*)
- **dtype (dtype)** (*data type of timestamps*)

Returns: **data (np.ndarray)** (*timestamp data*) **timestamps (np.array)** (*time stamp keynames.*)

`moseq2_extract.util.`**`load_timestamps`** (timestamp_file, col=0)
Read timestamps from space delimited text file.

Parameters:
- **timestamp_file (str)** (*path to timestamp file*)
- **col (int)** (*column in ts file read.*)

Returns: **ts (list)**

Return type: list of timestamps

`moseq2_extract.util.`**`make_gradient`** (width, height, h, k, a, b, theta=0)
https://stackoverflow.com/questions/49829783/draw-a-gradual-change-ellipse-in-skimage/49848093#49848093
Creates gradient around bucket floor representing slanted wall values. This is done by drawing an "ellipse" of equal x,y radii, resulting in a circle with weighted depth values from highest to lowest surrounding the circumference of the circle

Parameters:
- **width (int)** (*bounding box width*)
- **height (int) bounding box height**
- **h (int)** (*centroid x coordinate*)
- **k (int)** (*centroid y coordinate*)
- **a (int)** (*x-radius of drawn ellipse*)
- **b (int)** (*y-radius of drawn ellipse*)
- **theta (float)** (*degree to rotate ellipse in radians. (has no effect if drawing a circle)*)

Returns: **(2d np.ndarray)** (*numpy array with weighted values from 0.08 -> 0.8 representing the proportion of values*) *to create a gradient from. 0.8 being the proportioned values closest to the circle wall.*

`moseq2_extract.util.`**`mouse_threshold_filter`** (h5file, thresh=0)
Filters frames in h5 files by threshold value

Parameters:
- **h5file (str)** (*path to h5 file*)
- **thresh (int)** (*threshold at which to apply filter*)

Returns: **(3d-np boolean array)**

Return type: array of regions to include after threshold filter.

`moseq2_extract.util.`**`read_yaml`** (yaml_file)
Reads yaml file into dict object

Parameters: **yaml_file (str)** (*path to yaml file*)

Returns: **return_dict (dict)**

Return type: dict of yaml contents

`moseq2_extract.util.`**`recursive_find_h5s`**
(root_dir='/Users/aymanzeine/Desktop/moseq/moseq2-extract/docs', ext='.h5', yaml_string='{}.yaml')
Recursively find h5 files, along with yaml files with the same basename

Parameters:
- **root_dir (str)** (*path to base directory to begin recursive search in.*)
- **ext (str)** (*extension to search for*)
- **yaml_string (str)** (*string for filename formatting when saving data*)

Returns: **h5s (list)** (*list of found h5 files*) **dicts (list)** (*list of found metadata files*) **yamls (list)** (*list of found yaml files*)

`moseq2_extract.util.`**`recursive_find_unextracted_dirs`**
(root_dir='/Users/aymanzeine/Desktop/moseq/moseq2-extract/docs', session_pattern='session_\\d+\\.(?:tgz|tar\\.gz)', filename='.dat', yaml_path='proc/results_00.yaml', metadata_path='metadata.json', skip_checks=True)
Recursively find unextracted (or incompletely extracted) directories

Parameters:
- **root_dir (os Path-like)** (*path to base directory to start recursive search from.*)
- **session_pattern (str)** (*folder name pattern to search for*)
- **filename (str)** (*file extension to search for*)
- **yaml_path (str)** (*path to respective extracted metadata*)
- **metadata_path (str)** (*path to relative metadata.json files*)
- **skip_checks (bool)** (*indicates whether to check if the files exist at the given relative paths*)

Returns: **proc_dirs (1d-list)**

Return type: list of paths to each unextracted session's proc/ directory

`moseq2_extract.util.`**`scalar_attributes`** ()
Gets scalar attributes

Returns: **attributes (dict)**

Return type: collection of metadata keys and descriptions.

`moseq2_extract.util.`**`select_strel`** (string='e', size=10, 10)
Returns structuring element of specified shape.

Parameters:
- **string (str)** (*indicates whether to use ellipse or rectangle*)
- **size (tuple)** (*size of structuring element*)

Returns:

Return type: strel (cv2.StructuringElement)

`moseq2_extract.util.`**`strided_app`** (a, L, S)
from https://stackoverflow.com/questions/40084931/taking-subarrays-from-numpy-array-with-given-stride-stepsize/40085052#40085052

Parameters:
- **a (np.ndarray) - array to get subarrarys from.**
- **L (int) - Window Length**
- **S (int) - Stride size**

Returns:

Return type: (np.ndarray) - array of subarrays at stride S.

`moseq2_extract.util.`**`time_str_for_filename`** (time_str: str) → str

Process the time string supplied by moseq to be used in a filename. This removes colons, milliseconds, and timezones.

Parameters: **time_str (str)** (*time str to format*)

Returns: **out (str)**

Return type: formatted timestamp str

Subpackages

moseq2_extract.extract package

Extract - Extract Module

`moseq2_extract.extract.extract.`**`extract_chunk`** (chunk, use_em_tracker=False, prefilter_space=3, prefilter_time=None, iters_tail=1, iters_min=0, strel_tail=array([[0, 0, 0, 0, 1, 0, 0, 0, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 0, 0, 0, 1, 0, 0, 0, 0]], dtype=uint8), strel_min=array([[1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1]], dtype=uint8), min_height=10, max_height=100, mask_threshold=- 20, use_cc=False, bground=None, roi=None, rho_mean=0, rho_cov=0, tracking_ll_threshold=- 100, tracking_segment=True, tracking_init_mean=None, tracking_init_cov=None, tracking_init_strel=array([[0, 0, 0, 0, 1, 0, 0, 0, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 0, 0, 0, 1, 0, 0, 0, 0]], dtype=uint8), flip_classifier=None, flip_smoothing=51, frame_dtype='uint8', save_path='/Users/aymanzeine/Desktop/moseq/moseq2-extract/docs/proc', progress_bar=True, crop_size=80, 80, true_depth=673.1, centroid_hampel_span=5, centroid_hampel_sig=3, angle_hampel_span=5, angle_hampel_sig=3, model_smoothing_clips=- 300, - 150, tracking_model_init='raw', verbose=0, **kwargs)

This function looks for a mouse in background-subtracted frames from a chunk of depth video. It is called from the moseq2_extract.helpers.extract module.

Parameters:

- **chunk (3d np.ndarray)** (*chunk to extract - (chunksize, height, width)*)
- **use_em_tracker (bool)** (*The EM tracker uses expectation-maximization to fit a 3D gaussian on a frame-by-frame*) – basis to the mouse's body and determine if pixels are mouse vs cable.
- **prefilter_space (tuple)** (*spatial kernel size*)
- **prefilter_time (tuple)** (*temporal kernel size*)
- **iters_tail (int)** (*number of filtering iterations on mouse tail*)
- **iters_min (int)** (*minimum tail filtering filter kernel size*)
- **strel_tail (cv2::StructuringElement - Ellipse)** (*filtering kernel size to filter out mouse tail.*)
- **strel_min (cv2::StructuringElement - Rectangle)** (*filtering kernel size to filter mouse body in cable recording cases.*)
- **min_height (int)** (*minimum (mm) distance of mouse to floor.*)
- **max_height (int)** (*maximum (mm) distance of mouse to floor.*)
- **mask_threshold (int)** (*Threshold on log-likelihood to include pixels for centroid and angle calculation*)
- **use_cc (bool)** (*boolean to use connected components in cv2 structuring elements*)
- **bground (np.ndarray)** (*numpy array represented previously computed background*)
- **roi (np.ndarray)** (*numpy array represented previously computed roi*)
- **rho_mean (int)** (*smoothing parameter for the mean*)
- **rho_cov (int)** (*smoothing parameter for the covariance*)
- **tracking_ll_threshold (float)** (*threshold for calling pixels a cable vs a mouse (usually between -16 to -12).*) – If the log-likelihood falls below this value, pixels are considered cable.
- **tracking_segment (bool)** (*boolean for whether to use only the largest blob for EM updates.*)
- **tracking_init_mean (float)** (*Initialized mean value for EM Tracking*)
- **tracking_init_cov (float)** (*Initialized covariance value for EM Tracking*)
- **tracking_init_strel (cv2::StructuringElement - Ellipse)**
- **flip_classifier (str)** (*path to pre-selected flip classifier.*)
- **flip_smoothing (int)** (*amount of smoothing to use for flip classifier.*)
- **frame_dtype (str)** (*Data type for processed frames*)
- **save_path** (*(str): Path to save extracted results*)
- **progress_bar (bool)** (*Display progress bar*)
- **crop_size (tuple)** (*size of the cropped mouse image.*)
- **true_depth (float)** (*previously computed detected true depth value.*)
- **centroid_hampel_span (int)** (*Hampel filter span kernel size*)
- **centroid_hampel_sig (int)** (*Hampel filter standard deviation*)
- **angle_hampel_span (int)** (*Angle filter span kernel size*)
- **angle_hampel_sig (int)** (*Angle filter standard deviation*)
- **model_smoothing_clips (tuple)** (*Model smoothing clips*)
- **tracking_model_init (str)** (*Method for tracking model initialization*)
- **verbose (int)** (*Level of verbosity during extraction process. [0-2]*)

Returns: **results** (*(3d np.ndarray) - (nframes, crop_height, crop_width)*) *extracted cropped, oriented and centered RGB video chunk to be written to file.*

Extract - Proc Module

`moseq2_extract.extract.proc.`**`apply_roi`** (frames, roi)
Apply ROI to data, consider adding constraints (e.g. mod32==0).

Parameters:
- **frames (3d np.ndarray)** (*input frames to apply ROI.*)
- **roi (2d np.ndarray)** (*selected ROI to extract from input images.*)

Returns: **cropped_frames (3d np.ndarray)**

Return type: Frames cropped around ROI Bounding Box.

`moseq2_extract.extract.proc.`**`clean_frames`** (frames, prefilter_space=3, prefilter_time=None, strel_tail=array([[0, 0, 0, 1, 0, 0, 0], [0, 1, 1, 1, 1, 1, 0], [1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 1, 1, 0], [0, 0, 0, 1, 0, 0, 0]], dtype=uint8), iters_tail=None, frame_dtype='uint8', strel_min=array([[1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1], [1, 1, 1, 1, 1]], dtype=uint8), iters_min=None, progress_bar=True, gui=False, verbose=0)
Simple filtering, median filter and morphological opening.

Parameters:
- **frames (3d np.ndarray)** (*Frames (nframes x r x c) to filter.*)
- **prefilter_space (tuple)** (*kernel size for spatial filtering*)
- **prefilter_time (tuple)** (*kernel size for temporal filtering*)
- **strel_tail (cv2.StructuringElement)** (*Element for tail filtering.*)
- **iters_tail (int)** (*number of iterations to run opening*)
- **frame_dtype (str)** (*frame encodings*)
- **strel_min (int)** (*minimum kernel size*)
- **iters_min (int)** (*minimum number of filtering iterations*)
- **progress_bar (bool)** (*display progress bar*)
- **gui (bool)** (*indicate GUI is executing function*)
- **verbose (bool)** (*display progress*)

Returns: **filtered_frames (3d np array)**

Return type: frame x r x c

`moseq2_extract.extract.proc.`**`compute_scalars`** (frames, track_features, min_height=10, max_height=100, true_depth=673.1)
Computes scalars.

Parameters:
- **frames (3d np.ndarray)** (*frames x r x c, uncropped mouse*)
- **track_features (dict)** (*dictionary with tracking variables (centroid and orientation)*)
- **min_height (float)** (*minimum height of the mouse*)
- **max_height (float)** (*maximum height of the mouse*)
- **true_depth (float)** (*detected true depth*)

Returns: **features (dict)**

Return type: dictionary of scalars

`moseq2_extract.extract.proc.`**`crop_and_rotate_frames`** (frames, features, crop_size=80, 80, progress_bar=True, gui=False, verbose=0)
Crops mouse from image and orients it s.t it is always facing east.

Parameters:
- **frames (3d np.ndarray)** (*frames to crop and rotate*)
- **features (dict)** (*dict of extracted features, found in result_00.h5 files.*)
- **crop_size (tuple)** (*size of cropped image.*)
- **progress_bar (bool)** (*Display progress bar.*)
- **gui (bool)** (*indicate GUI is executing function*)
- **verbose (bool)** (*display progress*)

Returns: **cropped_frames (3d np.ndarray)**

Return type: Crop and rotated frames.

`moseq2_extract.extract.proc.`**`feature_hampel_filter`** (features, centroid_hampel_span=None, centroid_hampel_sig=3, angle_hampel_span=None, angle_hampel_sig=3)

Filters computed extraction features using Hampel Filtering.

Parameters:
- **features (dict)** (*dictionary of video features*)
- **centroid_hampel_span (int)** (*Centroid Hampel Span Filtering Kernel Size*)
- **centroid_hampel_sig (int)** (*Centroid Hampel Signal Filtering Kernel Size*)
- **angle_hampel_span (int)** (*Angle Hampel Span Filtering Kernel Size*)
- **angle_hampel_sig (int)** (*Angle Hampel Span Filtering Kernel Size*)

Returns: **features (dict)**

Return type: filtered version of input dict.

`moseq2_extract.extract.proc.`**`get_bbox`** (roi)

Given a binary mask, return an array with the x and y boundaries

Parameters: **roi (2d np.ndarray)** (*ROI boolean mask to calculate bounding box.*)

Returns: **bbox (2d np.ndarray)**

Return type: Bounding Box around ROI

`moseq2_extract.extract.proc.`**`get_bground_im`** (frames)

Returns background

Parameters: **frames (3d numpy array)** (*frames x r x c, uncropped mouse*)

Returns: **bground (2d numpy array)**

Return type: r x c, background image

`moseq2_extract.extract.proc.`**`get_bground_im_file`** (frames_file, frame_stride=500, med_scale=5, **kwargs)

Returns background from file

Parameters:
- **frames_file (str)** (*path to data with frames*)
- **frame_stride (int)** (*stride size between frames for median bground calculation*)
- **med_scale (int)** (*kernel size for median blur for background images.*)
- **kwargs**

Returns: **bground (2d numpy array)**

Return type: r x c, background image

`moseq2_extract.extract.proc.`**`get_flips`** (frames, flip_file=None, smoothing=None)

Predicts frames where mouse orientation is flipped to later correct.

Parameters:
- **frames (3d numpy array)** (*frames x r x c, cropped mouse*)
- **flip_file (str)** (*path to joblib dump of scipy random forest classifier*)
- **smoothing (int)** (*kernel size for median filter smoothing of random forest probabilities*)

Returns: **flips (bool array)**

Return type: true for flips

`moseq2_extract.extract.proc.`**`get_frame_features`** (frames, frame_threshold=10, mask=array([], dtype=float64), mask_threshold=- 30, use_cc=False, progress_bar=True, gui=False, verbose=0)

Use image moments to compute features of the largest object in the frame

Parameters:

- **frames (3d np.ndarray)** (*input frames*)
- **frame_threshold (int)** (*threshold in mm separating floor from mouse*)
- **mask (3d np.ndarray)** (*input frame mask for parts not to filter.*)
- **mask_threshold (int)** (*threshold to include regions into mask.*)
- **use_cc (bool)** (*Use connected components.*)
- **progress_bar (bool)** (*Display progress bar.*)
- **gui (bool)** (*indicate GUI is executing function*)
- **verbose (bool)** (*display progress*)

Returns: **features (dict of lists)** (*dictionary with simple image features*) **mask (3d np.ndarray)** (*input frame mask.*)

`moseq2_extract.extract.proc.`**`get_largest_cc`** (frames, progress_bar=False)

Returns largest connected component blob in image

Parameters:

- **frames (3d numpy array)** (*frames x r x c, uncropped mouse*)
- **progress_bar (bool)** (*display progress bar*)

Returns: **flips (3d bool array)**

Return type: frames x r x c, true where blob was found

`moseq2_extract.extract.proc.`**`get_roi`** (depth_image, strel_dilate=array([[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]], dtype=uint8), dilate_iters=1, strel_erode=None, noise_tolerance=30, weights=1, 0.1, 1, overlap_roi=None, gradient_filter=False, gradient_kernel=7, gradient_threshold=3000, fill_holes=True, gui=False, verbose=0, **kwargs)

Get an ROI using RANSAC plane fitting and simple blob features

Parameters:

- **depth_image (2d np.ndarray)** (*Singular depth image frame.*)
- **strel_dilate (cv2.StructuringElement - Rectangle)** (*dilation shape to use.*)
- **dilate_iters (int)** (*number of dilation iterations.*)
- **strel_erode (int)** (*image erosion kernel size.*)
- **noise_tolerance (int)** (*threshold to use for noise filtering.*)
- **weights (tuple)** (*weights describing threshold to accept ROI.*)
- **overlap_roi (np.ndarray)** (*list of ROI boolean arrays to possibly combine.*)
- **gradient_filter (bool)** (*Boolean for whether to use a gradient filter.*)
- **gradient_kernel (tuple)** (*Kernel size of length 2, e.g. (1, 1.5)*)
- **gradient_threshold (int)** (*Threshold for noise gradient filtering*)
- **fill_holes (bool)** (*Boolean to fill any missing regions within the ROI.*)
- **gui (bool)** (*Boolean for whether function is running on GUI.*)
- **verbose (bool)** (*Boolean for whether to display progress*)
- **kwargs**

Returns: **rois (list)** (*list of 2d roi images.*) **roi_plane (2d np.ndarray)** (*computed ROI Plane using RANSAC.*) **bboxes (list)** (*list of computed bounding boxes for each respective ROI.*) **label_im (list)** (*list of scikit-image image properties*) **ranks (list)** (*list of ROI ranks.*) **shape_index (list)** (*list of rank means.*)

`moseq2_extract.extract.proc.`**`im_moment_features`** (IM)
Use the method of moments and centralized moments to get image properties.

Parameters: **IM (2d numpy array)** (*depth image*)
Returns: **features (dict)** – centroid, and ellipse axis length
Return type: returns a dictionary with orientation,

`moseq2_extract.extract.proc.`**`model_smoother`** (features, ll=None, clips=- 300, - 125)
Spatial feature filtering.

Parameters:
- **features (dict)** (*dictionary of extraction scalar features*)
- **ll (np.array)** (*list of loglikelihoods of pixels in frame*)
- **clips (tuple)** (*tuple to ensure video is indexed properly*)

Returns:
Return type: features (dict) - smoothed version of input features

Extract - ROI Module

`moseq2_extract.extract.roi.`**`plane_fit3`** (points)
Fit a plane to 3 points (min number of points for fitting a plane)

Parameters: **points (2d numpy array)** (*each row is a group of points, columns correspond to x,y,z.*)
Returns: **plane (1d numpy array)**
Return type: linear plane fit–>a*x+b*y+c*z+d

`moseq2_extract.extract.roi.`**`plane_ransac`** (depth_image, depth_range=650, 750, iters=1000, noise_tolerance=30, in_ratio=0.1, progress_bar=True, mask=None, gui=False, verbose=0)
Naive RANSAC implementation for plane fitting

Parameters:
- **depth_image (2d numpy array)** (*hxw, background image to fit plane to*)
- **depth_range (tuple)** (*min/max depth (mm) to consider pixels for plane*)
- **iters (int)** (*number of RANSAC iterations*)
- **noise_tolerance (float)** (*dist. from plane to consider a point an inlier*)
- **in_ratio (float)** (*frac. of points required to consider a plane fit good*)
- **progress_bar (bool)** (*display progress bar*)
- **mask (bool 2d np.array)** (*boolean mask to find region to use*)
- **gui (bool)** (*whether GUI is used.*)
- **verbose (int)** (*0 or 1; 1 to print all information.*)

Returns: **best_plane (1d numpy array)** (*plane fit to data*) **dist (1d numpy array)** (*distance of the calculated coordinates and "best plane"*)

Extract - Track Module

`moseq2_extract.extract.track.`**`em_get_ll`** (frames, mean, cov, progress_bar=True)
Returns likelihoods for each frame given tracker parameters

Parameters:
- **frames (3d numpy array)** (*depth frames*)
- **mean (2d numpy array)** (*frames x d, mean estimates*)
- **cov (3d numpy array)** (*frames x d x d, covariance estimates*)
- **progress_bar (bool)** (*use a progress bar*)

Returns: **ll (3d numpy array)**

Return type: frames x rows x columns, log likelihood of all pixels in each frame

`moseq2_extract.extract.track.`**`em_init`** (depth_frame, depth_floor, depth_ceiling, init_strel=array([[0, 0, 0, 0, 1, 0, 0, 0, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 0, 0, 0, 1, 0, 0, 0, 0]], dtype=uint8), strel_iters=1)

Initialize EM Mask.

Parameters:
- **depth_frame (2d numpy array)** (*depth frame to initialize mask with.*)
- **depth_floor (float)** (*distance from camera to bucket floor.*)
- **depth_ceiling (float)** (*max depth value.*)
- **init_strel (cv2.structuringElement)** (*structuring Element to compute mask.*)
- **strel_iters (int)** (*number of morphological iterations.*)

Returns: **mouse_mask (2d numpy array)**

Return type: mask of depth frame.

`moseq2_extract.extract.track.`**`em_iter`** (data, mean, cov, lamd=0.1, epsilon=0.1, max_iter=25)

Single iteration of EM tracker

Parameters:
- **data (3d numpy array)** (*nx3, x, y, z coordinates to use*)
- **mean (1d numpy array)** (*dx1, current mean estimate*)
- **cov (2d numpy array)** (*dxd, current covariance estimate*)
- **lambd (float)** (*constant to add to diagonal of covariance matrix*)
- **epsilon (float)** (*tolerance on change in likelihood to terminate iteration*)
- **max_iter (int)** (*maximum number of EM iterations*)

Returns: **mean (1d numpy array)** (*updated mean*) **cov (2d numpy array)** (*updated covariance*)

`moseq2_extract.extract.track.`**`em_tracking`** (frames, raw_frames, segment=True, ll_threshold=- 30, rho_mean=0, rho_cov=0, depth_floor=10, depth_ceiling=100, progress_bar=True, init_mean=None, init_cov=None, init_frames=10, init_method='raw', init_strel=array([[0, 0, 0, 0, 1, 0, 0, 0, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 1, 1, 1, 1, 1, 1, 1, 0], [0, 0, 0, 0, 1, 0, 0, 0, 0]], dtype=uint8))

Naive tracker, use EM update rules to follow a 3D Gaussian

around the room.

Parameters:
- **frames (3d numpy array)** (*filtered frames - nframes x r x c.*)
- **raw_frames (3d numpy array)** (*chunk to track mouse in.*)
- **segment (bool)** (*use only the largest blob for em updates*)
- **ll_threshold (float)** (*threshold on log likelihood for segmentation*)
- **rho_mean (float)** (*smoothing parameter for the mean*)
- **rho_cov (float)** (*smoothing parameter for the covariance*)
- **depth_floor (float)** (*height in mm for separating mouse from floor*)
- **depth_ceiling (float)** (*max height in mm for mouse from floor.*)
- **progress_bar (bool)** (*display progress bar.*)
- **init_mean (np.ndarray)** (*array of inital frame pixel means.*)
- **init_cov (np.ndarray)** (*array of inital frame pixel covariances.*)
- **init_frames (int)** (*number of frames to include in the init calulation*)
- **init_method (str)** (*mode in which to process inputs*)
- **init_strel (cv2.structuringElement)** (*structuring Element to compute mask.*)

Returns: **model_parameters (dict)**

Return type: mean and covariance estimates for each frame

moseq2_extract.helpers package

Helpers - Data Module

`moseq2_extract.helpers.data.`**`build_manifest`** (loaded, format, snake_case=True)
aggregate_results() Helper Function. Builds a manifest file used to contain extraction result metadata from h5 and yaml files.

Parameters:
- **loaded (list of dicts)** (*list of dicts containing loaded h5 data.*)
- **format (str)** (*filename format indicating the new name for the metadata files in the aggregate_results dir.*)
- **snake_case (bool)** (*whether to save the files using snake_case*)

Returns: **manifest (dict)**

Return type: dictionary of extraction metadata.

`moseq2_extract.helpers.data.`**`copy_manifest_results`** (manifest, output_dir)
Copies all considated manifest results to their respective output files.

Parameters:
- **manifest (dict)** (*manifest dictionary containing all extraction h5 metadata to save*)
- **output_dir (str)** (*path to directory where extraction results will be aggregated.*)

Returns:

Return type: None

`moseq2_extract.helpers.data.`**`create_extract_h5`** (f, acquisition_metadata, config_data, status_dict, scalars, scalars_attrs, nframes, true_depth, roi, bground_im, first_frame, timestamps, extract=None)
Creates h5 file that holds all extracted frames and other metadata (such as scalars).

Parameters:

- **f (h5py.File object)** (*opened h5 file object to write to.*)
- **acquisition_metadata (dict)** (*Dictionary containing extracted session acquisition metadata.*)
- **config_data (dict)** (*dictionary object containing all required extraction parameters. (auto generated)*)
- **status_dict (dict)** (*dictionary that helps indicate if the session has been extracted fully.*)
- **scalars (list)** (*list of computed scalar metadata.*)
- **scalars_attrs (dict)** (*dict of respective computed scalar attributes and descriptions to save.*)
- **nframes (int)** (*number of frames being recorded*)
- **true_depth (float)** (*computed detected true depth*)
- **roi (2d np.ndarray)** (*Computed 2D ROI Image.*)
- **bground_im (2d np.ndarray)** (*Computed 2D Background Image.*)
- **first_frame (2d np.ndarray)** (*Computed 2D First Frame Image.*)
- **timestamps (np.array)** (*Array of session timestamps.*)
- **extract (moseq2_extract.cli.extract function)** (*Used to preseve CLI state parameters in extraction h5.*)

Returns:

Return type: None

`moseq2_extract.helpers.data.`**`get_selected_sessions`** (to_extract, extract_all)

Given user input, the function will return either selected sessions to extract, or all the sessions.

Parameters:

- **to_extract (list)** (*list of paths to sessions to extract*)
- **extract_all (bool)** (*boolean to include all sessions and skip user-input prompt.*)

Returns: **to_extract (list)**

Return type: new list of selected sessions to extract.

`moseq2_extract.helpers.data.`**`handle_extract_metadata`** (input_file, dirname, config_data, nframes)

Extracts metadata from input depth files, either raw or compressed.

Parameters:

- **input_file (str)** (*path to input file to extract*)
- **dirname (str)** (*path to directory where extraction files reside.*)
- **config_data (dict)** (*dictionary object containing all required extraction parameters. (auto generated)*)
- **nframes (int)** (*number of frames to extract.*)

Returns: **metadata_path (str)** (*path to respective metadata.json*) **timestamp_path (str)** (*path to respective depth_ts.txt or similar*) **alternate_correct (bool)** (*indicator for whether an alternate timestamp file was used*) **tar (bool)** (*indicator for whether the file is compressed.*) **nframes (int)** (*number of frames to extract*) **first_frame_idx (int)** (*index number of first frame in extraction.*) **last_frame_idx (int)** (*index number of last frame in extraction*)

`moseq2_extract.helpers.data.`**`load_h5s`** (to_load, snake_case=True)

aggregate_results() Helper Function to load h5 files.

Parameters:

- **to_load (list)** (*list of paths to h5 files.*)
- **snake_case (bool)** (*whether to save the files using snake_case*)

Returns: **loaded (list)**

Return type: list of loaded h5 dicts.

Helpers - Extract Module

`moseq2_extract.helpers.extract.`**`process_extract_batches`** (f, input_file, config_data, bground_im, roi, scalars, frame_batches, first_frame_idx, true_depth, tar, strel_tail, strel_min, output_dir, output_filename)

Compute extracted frames and save them to h5 files and avi files.

Parameters:

- **f (h5py.File)** (*opened h5 file to write extracted batches to*)
- **input_file (str)** (*path to depth file*)
- **config_data (dict)** (*dictionary containing extraction parameters (autogenerated)*)
- **bground_im (2d numpy array)** (*r x c, background image*)
- **roi (2d numpy array)** (*r x c, roi image*)
- **scalars (list)** (*list of keys to scalar attribute values*)
- **frame_batches (list)** (*list of batches of frames to serially process.*)
- **first_frame_idx (int)** (*index of starting frame.*)
- **true_depth (float)** (*computed detected true depth.*)
- **tar (bool)** (*compressed file indicator.*)
- **strel_tail (cv2.StructuringElement)** (*Element for tail filtering.*)
- **strel_min (int)** (*minimum kernel size*)
- **output_dir (str)** (*path to output directory that contains the extracted data, e.g. (proc/).*)
- **output_filename (str)** (*name of h5 file containing extraction data, e.g. (results_00).*)

Returns: **video_pipe (bool)**

Return type: boolean for whether function is done writing to video file.

`moseq2_extract.helpers.extract.`**`run_local_extract`** (to_extract, params, prefix, skip_extracted=False, output_directory=None)

Runs the extract command on given list of sessions to extract on local platform. This function is meant for the GUI interface to utilize the moseq2-batch extract functionality.

Parameters:

- **to_extract (list)** (*list of paths to files to extract*)
- **params (dict)** (*dictionary of ROI metadata from config file.*)
- **prefix (str)** (*prefix to CLI extraction command.*)
- **skip_extracted (bool)** (*Whether to skip already extracted session.*)
- **output_directory (str)** (*path to preferred output directory.*)

Returns:

Return type: None

`moseq2_extract.helpers.extract.`**`run_slurm_extract`** (to_extract, params, partition, prefix, escape_path, skip_extracted=False, output_directory=None)

Runs the extract command on given list of sessions to extract on SLURM platform. This function is meant for the GUI interface to utilize the moseq2-batch extract functionality.

Parameters:

- **to_extract (list)** (*list of paths to files to extract*)
- **params (dict)** (*dictionary of ROI metadata from config file.*)
- **partition (str)** (*name of slurm partition to use*)
- **prefix (str)** (*prefix to CLI extraction command.*)
- **escape_path (function)** (*gets path to return to original base directory*)
- **skip_extracted (bool)** (*Whether to skip already extracted session.*)
- **output_directory (str)** (*path to preferred output directory.*)

Returns:

Return type: None

Helpers - Wrappers Module

`moseq2_extract.helpers.wrappers.`**`aggregate_extract_results_wrapper`** (input_dir, format, output_dir)

Copies all the h5, yaml and avi files generated from all successful extractions to a new directory to hold all the necessary data to continue down the moseq pipeline.

Parameters:

- **input_dir (str)** (*path to base directory containing all session folders*)
- **format (str)** (*string format for metadata to use as the new aggregated filename*)
- **output_dir (str)** (*name of the directory to create and store all results in*)

Returns:

Return type: None

`moseq2_extract.helpers.wrappers.`**`copy_h5_metadata_to_yaml_wrapper`** (input_dir, h5_metadata_path)

Copy's user specified metadata from h5path to a yaml file.

Parameters:

- **input_dir (str)** (*path to directory containing h5 files*)
- **h5_metadata_path (str)** (*path within h5 to desired metadata to copy to yaml.*)

Returns:

Return type: None

`moseq2_extract.helpers.wrappers.`**`extract_wrapper`** (input_file, output_dir, config_data, num_frames=None, skip=False, extract=None, gui=False)

Wrapper function to run extract function for both GUI and CLI.

Parameters:

- **input_file (str)** (*path to depth file*)
- **output_dir (str)** (*path to directory to save results in.*)
- **config_data (dict)** (*dictionary containing extraction parameters.*)
- **num_frames (int)** (*number of frames to extract. All if None.*)
- **skip (bool)** (*indicates whether to skip file if already extracted*)
- **extract (function)** (*extraction function state (Only passed by CLI)*)
- **gui (bool)** (*indicates if GUI is running.*)

Returns: **output_dir (str)**

Return type: path to directory containing extraction (only if gui==True)

`moseq2_extract.helpers.wrappers.`**`flip_file_wrapper`** (config_file, output_dir, selected_flip=1, gui=False)

Wrapper function to download and save flip classifiers. :Parameters: * **config_file (str)** (*path to config file*)

- **output_dir (str)** (*path to directory to save classifier in.*)
- **selected_flip (int)** (*index of desired flip classifier.*)
- **gui (bool)** (*indicates if the GUI is running.*)

Returns:

Return type: None

`moseq2_extract.helpers.wrappers.`**`generate_index_wrapper`** (input_dir, pca_file, output_file, filter, all_uuids, subpath='/proc/')

Generates index file containing a summary of all extracted sessions.

Parameters:
- **input_dir (str)** (*directory to search for extracted sessions.*)
- **pca_file (str)** (*path to pca_scores file.*)
- **output_file (str)** (*preferred name of the index file.*)
- **filter (list)** (*list of metadata keys to conditionally filter.*)
- **all_uuids (list)** (*list of all session uuids.*)

Returns: **output_file (str)**

Return type: path to index file.

`moseq2_extract.helpers.wrappers.`**`get_roi_wrapper`** (input_file, config_data, output_dir=None, output_directory=None, gui=False, extract_helper=False)

Wrapper function to compute ROI given depth file.

Parameters:
- **input_file (str)** (*path to depth file.*)
- **config_data (dict)** (*dictionary of ROI extraction parameters.*)
- **output_dir (str)** (*path to desired directory to save results in.*)
- **output_directory (str)** (*GUI optional secondary external save directory path*)
- **gui (bool)** (*indicate whether GUI is running.*)
- **extract_helper (bool)** (*indicate whether this is being run independently or by extract function*)

Returns: *if gui* – output_dir (str): path to saved ROI results *elif extract_helper* – roi (2d array): ROI image to plot in GUI bground_im (2d array): Background image to plot in GUI first_frame (2d array): First frame image to plot in GUI

moseq2_extract.io package

IO - Image Module

`moseq2_extract.io.image.`**`read_image`** (filename, dtype='uint16', scale=True, scale_key='scale_factor')

Load image data, possibly with scale factor…

filename (str): path to file to write to.

image (2d numpy array): image to write scale (bool): indicates whether to scale image scale_key (str): indicates scale factor.
image (2d np array): loaded image

`moseq2_extract.io.image.`**`write_image`** (filename, image, scale=True, scale_factor=None, dtype='uint16', metadata={}, compress=0)

Save image data, possibly with scale factor for easy display.

Parameters:
- **filename (str)** (*path to file to write to.*)
- **image (2d numpy array)** (*the (unscaled) 2-D image to save*)
- **scale (bool)** (flag to scale the image between the bounds of *dtype*)
- **scale_factor (int)** (*factor by which to scale image*)
- **dtype (str)** (*array data type*)
- **metadata (dict)** (*[UNUSED] dictionary object that contains scaling info*)
- **compress (int)** (*image compression level*)

Returns:

Return type: None

IO - Video Module

moseq2_extract.io.video.**convert_mkv_to_avi** (filename)
Converts Azure MKV video file format to AVI.

Parameters: **filename (str) path to mkv file to convert**
Returns: **outpath (str)**
Return type: path to converted AVI video file.

moseq2_extract.io.video.**get_movie_info** (filename, frame_dims=512, 424, bit_depth=16)
Returns dict of movie metadata.

Parameters:
- **filename (str)** (*path to video file*)
- **frame_dims (tuple)** (*video dimensions*)
- **bit_depth (int)** (*integer indicating data type encoding*)

Returns: **metadata (dict)**
Return type: dictionary containing video file metadata

moseq2_extract.io.video.**get_raw_info** (filename, bit_depth=16, frame_dims=512, 424)
Gets info from a raw data file with specified frame dimensions and bit depth.

Parameters:
- **filename (string)** (*name of raw data file*)
- **bit_depth (int)** (*bits per pixel (default: 16)*)
- **frame_dims (tuple)** (*wxh or hxw of each frame*)

Returns: **file_info (dict)**
Return type: dictionary containing depth file metadata

moseq2_extract.io.video.**get_video_info** (filename)
Get dimensions of data compressed using ffv1, along with duration via ffmpeg.

Parameters: **filename (string)** (*name of file*)
Returns: **(dict)**
Return type: dictionary containing video file metadata

moseq2_extract.io.video.**load_movie_data** (filename, frames=None, frame_dims=512, 424, bit_depth=16, **kwargs)
Reads in frames

moseq2_extract.io.video.**read_frames** (filename, frames=range(0, 0), threads=6, fps=30, pixel_format='gray16le', frame_size=None, slices=24, slicecrc=1, get_cmd=False)
Reads in frames from the .nut/.avi file using a pipe from ffmpeg.

Parameters:
- **filename (str)** (*filename to get frames from*)
- **frames (list or 1d numpy array)** (*list of frames to grab*)
- **threads (int)** (*number of threads to use for decode*)
- **fps (int)** (*frame rate of camera in Hz*)
- **pixel_format (str)** (*ffmpeg pixel format of data*)
- **frame_size (str)** (*wxh frame size in pixels*)
- **slices (int)** (*number of slices to use for decode*)
- **slicecrc (int)** (*check integrity of slices*)
- **get_cmd (bool)** (*indicates whether function should return ffmpeg command (instead of executing).*)

Returns: **video (3d numpy array)**
Return type: frames x h x w

moseq2_extract.io.video.**read_frames_raw** (filename, frames=None, frame_dims=512, 424, bit_depth=16, dtype='<i2', tar_object=None)

Reads in data from raw binary file.

Parameters:
- **filename (string)** (*name of raw data file*)
- **frames (list or range)** (*frames to extract*)
- **frame_dims (tuple)** (*wxh of frames in pixels*)
- **bit_depth (int)** (*bits per pixel (default: 16)*)
- **tar_object (tarfile.TarFile)** (*TarFile object, used for loading data directly from tgz*)

Returns: **chunk (numpy ndarray)**

Return type: nframes x h x w

`moseq2_extract.io.video.`**`write_frames`** (filename, frames, threads=6, fps=30, pixel_format='gray16le', codec='ffv1', close_pipe=True, pipe=None, slices=24, slicecrc=1, frame_size=None, get_cmd=False, verbose=0)

Write frames to avi file using the ffv1 lossless encoder

Parameters:
- **filename (str)** (*path to file to write to.*)
- **frames (np.ndarray)** (*frames to write*)
- **threads (int)** (*number of threads to write video*)
- **fps (int)** (*frames per second*)
- **pixel_format (str)** (*format video color scheme*)
- **codec (str)** (*ffmpeg encoding-writer method to use*)
- **close_pipe (bool)** (*indicates to close the open pipe to video when done writing.*)
- **pipe (subProcess.Pipe)** (*pipe to currently open video file.*)
- **slices (int)** (*number of frame slices to write at a time.*)
- **slicecrc (int)** (*check integrity of slices*)
- **frame_size (tuple)** (*shape/dimensions of image.*)
- **get_cmd (bool)** (*indicates whether function should return ffmpeg command (instead of executing)*)
- **verbose (bool)** (*output progress.*)

Returns: **pipe (subProcess.Pipe)**

Return type: indicates whether video writing is complete.

`moseq2_extract.io.video.`**`write_frames_preview`** (filename, frames=array([], dtype=float64), threads=6, fps=30, pixel_format='rgb24', codec='h264', slices=24, slicecrc=1, frame_size=None, depth_min=0, depth_max=80, get_cmd=False, cmap='jet', pipe=None, close_pipe=True, frame_range=None)

Writes out a false-colored mp4 video.

Parameters:

- **filename (str)** (*path to file to write to.*)
- **frames (np.ndarray)** (*frames to write*)
- **threads (int)** (*number of threads to write video*)
- **fps (int)** (*frames per second*)
- **pixel_format (str)** (*format video color scheme*)
- **codec (str)** (*ffmpeg encoding-writer method to use*)
- **slices (int)** (*number of frame slices to write at a time.*)
- **slicecrc (int)** (*check integrity of slices*)
- **frame_size (tuple)** (*shape/dimensions of image.*)
- **depth_min (int)** (*minimum mouse depth from floor in (mm)*)
- **depth_max (int)** (*maximum mouse depth from floor in (mm)*)
- **get_cmd (bool)** (*indicates whether function should return ffmpeg command (instead of executing)*)
- **cmap (str)** (*color map to use.*)
- **pipe (subProcess.Pipe)** (*pipe to currently open video file.*)
- **close_pipe (bool)** (*indicates to close the open pipe to video when done writing.*)
- **frame_range (range())** (*frame indices to write on video*)

Returns: **pipe (subProcess.Pipe)**

Return type: indicates whether video writing is complete.

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- moseq2-extract-extract command line option
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moseq2-extract-aggregate-results command line option

- --format <format>
- --input-dir <input_dir>
- --output-dir <output_dir>
- -f
- -i
- -o

moseq2-extract-convert-raw-to-avi command line option

- --chunk-size <chunk_size>
- --delete
- --fps <fps>
- --output-file <output_file>
- --threads <threads>
- --verbose <verbose>
- -b
- -o
- -t
- -v
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moseq2-extract-copy-slice command line option

- --chunk-size <chunk_size>
- --copy-slice <copy_slice>
- --delete
- --fps <fps>
- --output-file <output_file>
- --threads <threads>

-b

-c

-o

-t

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moseq2-extract-download-flip-file command line option

--output-dir <output_dir>

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moseq2-extract-extract command line option

--angle-hampel-sig <angle_hampel_sig>

--angle-hampel-span <angle_hampel_span>

--bg-roi-depth-range <bg_roi_depth_range>

--bg-roi-dilate <bg_roi_dilate>

--bg-roi-fill-holes <bg_roi_fill_holes>

--bg-roi-gradient-filter <bg_roi_gradient_filter>

--bg-roi-gradient-kernel <bg_roi_gradient_kernel>

--bg-roi-gradient-threshold <bg_roi_gradient_threshold>

--bg-roi-index <bg_roi_index>

--bg-roi-shape <bg_roi_shape>

--bg-roi-weights <bg_roi_weights>

--bg-sort-roi-by-position <bg_sort_roi_by_position>

--bg-sort-roi-by-position-max-rois <bg_sort_roi_by_position_max_rois>

--cable-filter-iters <cable_filter_iters>

--cable-filter-shape <cable_filter_shape>

--cable-filter-size <cable_filter_size>

--centroid-hampel-sig <centroid_hampel_sig>

--centroid-hampel-span <centroid_hampel_span>

--chunk-overlap <chunk_overlap>

--chunk-size <chunk_size>

--compress <compress>

--compress-chunk-size <compress_chunk_size>

--compress-threads <compress_threads>

--config-file <config_file>

--crop-size <crop_size>

--detected-true-depth <detected_true_depth>

--dilate-iterations <dilate_iterations>

--flip-classifier <flip_classifier>

--flip-classifier-smoothing <flip_classifier_smoothing>

--fps <fps>

--frame-dtype <frame_dtype>

--frame-trim <frame_trim>

--max-height <max_height>

--min-height <min_height>

--model-smoothing-clips <model_smoothing_clips>

--output-dir <output_dir>

--spatial-filter-size <spatial_filter_size>

--tail-filter-iters <tail_filter_iters>

--tail-filter-shape <tail_filter_shape>

--tail-filter-size <tail_filter_size>

--temporal-filter-size <temporal_filter_size>

--tracking-model-init <tracking_model_init>

--tracking-model-ll-clip <tracking_model_ll_clip>

--tracking-model-ll-threshold <tracking_model_ll_threshold>

--tracking-model-mask-threshold <tracking_model_mask_threshold>

--tracking-model-segment <tracking_model_segment>

--use-plane-bground

--use-tracking-model <use_tracking_model>

--verbose <verbose>

--write-movie <write_movie>

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moseq2-extract-find-roi command line option

--bg-roi-depth-range <bg_roi_depth_range>

--bg-roi-dilate <bg_roi_dilate>

--bg-roi-fill-holes <bg_roi_fill_holes>

--bg-roi-gradient-filter <bg_roi_gradient_filter>

--bg-roi-gradient-kernel <bg_roi_gradient_kernel>

--bg-roi-gradient-threshold <bg_roi_gradient_threshold>

--bg-roi-index <bg_roi_index>

--bg-roi-shape <bg_roi_shape>

--bg-roi-weights <bg_roi_weights>

--bg-sort-roi-by-position <bg_sort_roi_by_position>

--bg-sort-roi-by-position-max-rois <bg_sort_roi_by_position_max_rois>

--config-file <config_file>

--dilate-iterations <dilate_iterations>

--output-dir <output_dir>

--use-plane-bground

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moseq2-extract-generate-config command line option

--output-file <output_file>

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moseq2-extract-generate-index command line option

--all-uuids <all_uuids>

--filter <filter>

--input-dir <input_dir>

--output-file <output_file>

--pca-file <pca_file>

--subpath <subpath>

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