EMDAT – USER MANUAL

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Eye Movement Data Analysis Toolkit (EMDAT) is a library for processing eye gaze data, developed in the University of British Columbia. Currently EMDAT is able to use data exported from Tobii studio software for analysis. While Tobii studio enables researchers to perform limited analysis on the eye gaze data collected by a Tobii eye tracker in an experiment, EMDAT can be used to calculate a comprehensive list of eye gaze features for each participant. Additionally, EMDAT has built-in mechanisms for data preprocessing and clean-up which makes it a valuable toolkit for researchers. EMDAT is developed with generalizability in mind, so that it can be used for a variety of experiments, with no or minimal amount of changes in the code provided. In summary the main functionalities of EMDAT are:

- Calculating a comprehensive set of features for eye gaze data, including:
    - General features for the whole experiment window, and
    - Features for specific areas on the screen (a.k.a., Areas Of Interest) and transitions between them.
- Eye gaze Preprocessing and clean up, including:
    - Evaluation of the quality of eye gaze samples collected during the experiment (data validation) with different methods, and
    - Automatic restoration of certain invalid eye gaze samples and improving the quality of data used in analysis.

While there are works in the literature, that report calculating different sets of features for eye gaze data (e.g., [1]), we could not find any publicly available library that would provide the above functionalities. We hope that EMDAT enables researchers with less coding experience, to analyze their eye tracking data more comprehensively.

The rest of this manual describes how to use the EMDAT library for analyzing eye tracking data collected by a Tobii eye tracker. It is important for the reader to be familiar with eye tracking concepts and Tobii Studio software before using EMDAT.

1. BASIC CONCEPTS

An eye-tracker provides eye-gaze information in terms *gaze samples* captured at the eye-tracker sampling frequency. E.g., a 120 Hertz (Hz) eye-tracker registers a gaze sample every 8.33 milliseconds (ms). A gaze sample includes the (x,y) coordinates of the gaze position on the screen. Several eye-trackers also provides information about the size of the pupil (pupillometry) and the distance from the eyes to the screen. The gaze samples are typically collected and saved either via an API or a third-party data collection software (as we elaborate more in Section 4.1).

Most eye-tracking data collection software and tools process the gaze samples into *fixations* (i.e., maintaining eye-gaze at one point on the screen, obtained by clustering together nearby gaze samples) and *saccades* (i.e., a quick movement of gaze from one fixation point to another), which are analyzed to derive a viewer's attention patterns. Most eye-tracking data collection software can generate these information.

A *recording* includes all eye-tracking data collected in a single session, i.e., from the start of the tracking to the end. In eye-tracking-based experiments, there can either be one recording per participant (i.e., the entire gaze data are collected all at once for a given participant); or several recordings per participant. Multiple recordings per participants can be necessary for instance if the experiments span across several days, or to allow for breaks during the study sessions. Often, recordings are divided into smaller units of time called *Scenes* (or *Segments*), which are meant to capture the meaningful parts of the recording.

Gaze samples can be tracked over the entire screen (by default), or over specific Areas of Interests (AOIs) that capture salient areas of the screen.

In EMDAT, the gaze samples, fixations and scenes are required for each recording. Saccades, pupil size and distance of the head to the screen are optional, as we will describe in Section 4.1.

2. FEATURES GENERATED BY EMDAT

EMDAT generates several sets of features for each of the scenes defined for each recording. This section defines all of these features, which are for the most part standard in eye-tracing data analysis and have been extensively used in research (see "*Eye Tracking: A comprehensive guide to methods and measures"* from Holmqvist et al. for a broad overview).

Fixation-based features.

Feature	Definition
`numfixations`	Total number of fixations
`fixationrate`	Total number of fixations / length of the recording or scene

`sumfixationduration`
`meanfixationduration`
`stddevfixationduration`
	Summative features over the duration of the fixations

Saccade-based features.

EMDAT capture saccades in terms of:

1. A straight line between two fixations (called *path* in EMDAT)
2. The actual trajectory formed by the gaze samples of the saccade (called *saccade* in EMDAT)

Feature	Definition
`sumpathdistance` `stddevpathdistance`	Summative statictics over the length of the *path*s
`eyemovementvelocity`	Mean speed of the *path*s (distance / duration)

`numsaccades`
`sumsaccadedistance`
`meansaccadedistance`
`stddevsaccadedistance`
`longestsaccadedistance`
	Summative statictics over the length of the saccades

`sumsaccadeduration`
`meansaccadeduration`
`stddevsaccadeduration`
`longestsaccadeduration`
	Summative statictics over the duration of the saccades

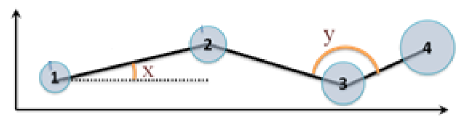
`meansaccadespeed`
`stddevsaccadespeed`
`minsaccadespeed`
	Summative statictics over the speed of the saccades (distance / duration)

maxsaccadespeed	
fixationsaccadetimeratio	Total fixation duration / total saccade duration

Angles-based features.

There are two types of angles measured in EMDAT:

1. The angle between the two consecutive saccades, called *relative saccade angle*. This is the *y* angle on the Figure below.
2. The angle between a saccade and the horizontal, called *absolute saccade angle*. This is the *x* angle on the Figure below.



Feature	Definition
meanabspathangles stddevabspathangles abspathanglesrate sumabspathangles	Summative statistics over the absolute path angles
meanrelpathangles stddevrelpathangles relpathanglesrate sumrelpathangles	Summative statistics over the relative path angles

Pupil-based features.

Most eye-trackers measure size (diameter) of the pupil at each gaze sample.

Feature	Definition
meanpupilsize stddevpupilsize maxpupilsize minpupilsize	Summative statictics of the pupil size over all gaze sample.
startpupilsize endpupilsize	Pupil size at the start and end of the recording or scene
meanpupilvelocity stddevpupilvelocity maxpupilvelocity minpupilvelocity	Summative statistics over the speed of the change in pupil size

Head distance-based features.

Most eye-trackers measure the distance of the eyes to the screen at each gaze sample. In EMDAT the distance of each eye is averaged before computing the features. They are smply called *distance* (future iterations should rename them to head_distance).

Feature	Definition
meandistance stddevdistance maxdistance mindistance	Summative statictics of the head distance over all gaze sample.
startdistance enddistance	Hea distance at the start and end of the recording or scene

Blink-based features.

Some eye-trackers can automatically detect and export blinks. If not, EMDAT includes a basic blink detector, with blink being defined as a temporary loss of data within specific time thresholds defined as a parameter (see Section 3.2.1).

Feature	Definition
blinknum	Total number of blinks
blinkdurationtotal blinkdurationmean blinkdurationstd blinkdurationmin blinkdurationmax	Summative statictics over the duration of all blinks
blinkrate	
blinktimedistancemean blinktimedistancestd blinktimedistancemax blinktimedistancemin	Summative statictics over the intervals between successive blinks

Interaction-based features.

These features are only for eye-trackers that also record the interaction events, namely mouse clicks and keyboard key press.

Feature	Definition
numevents numleftclic numrightclic numdoubleclic numkeypressed	Total number of events, clicks, and key pressed
leftclicrate rightclicrate doubleclicrate keypressedrate	Rate of clicks and keyboard events
timetofirstleftclic timetofirstrightclic timetofirstdoubleclic timetofirstkeypressed	Timestamp of the first event

AOI-based features.

Most of the above features can be defined over the subset of gaze samples, fixations and saccades that fall withon the boudaries of user-defined AOIs. Importantly, all AOI-based features are generated for each AOI defined by the user. Apart from the features defined above, EMDAT can also generate the following features, again for each AOI:

Feature	Definition
`aoitransfrom`	Number of transition from the AOI to each of the defined AOIs (including itself). A transition is a saccade with its start fixation in one AOI and the end fixation in another AOI.
`aoiproportion`	Proportion of all transitions from the AOI to each of the defined AOIs, out of all transitions for the AOI. For example for AOI_1: if there are 4 transitions from AOI_1 to AOI_2 and 20 transitions in total from AOI_1 to the other AOIs, the `aoiproportion` for AOI_1 is *4 / 20 = 0.2*
`aoisequence`	The list of all AOI visits (an AOI is visited if at least one fixation falls into it). For instance if a user's fixations falls into AOI_1, then AOI_2 and finaly AOI_1 again, the final sequence is [AOI_1, AOI_2, AOI_1]

Other

Feature	Definition
`numsegments`	Number of segment in the recording or scene
`length`	Length of the recording or scene
`numsamples`	Number of gaze samples

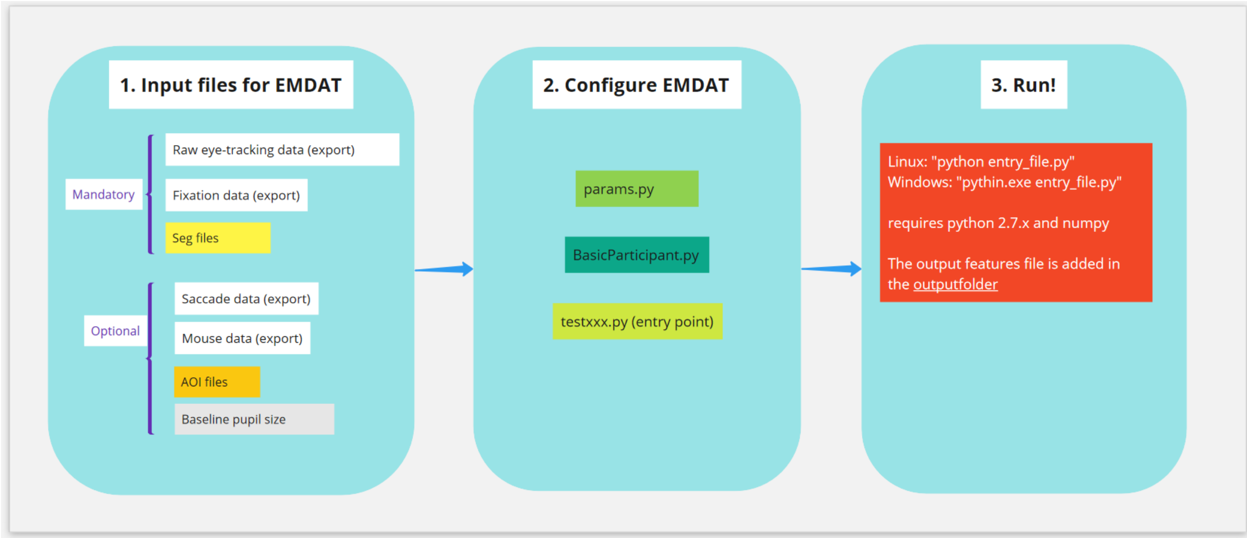
`blinktimedistancemean`
`blinktimedistancestd`
`blinktimedistancemax`
`blinktimedistancemin`
	Summative statictics over the intervals between successive blinks

3. REQUIREMENTS

EMDAT requires Pythion 2.7 and numpy. It works on all OS.

4. APPLYING EMDAT

There are three main stages required to apply EMDAT to a dataset, summarized in the chart below and described in the next subsections.



4.1 Input Data

Several files are inputted into EMDAT for each recording. This means that the input files listed below must be exported/generated for each recording.

4.1.1 EYE-TRACKER EXPORT DATA

EMDAT is meant to process eye-tracking data exported by an eye-tracking data collection software, and require at least the gaze samples and fixations. Currently EMDAT supports several data export format for the following data tracking software:

- *Tobii Studio 2.x* and *Tobii Studio 3.x*, that is provided by Tobii for Tobii Pro Eye-Tracker
- *SMI BeGaze 3.x*, that is provided for SMI eye-trackers

EMDAT can be extended to support other data format (see Advanced User Manual, Part XX).

The following files can be generated by the above software (where “XX” is a prefix that can be customized in the software) per recording:

- For *Tobii Studio 2.x:*
  - XX-All-Data.tsv: Contains all the gaze samples recorded by the eye-tracker for a given recording.
  - XX-Fixation-Data.tsv: The Fixations generated by Tobii Studio for the recording. The actual algorithm used by Tobii Studio can be selected in the options.
  - XX-Event-Data.tsv (optional): This file includes all the non-gaze events, such as mouse-clicks and key-presses. It also includes all the user-defined events.
- For *Tobii Studio 3.x:*
  - *XX-Data_Export.tsv*: Contains all gaze samples, fixations, saccades, and non-gaze events for a given recording.
- *For SMI BeGaze 3.x:*
  - *XX_Samples.txt: Contains the gaze samples*
  - *XX_Events.txt: Contains the fixations, saccades and blinks*

When exporting the above data, it is important to export them *per recording* (and not merge all recording together).

4.1.2 EXPERIMENT METADATA

EMDAT uses two other input data that includes context information about the eye-tracking data.

a) Scenes and Segments Files: EMDAT's features are generated over user-defined scenes to capture specific parts of the interaction. This is in particular to enable analysis of different phases or tasks of experiments. A scene is composed of a list of Segments that are defined by a start and end timestamp. The segments of different scenes can overlap.

Scenes and Segments are defined in tab-separated file without header, usually with a ".seg" extension. The format of a line in the Scene and Segment file is:

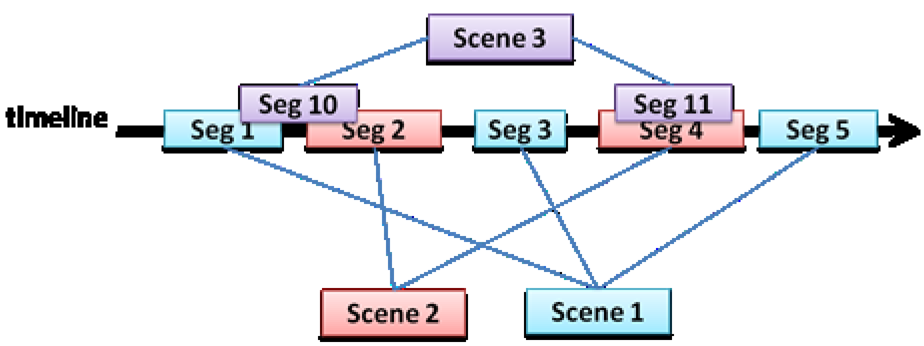
scene_name<tab>segment_name<tab>start_time<tab>end_time<newline>

Where *scene_name* is the unique name (or ID) of the Scene that this Segment belongs to, *segment_name* is the unique name/ID of the Segment for that scene, and *start_time* and *end_time* determines the time interval for the Segment.

Example with three scenes and 7 segments:

Scene_1seg_1	100	200
Scene_1seg_3	600	700
Scene_1seg_5	1100	1200
Scene_2seg_2	300	500
Scene_2seg_4	800	1000
Scene_3seg_10	170	350
Scene_3seg_11	850	950

Visual representation of these scenes:



A Segment can also be shared among two or more scenes, for example here seg_5 is shared by two scenes:

Scene_1seg_1	600	700
Scene_1seg_5	1100	1200
Scene_2seg_2	300	500
Scene_2seg_5	1100	1200

Importantly, the features listed above in Section 2 are generated for each scene.

Note: In case scenes and segments are not required, it is sufficient to define one Scene and Segment per recording for which the start time and end time captures the entire interaction. In that case the features are generated over the entire recordings. For instance:

Scene_all	seg_all	0	999999999999

One segment file is required per recording.

b) Areas of Interests (AOIs) files (optional): EMDAT generates by default features over all of the eye-tracking data captured in a scene. In addition, ENDAT can generates features for gaze samples that fall within specific AOIs. An AOI is defined in EMDAT as a set of polygons (list of x,y coordinates on the screen). EMDAT supports both static and dynamic AOIs, as follows.

Static AOI are active throughout the entire recording. They are define in tab-separated files without header, typically with a ".aoi" extension, as follows:

aoiname<tab>point1x,point1y<tab>point2x,point2y<tab>...<newline>

For instance, the following file defines two rectangular AOI:

Aoi_1	0,0	10,0	10,10	0,10
Aoi_2	50,30	50,50	80,50	80,30

AOIs can overlap. The shape of an AOI can be any polygons, by appending the list of x,y coordinates. For examples:

Aoi_3	0,0	10,3	10,7	10,10	10,20	20,20	20,17	20,5

An AOI can also be defined as multiple polygons, so as to capture different parts of the screen at once. To do so each polygon should be defined in a new line with the same name, e.g.:

Aoi_4	0,0	10,0	10,10	0,10				
Aoi_4	50,30	50,50	80,50	80,30				
Aoi_4	0,0	10,3	10,7	10,10	10,20	20,20	20,17	20,5

In this example Aoi_4 is defined as 3 polygons.

Dynamic AOIs are defined in a similar way than static AOIs (i.e., one or multiple polygons), but are in addition active only at specific times. The active periods are defined for each dynamic AOI by adding a second line with the list of active periods (defined via their start and end timestamp). The format of a dynamic AOI is:

aoiname<tab>point1x,point1y<tab>point2x,point2y<tab>...<newline>

#<tab>start1,end1<tab>start2,end2<tab>...<newline>

For instance, a dynamic AOI with two activation periods:

Aoi_1	0,0	10,0	10,10	0,10
#	1000,5000		7000,100000	

It is possible to define a dynamic AOI with multiple polygons in case the shape of the AOI changes over time. For instance:

Aoi_1	0,0	10,0	10,10	0,10				
#	1000,5000							
Aoi_1	0,0	10,3	10,7	10,10	10,20	20,20	20,17	20,5
#	11000,15000		17000,21000		29000,45000			

Static and dynamic AOIs can be defined together in a same AOI file. AOIs can be defined either globally or per recording. Global AOIs are shared across all recordings and are useful when the stimuli do not change across recordings. In that case only one AOI file is required overall. Otherwise AOIs can be defined per recording, and in that case one AOI file must be generated for each recording.

Important note: Currently the same unique AOI names must be defined for ALL recordings when using non-global AOI. If names are mismatch across recording EMDAT may generate incorrect output features! This is a limitation to be addressed in later version. Currently, if some AOIs are not required in all recordings, the issue can be tackled by defining them with (0,0) coordinates, e.g.:

Aoi_recordpecific 0,0 0,0 0,0

c) Baseline pupil size (optional). To account for physiological differences or changes in lightning, pupil sizes are often normalized. EMDAT offers several way to perform such normalization, one of them being based on baseline pupil sizes collected during the experiment. Baseline pupil sizes are typically collected by having the participants staring at a unicolor screen, so as to measure their pupil size when they are not visually nor mentally stimulated. Importantly, EMDAT can still perform normalization even without such baseline pupil sizes (as we will show in Section 3). Baseline pupil sizes are defined for all recordings in a tab-separated file, for each Scene defined in the Scene and Segment file for that recording. The format is:

recording_name<tab>baseline_size<tab>baseline_size<tab>…<newline>

The header of this file should be:

pid<tab>Scene_name<tab>Scene_name<tab>…<newline>

For instance:

Pid	Scene_aScene_b	
Rec_1	3	4
Rec_2	5	6

Note: This format might not be ideal for all settings and could be improved in later iteration of EMDAT.

4.1.3 INPUT FILE STRUCTURE

There is no required file structure on the HDD for the input files as the paths will be manually configured in the next section. As a general guideline the following structure can be used:

```
+---input_data
|       +---eyetracker_data_export
|       +---scenes_segments
|       +---aois
|       +---baseline_pupil_size
```

4.2 Configure EMDAT

EMDAT is meant to be integrated into data analysis flow via flexible and customizable scripting. To allow such integration EMDAT requires configuration of three files, as shown in Fig. 1.

4.2.1 PARAMS.PY

This file includes the main parameters used by EMDAT. All parameters come with default values, that can be changed as needed. The list of parameters is defined next.

Parameter	Description
Eye tracker type and path	
`EYELOGDATAFOLDER`	Path of the folder that has the files exported from Tobii Default is ./sampledata
`EXTERNALLOGDATAFOLDER`	the folder that has the external log files (*not supported anymore*)
`EYETRACKERTYPE`	The type of eye-tracker file format. Currently the supported type are “TobiiV2”, “TobiiV3”, and “SMI” (see Section 1)
Eye tracker specific parameters (depend on the EYETRACKERTYPE)	
`NUMBEROFEXTRAHEADERLINES`	**TobiiV2 only.** Number of extra metadata lines at the beginning of the files exported from Tobii Studio 2.x This is specific to the experiment and is based on the number of control variables defined in Tobii studio for the experiment (e.g., age, vision, etc.) and is recorded at the beginning of the files for each participant. Default is 8 (with the basic export)
`FIXATIONHEADERLINES`	**TobiiV2 only.** number of metadata lines at the beginning of the 'Fixation-Data' files exported from Tobii before the actual data. Default is 19 (with the basic export)
`ALLDATAHEADERLINES`	**TobiiV2 only.** number of metadata lines at the beginning of the 'All-Data' files exported from Tobii before the actual data. Default is 26 (with the basic export)
`EVENTSHEADERLINES`	**TobiiV2 only.** number of metadata lines at the beginning of the 'Event-Data' files exported from Tobii before the actual data. Default is 27 (with the basic export)
`EVENTS_FIRST_DATA_LINE`	**SMI only.** the line number of the first data row in Events file. Default is 22 (with the basic export)
`FIXATION_HEADER_LINE`	**SMI only.** the line number of the row that contains the table header for fixations. Default is 11 (with the basic export)
`SACCADE_HEADER_LINE`	**SMI only.** the line number of the row that contains the table header for fixations. Default is 14 (with the basic export)

USER_EVENT_HEADER_LINE	**SMI only.** the line number of the row that contains the table header for user events. Default is 20 (with the basic export)
RAW_HEADER_LINE	**SMI only.** the line number of the first data row in Raw file. Default is 1 (with the basic export)
MONOCULAR_EYE	**SMI only.** L or R for using left/right eye event when averaging both eyes measures is not possible. Default is "L"
Features generation parameters	
MEDIA_OFFSET	The (x,y) coordinates of the top left corner of the window showing the interface under study. This is to shift all gaze samples' coordinates accordingly, by subtracting the x_offset and Y_offset, which can be useful to define AOIs relatively to the study interface. (0,0) by default value, corresponding to no offsetting. This parameter is to be used with caution depending on the settings of the eye-tracker data collection tool (which can include its own offset).
featurelist	A list of non-AOI-based features to be generated. By default the list includes all features. To generate less features a subset of the list can be defined. All features are defined in Section 3. The full list is: ['numsegments','length','numsamples','numfixations','fixationrate','meanabspathangles', 'meanfixationduration','meanpathdistance','meanrelpathangles','stddevabspathangles', 'stddevfixationduration','stddevpathdistance','stddevrelpathangles', 'eyemovementvelocity', 'abspathanglesrate', 'relpathanglesrate', 'sumabspathangles','sumfixationduration','sumpathdistance','sumrelpathangles', 'blinknum', 'blinkdurationtotal', 'blinkdurationmean', 'blinkdurationstd', 'blinkdurationmin', 'blinkdurationmax', 'blinkrate', 'blinktimedistancemean', 'blinktimedistancestd', 'blinktimedistancemax', 'blinktimedistancemin', 'meanpupilsize', 'stddevpupilsize', 'maxpupilsize', 'minpupilsize', 'startpupilsize','endpupilsize',

	'meanpupilvelocity', 'stddevpupilvelocity', 'maxpupilvelocity', 'minpupilvelocity', 'meandistance', 'stddevdistance', 'maxdistance', 'mindistance', 'startdistance', 'enddistance', 'numsaccades', 'sumsaccadedistance', 'meansaccadedistance', 'stddevsaccadedistance', 'longestsaccadedistance', 'sumsaccadeduration','meansaccadeduration', 'stddevsaccadeduration', 'longestsaccadeduration', 'meansaccadespeed', 'stddevsaccadespeed','minsaccadespeed', 'maxsaccadespeed', 'fixationsaccadetimeratio', 'numevents', 'numleftclic', 'numrightclic', 'numdoubleclic', 'numkeypressed', 'leftclicrate', 'rightclicrate', 'doubleclicrate', 'keypressedrate', 'timetofirstleftclic', 'timetofirstrightclic', 'timetofirstdoubleclic', 'timetofirstkeypressed']
aoinames	list of the AOI names
aoisequencefeat	The list of AOI-sequence-based features, as defined in Section 3. Default is to generate all features: ['aoisequence']
aoigeneralfeat	A list of general AOI features, as defined in Section 3. Default is the full set of features: ['fixationrate','numfixations','totaltimespent','proportionnum', 'proportiontime','longestfixation', 'meanfixationduration', 'stddevfixationduration', 'timetofirstfixation','timetolastfixation', 'numevents', 'numleftclic', 'numrightclic', 'numdoubleclic', 'leftclicrate', 'rightclicrate', 'doubleclicrate', 'timetofirstleftclic', 'timetofirstrightclic', 'timetofirstdoubleclic', 'timetolastleftclic', 'timetolastrightclic', 'timetolastdoubleclic',

	'meanpupilsize', 'stddevpupilsize', 'maxpupilsize', 'minpupilsize', 'startpupilsize','endpupilsize', 'meanpupilvelocity', 'stddevpupilvelocity', 'maxpupilvelocity', 'minpupilvelocity', 'meandistance', 'stddevdistance', 'maxdistance', 'mindistance', 'startdistance', 'enddistance']
aoinames	List of all AOI-names, required for the next sets of features.
aoitransfrom	A list of frequency-based features for transitions between AOIs, as defined in Section 3. By default, it is populated automatically based on the aoinames.
aoiproportion	A list of proportion-based features for transitions between AOIs, as defined in Section 3. By default it is populated automatically based on the aoinames.
aoifeaturelist	The final list of all AOI-based features which is populated automatically based on aoigeneralfeat, aoitransfrom and aoiproportion, and aoinames.
blink_threshold	Lower and upper bound on size of invalid data gaps to be treated as blinks. Used to automatically compute blinks when they are not exported by the eye-tracker.
Data processing, restoration and validation	
VALIDITY_METHOD	EMDAT supports several methods to measure data quality within each segment and scene. Current values are: “1”: data quality is defined as the proportion of valid gaze samples as exported by the eye-tracker. This means validity is eye-tracker-dependent and is read as part of the eye-tracker input files (see Section 4.1). “2”: data quality is defined in a binary way in terms of maximum time gap allowable, with a time gap being define as a series of gaze samples with missing coordinates or labeled as invalid by the eye-tracker. “3”: data quality is defined as the proportion of valid gaze samples (including restored samples) as exported by the eye-tracker. Restored samples are samples that are labeled as invalid by the eye-tracker, but EMDAT could extrapolate its coordinates based on the fixation/saccade it likely falls into
VALID_PROP_THRESH	the minimum proportion of valid samples for a Segment or Scene to be considered valid. This is used for VALIDITY_METHOD 1 and 3. Scene and segment is validity lower than the threshold will be discarded by EMDAT Default is 0.8 (i.e., 80% of the gaze samples must be valid). A threshold of 0 means that no segment or scene are discarded.
VALID_TIME_THRESH	the maximum gap size allowable in samples for a Segment or Scene to be considered valid. The unit depend on the timestamp unit of the eye-tracker

	exported data. Most eye-trackers exports timestamp at the milliseconds levels, and the default maximum gap is set at 3000 ms (i.e., 3 seconds).
`MAX_SEG_TIMEGAP`	maximum gap size (ms) allowable in a segment with auto-partition option. Auto-partition is fully explained below in Section 4.2.3. Default is 1000 ms
`VALID_SAMPLES_PROP_SACCADE`	proportion of valid gaze samples required per saccade. This is currently used only by TobiiV3 EYE_TRACKRER_TYPE when estimating saccade path. If less than 1, missing gaze sample will be extrapolated. Default is 1, meaning that a saccade is valid only if all of its gaze samples are valid.
`MINSEGSIZE`	minimum segment length that is considered meaningful for this experiment. Shorter segments will be discarded. Default is 0 (no segment are discarded)
`INCLUDE_HALF_FIXATIONS`	A Boolean value determining if a fixation extends between two consecutive Segments, should it be included in those Segments or not. Default is False.
`PUPIL_ADJUSTMENT`	Pupil adjustment to minimize the pupil size differences among individual users, see Section 4.1. Currently supports 3 values: "None": no adjustement (default) "rpscenter": substraction of the baseline pupil size from the raw pupil size "PCPS": Normalization of pupil size based on the baseline pupil size following [Iqbal et al., 2005, doi>10.1145/1054972.1055016]
Developper mode	
`DEBUG`	If TRUE, all warnings are treated as errors and all exceptions are risen. The verbosity level is set to "VERBOSE" (see below)
`VERBOSE`	Amount of print statements in the console. Currently supports three values: "QUIET": prints nothing except errors and warnings "NORMAL": prints essential information (default) VERBOSE: prints information useful for debugging

4.2.2 BASICPARTICIPANTS.PY

This file is meant to initialize processing of the recording. In this file it is important to make sure that the file format are modified to fit the file structure and file name. Namely in *read_participants_Basic()*, the following variables must be checked and modified as needed: allfile, fixfile, sacfile, evefile, segfil, aoifile.

The sample Basicparticipant.py file in the repo includes code for each of the supported eye-trackers, for example for TobiiV3:

```
allfile = "{dir}/TobiiV3/P{rec}_Data_Export.tsv".format(dir=datadir, rec=rec)
fixfile = "{dir}/TobiiV3/P{rec}_Data_Export.tsv".format(dir=datadir, rec=rec)
sacfile = "{dir}/TobiiV3/P{rec}_Data_Export.tsv".format(dir=datadir, rec=rec)
```

```
evefile = "{dir}/TobiiV3/P{rec}_Data_Export.tsv".format(dir=datadir, rec=rec)
segfile = "{dir}/TobiiV3/TobiiV3_sample_{rec}.seg".format(dir=datadir, rec=rec)
aoifile = "{dir}/TobiiV3/TobiiV3_sample_{rec}.aoi".format(dir=datadir, rec=rec)
```

When applying EMDAT to a new dataset, it is best to simply duplicate the sample BasicParticipant.py, and modify the above variables. This is to allow supporting multiple datasets and even multiple ways to process the data from one dataset.

Note that there is a multiprocesses version of BasicParticipant in the repo (working for TobiiV2) that is meant to process the recordings in parallel. It works in the exact same way.

4.2.2 ENTRY POINT

The entry point needs to:

- Iterate over the recording
- Call the *read_participants_Basic()* function for each recording

The EMDAT repositery include several sample entry points named *testBasic*.py*. They can serve as examples.