This Document belongs to DECAF dataset documentations.

Dear user,

In this document we cover the description of the **pre-processed data**.

We assume the reader of this document has already read the paper well and hence we skip some of the details.

This document may be updated in future.

DECAF-PreProcessed

The **pre-processed data** of DECAF is shared via the "DECAF-PreProcessed" folder that includes the following items:

1- Movie, type: folder
2- Music, type: folder
3- MovieDataSegments-Face-Phys.zip, type: zip file
4- MusicDataSegments-Face-Phys.zip, type: zip file

Within the next sections we review the content of each of the 4 items.

Item 1: Movie (Folder)

This folder includes the output of the "Time-Frequency Analysis" step on the MEG data of each subject (30 subjects) for the movie video clips (36 clips). The analysis is done using the FieldTrip toolbox (http://www.fieldtriptoolbox.org/) in MATLAB and hence the folder contains 30 files with ".mat" extension corresponding to the 30 subjects.

The file name template for the 30 mat files is "Sub**##$$$V**_TFAnalysis.mat" where **##** is the subject-numeric-ID and ranges from 01 to 30 and **$$$** is a three-letters abbreviation subject-character-ID. **V** is a letter identifying that the file is related to "movie **v**ideo clips".

Sub##$$$V_TFAnalysis.mat:

The content of this file is the output of Time-Frequency Analysis step on the MEG signals following the DECAF article. The file contains one variable namely "**data_tf**" of the ***struct*** (MATLAB variable) type.

The fields of the data_tf are shows bellow:

```
data_tf
        label: {204x1 cell}
        dimord: 'rpt_chan_freq_time'
        freq: [1x45 double]
        time: {1x36 cell}
        powspctrm: {1x36 cell}
        cumtapcnt: [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]
```

grad: [1x1 struct]
cfg: [1x1 struct]

"**powspctrm**" is a 1x36 cell array that includes the power spectrum results for the 36 movie video clips. Since the movie video clips have varying lengths their corresponding output could not be arranged in a 4-dimensional matrix and instead the outputs are kept in 36 cells each containing a 3-dimensional matrix. Each cell corresponds to a clip in the same order as presented to user. The 3-dimensional matrix of each cell has a size of *204 x 45 x (L+5)* where 204 is the total number of channels (102 pairs of gradiometers and 102 magnetometers), 45 is the total number of frequency points (1Hz to 45 Hz) and L is the length of each movie video clip in seconds. The "5" is the length of the baseline (fixation period) in seconds.

data_tf.powspctrm{videoID} is a 204x45x(L+5) matrix, where videoID varies from 1 to 36

"label" includes the corresponding labels for the data of 102 pairs of gradiometer channels and 102 magnetometer channels in the "**powspctrm**" field.

"**freq**" specifies the corresponding frequency points for the data in the "**powspctrm**" field.

"**time**" is a 1x36 cell array that includes the time points of each corresponding video clip. Each cell is a 1x(L+5) vector where L is the length of the corresponding movie video clip and 5 is the length of the fixation period.

To know about other fields of the data_tf struct please read the documentations of the FieldTrip toolbox.

Important Hint: The cells are placed as the same order as the corresponding movie video clips were presented to the subjects. Please check the "*PermutationList"* variable in "*Dt_Order_Movie.mat*" file in the "*DECAF-CLS-Features.zip*" file to get access to the presentation order of the original clips.

Item 2: Music (Folder)

This folder includes the output of the "Time-Frequency Analysis" step on the MEG data of each subject (30 subjects) for the music video clips (40 clips). The analysis is done using the FieldTrip toolbox (http://www.fieldtriptoolbox.org/) in MATLAB and hence the folder contains 30 files with ".mat" extension corresponding to the 30 subjects.

The file name template for the 30 mat files is "Sub**##$$$M**_TFAnalysis.mat" where **##** is the subject-numeric-ID and ranges from 01 to 30 and **$$$** is a three-letters abbreviation subject-character-ID. **M** is a letter identifying that the file is related to "**m**usic video clips".

Sub##$$$M_TFAnalysis.mat:

The content of this file is the output of Time-Frequency Analysis step on the MEG signals following the DECAF article. The file contains one variable namely "**data_tf**" of the ***struct*** (MATLAB variable) type.

The fields of the data_tf are shows bellow:

data_tf
label: {204x1 cell}
dimord: 'rpt_chan_freq_time'
freq: [1x45 double]
time: [1x65 double]
powspctrm: [4-D double]
cumtapcnt: [40x45 double]
grad: [1x1 struct]
cfg: [1x1 struct]

"**powspctrm**" is a 4 dimensional matrix that includes the power spectrum results for the 40 music video clips. Since the music video clips have the same lengths (60 seconds) they could be arranged in a 4-dimensional matrix. The 4-dimensional matrix has the size of 40 x *204 x 45 x (60+5)* where 40 is the number of music video clips, 204 is the total number of channels (102 pairs of gradiometers and 102 magnetometers), 45 is the total number of frequency points (1Hz to 45 Hz) and 60 is the length of each music video clip in seconds. The "5" is the length of the baseline (fixation period) in seconds.

data_tf.powspctrm is a 40x204x45x(65) matrix

"label" includes the corresponding labels for the data of 102 pairs of gradiometer channels and 102 magnetometer channels in the "**powspctrm**" field.

"**freq**" specifies the corresponding frequency points for the data in the "**powspctrm**" field.

"**time**" is a 1x65 vector that includes the time points of any of the corresponding music video clip including the fixation period.

To know about other fields of the data_tf struct please read the documentations of the FieldTrip toolbox.

Important Hint: The 3 dimensional matrices corresponding to the 40 music video clips are concatenated to each other and form the 4 dimensional "data_tf.powspctrm". The 3-dimensional matrices are placed as the same order as the corresponding music video clips were presented to the subjects. Please check the "*PermutationList*" variable in "*Dt_Order_Music.mat*" file in the "*DECAF-CLS-Features.zip*" file to get access to the presentation order of the original clips.

Item 3: MovieDataSegments-Face-Phys.zip

Upon extracting the content of the "**MovieDataSegments-Face-Phys.zip**" file, you will get a folder namely "**MovieDataSegments**" which includes four sub-folders with the following names:

- **ECGData**: Includes the electrocardiography (ECG) signals of the subjects.
- **EMGData**: Includes the trapezius electromyography (tEMG) signals of the subjects.
- **EMOData**: Includes the facial tracks (EMO) of the subjects.
- **EOGData**: Includes the horizontal electrooculography (hEOG) signals of the subjects.

Each of the 4 folders has 30 sub-folders in correspondence to the 30 subjects. The template name of the folders is "**S##**" where S is stands for the word "**s**ubject" and **##** is the subject-numeric-ID and ranges from 01 to 30. Each **S##** includes 36 files corresponding to the 36 video clips and with the ".mat" extensions. The files can be loaded using Octave or MATLAB and includes vectors or matrices of the relevant digital signals.

Important Note: The clip-numeric-IDs that will be used in the description of this section are the original clip IDs. In other words, the files are already sorted according to "*PermutationList*" variable in "*Dt_Order_Movie.mat*" file in the "*DECAF-CLS-Features.zip*" file and do **not** follow the order in the actual presentation.

ECGData

The files under each **S##** folder has a template name of "**ECG_Clip##.mat**" where **##** is the clip-numeric-ID and ranges from 01 to 36. Each file includes the ECG digital signal via a variable, namely, "**ThsECG**" which is a vector of the size of 1xL, where L is the length of the ECG signal in milliseconds.

* The sampling rate of the signals is **1000Hz**.

* The current versions of the published pre-processed signals **do not** include the signal during the fixation period (5 seconds baseline).

* Some signals are distorted by remarkable amount of noise. For accurate heart beat detection in such sample, we recommend using the 0.1Hz-30Hz component of the tEMG signal.

* Please consider the "**Important Note**" explained above.

EMGData

The files under each **S##** folder has a template name of "**EMG_Clip##.mat**" where **##** is the clip-numeric-ID and ranges from 01 to 36. Each file includes the trapezius-EMG digital signal via a variable, namely, "**ThsEMG**" which is a vector of the size of 1xL, where L is the length of the tEMG signal in milliseconds.

* The sampling rate of the signals is **1000Hz**.

* The current versions of the published pre-processed signals **do not** include the signal during the fixation period (5 seconds baseline).

* Please consider the "**Important Note**" explained above.

EMOData

The files under each **S##** folder has a template name of "**EMO_Clip##.mat**" where **##** is the clip-numeric-ID and ranges from 01 to 36. Each file includes the output of the facial tracker and facial expression analysis via a variable, namely, "**ThsEMO**" which is a matrix of the size of *NF*x22, where *NF* is the number of frames in the corresponding facial video clip. The frame rate of the video streams is 20 fps and hence *NF* = 20 x L where L is the length of the video clip in seconds. The labels for the 22 columns of the **ThsEMO** are as follows:

01: Frame number	12: deformation of the right lid
02: vertical deformation of the upper lip	13: deformation of the left lid
03: vertical deformation of the lower lip	14: neutral state assuming a neutral frontal initial frame
04: horizontal deformation of the left lip corner	15: happy state assuming a neutral frontal initial frame
05: vertical deformation of left lip corner	16: surprised state assuming a neutral frontal initial frame
06: horizontal deformation of the right lip corner	17: angry state assuming a neutral frontal initial frame
07: vertical deformation of the right lip corner	18: disgusted state assuming a neutral frontal initial frame
08: deformation of the right eyebrow	19: fearful state assuming a neutral frontal initial frame
09: deformation of the left eyebrow	20: sad state assuming a neutral frontal initial frame
10: deformation of the right cheek	21: x dimension of the head pose
11: deformation of the left cheek	22: y dimension of the head pose

* Given the angle of the NIR camera during the facial recordings, the visible faces are under the impact of about 30 degrees of head pitch and hence the initial frames for the tracker are not frontal. Since the tracker assumes the initial frames are frontal view faces, the emotional state results provided by the tracker are not reliable and we do not recommend using the values in columns 14 to 20.

* Given the noise on the NIR channels, unfortunately the tracker failed on some facial videos. The failure rate of the tracker on facial videos in response to movie video clips and music video clips is 15.5% and 19% respectively. The state of failure can be determined from the matrix entries. In case facial analysis is critical in your research on DECAF, we recommend using another method for facial tracking on the video clips instead of using the currently provided facial tracks.

* We will provide the results of other available trackers in soon future.

* Please consider the "**Important Note**" explained above.

EOGData

The files under each **S##** folder has a template name of "**EOG_Clip##.mat**" where **##** is the clip-numeric-ID and ranges from 01 to 36. Each file includes the horizontal EOG digital signal via a variable, namely, "**ThsEOG**" which is a vector of the size of 1xL, where L is the length of the hEOG signal in milliseconds.

The sampling rate of the signals is 1000Hz.

* Please consider the "**Important Note**" explained above.

* The sampling rate of the signal is **1000Hz**.

* The current versions of the published pre-processed signals **do not** include the signal during the fixation period (5 seconds baseline).

Item 4: MusicDataSegments-Face-Phys.zip

Upon extracting the content of the "**MusicDataSegments-Face-Phys.zip**" file, you will get a folder namely "**MusicDataSegments**" which includes four sub-folders similar to **Item 3.**

The description provided in Section "Item 3: MovieDataSegments-Face-Phys.zip" holds for this section.

Please note that:

1. Clip-numeric-ID ranges from 01 to 40
2. The length of all the music video clips is 60 seconds