Function Documentation
LabScripts
MATLAB

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V2.0

Contents

Plotting_And_Statistics

RMANOVA (v1.1)

This function will carry out a repeated measures ANOVA on a table of data.

Required Inputs	Description
Data	Data must be a {nSubjects x nVariable} table.
FactorNames	A cell containing the names of each of the factors. For example, factors of {'GENDER' 'AGE'}.
FactorLevels	A cell, the same length as 'FactorNames', but containing the levels for each of the factors. For example, factors of 'GENDER' and 'AGE' would contain: {{'MALE'; 'FEMALE'} {'A18-24'; 'A25-30'; 'A30PLUS'}}
LevelIndices	A cell, the same length as 'FactorNames', indicating the factor and level that each variable in 'Data' belongs to.

Optional Inputs	Description
SaveOutput	Name of file to save data to (.txt format). (DEFAULT: [])

Outputs	Description
ANOVATable	A table containing the main effects and interactions between all factors.

postHocTesting_fullAnalysis (v1.2)

Carries out statistics using the EEGLab statcond function. This function takes a cell array of data and carries out (permutation-based) ANOVAs and all possible post-hoc tests.

Required Inputs	Description
statData	This is a cell array of data in the same format that is required by the statCond function.

Optional Inputs	Description
Permutation	Whether to carry out permutation analysis, or just regular ANOVA / T-Tests. (DEFAULT: 1)
nPerm	Number of permutation for "Permutation". (DEFAULT: 5000)
RowCondition	Name of conditions in each row. (DEFAULT: {'R01 'R02' ... 'RXX'})
ColCondition	Name of conditions in each column. (DEFAULT: {'C01 'C02' ... 'CXX'})
IndividualLEvels	Cell array of condition names corresponding to the size of statData. (DEFAULT: {'R01C01' 'R01C02' ... 'RXXCXX'})
ANOVATitle	Title of ANOVA. (DEFAULT: 'ANOVA Results')
PrintToFile	File ID if printing to file. (DEFAULT: [])
PlotData	Plot the data into bar graph. (DEFAULT: 1)
PlotData_Effect	What effect to plot (1 = ROW; 2 = COL; 3 = INT). (DEFAULT: 3)
PlotData_LineType	Whether to plot 'SE' or 'SD'. (DEFAULT: 'SE')
CILineWidth	Width of confidence interval line. (DEFAULT: 3).
CIOneWay	Whether to plot confidence intervals in both directions, or just in the direction of the data. (DEFAULT: 1)

Outputs	Description
postHocStruct	Structure containing information regarding ANOVA and post-hoc T-Tests.
figHandle	Handle for plotting data.

createRectangleCoords (v1.0)

Given an origin, width and height, this will produce the coordinates for the resulting rectangle.

Required Inputs	Description
origin	Rectangle origin.
w	Rectangle width.
h	Rectangle height.
Optional Inputs	**Description**
Outputs	**Description**
coords	Four points for rectangle corners.

createSurfaceCube (v1.0)

Given an origin and size of the vertices of the cube, this will compute coordinates across the surface of the cube.

Required Inputs	Description
centre	Cube origin.
size	Cube vertices size.
distBetweenPoints	Distance between each point on surface.
Optional Inputs	**Description**
Outputs	**Description**
coordsSurface	Coordinates of points across cube surface.

removeImageEmptySpace (v1.0)

Takes a MATLAB variable containing an image in RGB form and removes empty space surrounding the image. This is quite computationally demanding, but it helps quite a lot when visualising images in figures.

Required Inputs	Description
imageVar	RGB image (see 'imread').
Optional Inputs	**Description**
Outputs	**Description**

imageVarNew	RGB image with no empty space around edges.

expandPolygon (v1.1)

This will expand a polygon by a given factor whilst maintaining the centre point.

Required Inputs	Description
x	X Coordinates for the polygon to be expanded.
y	Y Coordinates for the polygon to be expanded.
factor	The factor by which to expand the polygon (where 1 = same size).
Optional Inputs	**Description**
Outputs	**Description**
Xexp	Expanded X Coordinates.
Yexp	Expanded Y Coordinates.

linearRegression (v1.0)

Carries out linear regression with a single predictor.

Required Inputs	Description
response	Response variable.
predictor	Predictor variable.
Optional Inputs	**Description**
Outputs	**Description**
R	R value for regression.
Rsq	R squared value for regression.

polygonOverlapList (v1.0)

This will return an index of overlapping polygons. For example, given a list of coordinates (CELL), will sequentially compare coordinates with one another and return all overlapping polygons. Requires Mapping Toolbox.

Required Inputs	Description
X	Cell containing list of X coordinates.
Y	Cell containing list of Y coordinates.
Optional Inputs	**Description**
drawPlot	Draw the polygons. (DEFAULT: [])
Outputs	**Description**

Overlap	Indices indicating the location of any two overlapping polygons.

scatterLSLine3D (v1.0)

Plot scatter plot in 3D with least-squares line.

Required Inputs	Description
XYZ	[X Y Z] data to plot.

Optional Inputs	Description
Colour	Line and marker colour.
MarkerSize	Marker size.

Outputs	Description
figHandle	Figure handle.

minimiseFigWhiteSpace (v1.0)

Minimise the white space on the current axis for saving.

Required Inputs	Description

Optional Inputs	Description

Outputs	Description

butterflyPlotFunction (v1.0)

Plot scatter plot in 3D with least-squares line.

Required Inputs	Description
data	Electrode x Time data.
electrode	Number of electrodes. This is merely to ensure the correct dimensions are plotted.
baseline	When baseline period starts, e.g. [-200].

Optional Inputs	Description

Outputs	Description

CohensD (v1.0)

Calculate Cohen's D measure of effect size giving the data from two groups.

Required Inputs	Description
group1	Nx1 array for group 1.
group2	Nx1 array for group 2.
Optional Inputs	**Description**
Outputs	**Description**
d	Cohen's D.

Data_Config

stimuliRandomisation (v1.0)

Will randomise stimuli. Can take a table, character or numeric array as input. You can also define a seed number if you want to control the random number generator to produce predictable random sequences, or shuffle the random number generator to get different sequences each time.

Some versions of MATLAB do not contain the "randperm" function that this script depends on, so it will only work on newer versions.

Required Inputs	Description
stimList	An array (table, numeric, character).

Optional Inputs	Description
seed	What seed to use for the random number generator. If you need predictable sequences each time this script is used, then input the same seed number. If different sequences are needed, use the "shuffle" parameter. (DEFAULT: 'shuffle')

Outputs	Description
stimListRand	The randomised stimList.
originalIndex	The randomly generated array used for randomisation.

findArrayClusters (v1.0)

Will take an array of N length and will extract clusters of values that overlap by a pre-defined amount.

Required Inputs	Description
data	Data array.
overlap	Allowed overlap to be included in cluster.
minSize	Minimum number of data points in cluster.

Optional Inputs	Description

Outputs	Description
clusters	Clusters of data.

findPeaks (v1.0)

Will find peaks within a given array of Nx1 / 1xN. NOTE THAT NO LOGIC IS GIVEN FOR WHAT SHOULD HAPPEN WHEN A PEAK IS EQUAL FOR TWO CONSECUTIVE TIME POINTS (YET).

Required Inputs	Description
data	Nx1 or 1xN array of data.

overlap	The script will find peaks and if multiple peaks are found within the latency (Peak Latency +/- overlap), it will find the largest peak and remove the others.
threshold	This will only find peaks that occur above a certain percentage of maximum power. Since the data is normalised between 0 and 1 within this script, the threshold should be between 0 and 1.
norm	Whether to normalise data first between 0 and 1.

Optional Inputs	Description

Outputs	Description
peakLatencies	The latencies at which the data peaks given a certain overlap and threshold.

nDigitString (v1.1)

Converts a number to a character array of letters with leading zeros to equalise character length. For example, can convert the number 90 to a character array of "0090", or 127 to "0127". Does not work with negative numbers.

Required Inputs	Description
iteration	Number to convert.
lengthOfString	Length of string to produce. Can also be an array of 1xN / Nx1.

Optional Inputs	Description

Outputs	Description
string	String of lengthOfString length.

linearInterp_1D (v1.0)

Will take an array of N length and resize it to a length of finalSize. This is done by 1D interpolation.

Required Inputs	Description
data	Array of N length.
finalSize	Final length of array.

Optional Inputs	Description

Outputs	Description
interpData	Interpolated data.

nanUnique (v1.0)

Extract unique numbers in an array that has NaN values. The MATLAB built-in function 'unique' will return the number of instances that NaN was found.

Required Inputs	Description

	Data array.
x	Data array.

Optional Inputs	Description

Outputs	Description

y	Unique values.

normaliseData (v1.0)

Normalise an array between X and Y.

Required Inputs	Description
data	Data array.
x	Lower bound.
y	Upper bound.

Optional Inputs	Description

Outputs	Description
normalised	Normalised data.

Pix2VisualAngle (v1.1)

Given the start and end point of two gaze positions, this function calculates the degrees of visual angle between the two points, and the direction in terms of angle.

Optionally, you can input the size of the monitor and the resolution. This will mean you can accurately calculate the size of a single pixel. This will be assumed to be 0.0264583333 if these values are not given.

Required Inputs	Description
start	Start point of gaze [x y]. Can be a list of points.
finish	End point of gaze [x y]. Can be a list of points.
viewingDistance	Distance from monitor.

Optional Inputs	Description
Plot	Plot the start and end point. (DEFAULT: 0)
Resolution	Screen resolution. (DEFAULT: [])
MonitorSize	Screen size. (DEFAULT: [])

Outputs	Description
amplitude	Visual degrees between two points.
direction	Direction between two points.

roundTo (v1.0)

Round to the nearest defined amount. For example, round to nearest 0.25. Also has the ability to round up or down with optional argument input.

Required Inputs	Description
val	Value to round.
increment	Increment to round to.

Optional Inputs	Description
Direction	'up' > Round up to increment. 'down' > Round down to increment. 'nearest' > Round to nearest increment.

Outputs	Description
newVal	Rounded value.

auctionSplit (v2.0)

This will take an Nx2 array with the first column containing indices of values, and the second column indicating values we want to organise into different categories. This function will organise the values into separate categories, with or without overlap, and of equal or unequal size.

Required Inputs	Description
values	Values that we want to split.
nSplit	Number of split categories.
nStim	Number of values in 'values'. This is merely confirmatory and not strictly necessary for the script.
overlap	Whether overlap is permitted between categories.
equalSize	Whether category sizes should be equalised.

Optional Inputs	Description
saveFile	File name that data should be saved under. If this file already exists, it will load up the values instead. (DEFAULT: [])
secondOrderParameter	Since overlap with many categories and no overlap can reduce the number of values massively, you can introduce a second parameter to order variables on to increase number of values extracted. (DEFAULT: [])

Outputs	Description
splitValues	Values, but split into the appropriate number of categories.

EEG

clusterCovar (v1.5)

Carries out regression analysis over a specified time interval for clustered independent components. Since multiple components can be contributed by a single subject, components from the same subject are first merged (via summation). This function accepts multiple predictors and utilises the fitlm() function.

The function outputs the data into a variable, as well as plots the data across the latency interval with corresponding Adjusted R^2 Values and P-Values. Note that these values are taken from the highest order of predictors. For example, inputting 3 predictors will produce the following formula:

y ~ x1 + x2 + x3 + x1:x2 + x1:x3 + x2:x3 + x1:x2:x3

In this scenario, we will plot data in relation to "x1:x2:x3".

Required Inputs	Description
STUDY	EEGLab STUDY structure containing clustered data.
ALLEEG	EEGLab ALLEEG structure.
behaviouralData	ehavioural data. This must be in the format of a {1 x nPredictor} cell array of tables, each table being a {nSub x nCond} array. The titles of the tables must correspond to variables within the STUDY.condition variable.
clusters	

Optional Inputs	Description
Latency	Latency over which to carry out regression. (DEFAULT: [])
AverageConditions	Names of conditions in which you may want to average across. This should be a {1 x nAverage} cell array, with each column containing its own cell array of variable names. These variable names must correspond to names in the behaviouralData and the STUDY.condition variable. (DEFAULT: [])
Regression	Whether to carry out regression or correlation. (DEFAULT: 1)
AverageOverLatency	Whether you want to average over the latency input. (DEFAULT: 0)
FDR	False-discovery rate correction (BHFDR). (DEFAULT: 0)
PredictorNames	Name of predictor variables. (DEFAULT: {})
ResponseName	Name of response variable. (DEFAULT: {})
ForceStudyCond	Force the STUDY.condition variable to be identical to the behaviouralData condition names as indicated by the behaviouralData table VariableNames. USE THIS WITH CAUTION, THIS ASSUMES THAT THE ORDER OF THE VARIABLES IN THE BEHAVIOURAL DATA TABLE CORRESPOND PERFECTLY TO THE STUDY CONDITIONS IN TERMS OF ORDERING. (DEFAULT: 0)
PValYAxis	The range of P-Values to visualize when plotting P-Values over latencies. (DEFAULT: 0.05)
PlotSave	Directory to save each plot to. (DEFAULT: [])
StandardizeData	Standardize data to z-scores. (DEFAULT: 0)
ExtractCovariateData	Whether to extract the covariate data only for analysis elsewhere. This will organise the data into columns representing either the covariate or the dependent variable for each level of the independent variable. (DEFAULT: 0)

Outputs	Description

OUTPUT	Data extracted from each of the regression analyses taken place, along with the corresponding predictor and response data. The full linear model for each analysis is included.

extractEpochNumberInSets (v1.0)

This function will take a directory that has a list of folders, each corresponding to a subject. Each folder should contain a number of set files corresponding to several conditions. It will load up the set files, and extract the number of epochs each set file contains and return a table.

If you also have other variables encoded for each event within the EEG.event structure, you can extract the mean of these variables for each set file.

If you have several events for each trial, and want to extract the mean of a across trials and not just across all epochs, this function can also extract a single value for each trial if the column indicating trial number is given.

Required Inputs	Description
folder	Folder containing several directories corresponding to subjects.

Optional Inputs	Description
TrialNumColumn	Name of column that indicates trial number. (DEFAULT: [])
Conditions	Name of conditions in set files. (DEFAULT: [])
TrialAverage	Name of columns that we want to obtain a trial average of. (DEFAULT: [])
TrialAverage_ConditionAverage	Cell array, corresponding to the number of variables in the "TrialAverage", with each cell array containing a cell array indicating what condition indices to average over. For example, {{[1 2] [3] [4]} {[1] [2] [3] [4]}}. (DEFAULT: []).
AllEventAverage	Name of columns that we want to obtain an epoch average of. (DEFAULT: [])
AllEventAverage_ConditionAverage	Cell array, corresponding to the number of variables in the "AllEventAverage", with each cell array containing a cell array indicating what condition indices to average over. For example, {{[1 2] [3] [4]} {[1] [2] [3] [4]}}. (DEFAULT: []).
SaveAndClose	Whether we want to save the plots to a folder and then close them, or just keep them open. Must be a directory. (DEFAULT: [])
PlotERP	Whether we want to plot the ERP for each condition. (DEFAULT: 1)
PlotEpoch	Epoch to plot. (DEFAULT: 1:size(EEG.data,2))
PlotConditions	Whether to plot conditions for ERPs or just the grand average. (DEFAULT: 0).
ERPDataSave	Where we want to save ERP data. (DEFAULT: [])
EpochInformationSave	Where we want to save Epoch Info. (DEFAULT: [])
ERPOnly	Plot ERP Only. (DEFAULT: 0)
PlotElectrodes	Plot specific electrodes. (DEFAULT: [])
ExtractMasterFileOnly	Extract one file only. (DEFAULT: 0)
EpochDataType	Event types to epoch. (DEFAULT: [])
EpochDataEpoch	Event epoch. (DEFAULT: [])
EpochDataBaseline	Event epoch baseline. (DEFAULT: [])
ConditionColumn	What column to use to extract conditions. (DEFAULT: [])

Outputs	Description

epochN	Table indicating number of epochs in each condition.
trialN	Table indicating number of trials in each condition.
trialAverage	Trial average means.
eventAverage	Event average means.
ERPData	ERP Data.

combineEvt (v1.0)

Will combine at least two event files into a single .evt file. Event files must be .evt format exported from BESA, or at least in the same format.

Required Inputs	Description
saveLoc	Save file for combined event file.

Optional Inputs	Description
varargin	Will take any number of input arguments listing filenames of event files that you wish to combine.

Outputs	Description

createEvtFormat (v1.0)

Create a variable with the same format of .evt file.

Required Inputs	Description
timeStamps	Time of events.
code	Code column (usually 1).
tiggers	Triggers corresponding to events.
multiply	Whether to multiply the timestamps by 1,000,000 to return the values from seconds to microseconds that BESA produces.

Optional Inputs	Description

Outputs	Description
E	Event variable.

evtTriggerExtract (v1.0)

This will extract a single trigger from a .EVT file. It will read the event file and extract all triggers defined by 'trigger', and then extract the trigger(s) from that list defined by 'index'.

Required Inputs	Description
evtFile	BESA Event File (.evt) from which to extract event(s).
trigger	List of doubles indicating ID number of trigger to extract from event file.
index	When multiple events with same trigger ID are present, index refers to what trigger should be extracted, e.g. 1 = first trigger N,

	'end' = last event in list of events, 'all' will return all events matching the triggers.

Optional Inputs	Description
ExtractDIN	Whether to extract the DIN line, rather than the exported trigger. Likely to cause a crash with BESA versions prior to 6.1. (DEFAULT: 0)

Outputs	Description
TS	A list of timestamps for the events that match 'trigger' and 'index'.
CODE	A list of codes for the events that match 'trigger' and 'index'.
TD	A list of trigger IDs for the events that match 'trigger' and 'index'.

extractEpochEvents (v1.0)

When working with epoched data, the EEG.event structure contains multiple repeats of events, since it repeats events that occur repeatedly across multiple epochs.

Required Inputs	Description
EEG	EEG data structure from EEGLab (Must be epoched).

Optional Inputs	Description

Outputs	Description
events	Indices of events that correspond to each epoch.

importEventsToEEGLab (v1.0)

Will import .evt file into EEG.event structure. BESA .evt files are in microseconds, whereas EEGLab takes milliseconds, so it will divide the timestamps by 1000. This function can also encode a value for each event that corresponds to that event. For example, if fixations are encoded, then the saccade amplitude can be encoded into a column in the EEG.event structure. This data needs to be an array in MATLAB and be the same size as the .evt file.

Required Inputs	Description
EEG	EEG data structure from EEG Lab.
evtFile	Event file containing events.

Optional Inputs	Description
Include	Trigger numbers to include.
Exclude	Trigger numbers to exclude.
TriggerInfo	Nested cells containing trigger number and the subsequent variable names for the EEG.event structure. (DEFAULT: []). Example: {{12,'type','fixation','TrialType','Small'} ... {22,'type','fixation','TrialType','Large'}};
{RegressorName,RegressorData}	Any other regressors to input as separate column can be input. To do so, name the column with the parameter and the

	subsequent variable should be the same size as the events file.
Outputs	**Description**
EEG	EEG data structure from EEG Lab.

inputMissingEvent (v1.0)

Will input a single event into a .evt file. The event must be in microseconds, for example, 1 second = 1,000,000. This is since .evt files default to microseconds.

Required Inputs	**Description**
evtFile	Event file to input event.
latency	Latency of event
condition	Trigger number for event.
Optional Inputs	**Description**
Outputs	**Description**

mergeDatasetsInFolders (v1.0)

This will take a directory with N folders in it. Each of these folders should correspond to a subject, with each subject folder containing a set file for each condition. This will iterate through each folder and merge the set files into new set files depending on the input. This is good if you want to create set files that are merged across conditions.

Required Inputs	**Description**
folder	Folder containing subject folders.
fileAppendice	Cell array containing a cell array for each new condition, containing the names of the set files that we wish to merge.
fileAppendiceNew	Cell array of conditions corresponding to the length of filleAppendice, indicating the names of the new conditions.
saveDir	Directory in which new set files will be saved. A new folder for each subject will be made. If this is the same as the folder input, it will save them in the same folder.
Optional Inputs	**Description**
Outputs	**Description**

mergeSubjectComponents (v1.0)

Clustered data can contain multiple components from the same subject. However, in order to do statistics, we need to merge the components from the same subject in a cluster. In line with the EEGLab manual, all components from the same subject will be summated to produce a single component for each cluster, although this technically isn't an IC anymore.

Required Inputs	**Description**

STUDY	EEGLab STUDY data structure with clustered data.
ALLEEG	EEGLab ALLEEG data structure.
cluster	Cluster for which we want to merge components.
Optional Inputs	**Description**
Outputs	**Description**
data	Merged data for desired cluster.
STUDY	EEGLab STUDY data structure.
ALLEEG	EEGLab ALLEEG data structure.

MNIPointLoc (v1.0)

This will take an MNI coordinate (XYZ) and return the region that it most likely bekongs to. This uses an online database and function 'cuixuFindStructure' produced Xu Cui (2007). This function can return the nearest Brodmann area, or nearest GrayMatter, or all regions within a specified cube of NxNxN mm.

Required Inputs	**Description**
MNI	MNI coordinate to identify (XYZ).
Optional Inputs	**Description**
DBFile	The path the the 'TDdatabase.mat' file. Will default to the current dir (DEFAULT: [])
CubeSpace	Whether to extract a cube of regions. (DEFAULT: 0)
CubeSpaceSize	Size of cube (mm). (DEFAULT: 5)
CubeSpaceDist	Distance between points. (DEFAULT: 0.2)
NearestGrayMatter	Whether to extract nearest gray matter. (DEFAULT: 0)
NearestBrodmann	Whether to extract nearest Brodmann area. (DEFAULT: 0)
Search_SizeIteration	When searching through regions for either the nearest Brodmann or Gray Matter, this defines how much to extend the search area by on each iteration. Note that, in order to save computing time, a cube will be created of coordinates and only the surface coordinates will be localised. Each iteration, the cube will increase in size. (DEFAULT: 1)
Search_Dist	Distance between coordinates when searching. (DEFAULT: 0.2)
Search_StopThreshold	Size of cube when we should stop searching. (DEFAULT: 20)
Outputs	**Description**
COORDSPACE	Structure with information on source localisation.
sourceError	Whether an error was found during search.

plotElectrodes (v1.0)

Will plot specified electrode numbers on a topographic map using the 'topoplot' function.

Required Inputs	Description
electrodeNumbers	Numbers of the electrodes to plot on the scalp map.

Optional Inputs	Description
electrodeParam	Parameters that define the appearance of the electrode markers. This paramater takes the numbers of the electrodes (electrodeNumbers), the shape (e.g., s = square), the colour of the markers and the size. (DEFAULT: {electrodeNumbers,'s','red',50}).
electrodeLocations	Electrode locations variable. Importing an electrode location file into EEGLab will give you the variable that you require. However, I put this as an optional input since the "rloc128.m" function produces the same variable for "egihydrocel_129" electrode locations file. (DEFAULT: rloc128)
markerSize	Size of the marker in the plot.

Outputs	Description

plotSigElectrodesOverTime (v1.0)

This will take a [nCond x nSub x nElectrodes x nTimePoints] array and plot significant differences between conditions over time. You can either investigate all differences over the time course, or can specify a latency to investigate differences. You can also average across a specified latency, and save the plots to file.

At the moment, this will likely not work if:
      1) Data not sampled at 1000 Hz.
      2) Any of the parameters nElec, nTime, nSub, nCond are equal.
      3) Electrode locations are different to that of the EGI_HYDROCEL_129.

Required Inputs	Description
Data	Data to plot.
nElec	How many electrodes.
nTime	How many timepoints.
nSub	How many subjects.
nCond	How many conditions.
startLat	When the baseline interval begins.
latencyAverage	How many time points do we include in a single time bin.

Optional Inputs	Description
topoPerFig	How many topographic maps to include in each figure. (DEFAULT: 20)
startPlotLatency	Start point to begin plotting. (DEFAULT: [])
endPlotLatency	End point to begin plotting. (DEFAULT: [])
savePlots	Directory to save plots in. (DEFAULT: [])
sigPVals	When plotting significant differences across the scalp, markers will increase in size for increasingly significant differences. This

	parameter defines the three P-Values that indicate marker size. (DEFAULT: [0.05 0.01 0.001])
oneMap	Whether to plot single map over specified latency. (DEFAULT: [])
oneMapConds	If plotting oneMap, then the conditions will need to be named, corresponding to the order within the data input. (DEFAULT: [])
Outputs	**Description**

plotHydrocel129 (v1.0)

Plots the EGI 129 channel hydrocel sensor net with labels.

Required Inputs	**Description**
Optional Inputs	**Description**
Outputs	**Description**

readEvt_6_1 (v1.0)

Read .evt file exported from BESA. This works with BESA 6.1, since this BESA version produces a 4th column (DIN).

Author: Andrej Stancak

Required Inputs	**Description**
Ename	Event file name.
Optional Inputs	**Description**
Outputs	**Description**
E	Matlab array of events.

removeEvtAtf (v1.2)

Takes an .evt file containing a list of events and recodes event triggers as "999" if it overlaps with the latency of any of the artefacts given in a second event file. This overlap is dependent on the epoch which is given in the format [-100 399], i.e. milliseconds.

Required Inputs	**Description**
evt	Event file containing events to be recoded.
evtAtf	Event file containing artefact latencies. Artefact onset and offset must have codes of [21 22] respectively.
epoch	The epoch of the event. If the artefact occurs within the epoch of an event, it is excluded.
Optional Inputs	**Description**
saveLoc	Save location. If not given, the new .evt file will be put into same location as "evt".

artiMult	Whether to multiply the original trigger by artiMult, or whether to simply recode as 999. (DEFAULT: [])
resampleArtefactLatencies	Whether to resample the artefact latencies into samples rather than ms. This is useful for data that has been resampled. This must be a cell containing the original sampling rate and the new sampling rate. For example, {'Original' 1000 'New' 256}. (DEFAULT: {})
resampleEventLatencies	Whether to resample the event latencies into samples rather than ms. This is useful for data that has been resampled. This must be a cell containing the original sampling rate and the new sampling rate. For example, {'Original' 1000 'New' 256}. (DEFAULT: {})
Outputs	**Description**
finalSaveLoc	Final save location of event file.

rloc128 (v1.0)

Will load up the .sfp and .elp for egi_hydrocel_129 sensor net and produce a channel locations variable.

Author: Andrej Stancak

Required Inputs	**Description**
Optional Inputs	**Description**
elpFile	Location of .elp file.
sfpFIle	Location of .sfp file.
Outputs	**Description**
elpFile	Electrode locations variable.

saveEvt_6_1 (v1.0)

Will save a matrix of values to a .evt file. Matrix must be in .evt format already.

Author: Andrej Stancak

Required Inputs	**Description**
events	Contains a matrix matching the .evt format to be saved.
saveLoc	The location where new event file is to be saved.
Optional Inputs	**Description**
Outputs	**Description**

sigElectrodes (v1.0)

Given an array of P-Values corresponding to electrodes, this will plot the significant P-Values and increase the size of the marker based on the sigSizes input.

Required Inputs	Description
E	Electrode locations file. If empty, this defaults to rloc128.
plotData	An Nx1 array (N = number of electrodes) of P values showing significance at specific electrodes.
sigSizes	P-Values indicating what P-Values will have different size markers, e.g. [0.05 0.01 0.001].

Optional Inputs	Description

Outputs	Description

STUDY_subjectClusters (v1.0)

This will extract the subjects that belong to each cluster in a STUDY design. Data must have been clustered.

Required Inputs	Description
STUDY	EEGLab STUDY data structure.
clusters	Cluster(s) that you want to extract the subjects.

Optional Inputs	Description

Outputs	Description
subjectCluster	Subjects that belong to each cluster.

BaselineCorrect (v1.0)

Baseline correct EEG data.

Required Inputs	Description
Data	EEG epoch to be baseline corrected.
nChan	Number of EEG channels, purely to orientate the data.
TimeCourse	The timecourse of the epoch, e.g. -300:999.
Baseline	Baseline period, e.g. -300:-200.

Optional Inputs	Description

Outputs	Description
NewData	Baseline corrected data.

ERPGif (v1.0)

Will generate a GIF of an ERP across the scalp.

Required Inputs	Description
data	nElec x TimeCourse EEG data.
nElec	Number of electrodes, purely for orientation.
saveName	Name of GIF to save.
ELoc	Electrode locations variable.
Optional Inputs	**Description**
Intervals	Intervals to plot the scalp maps at. (DEFAULT: 1)
FPS	Frames per second for GIF. (DEFAULT: 10)
Baseline	Baseline in ms, e.g. -300. (DEFAULT: 0)
Title	Title to place over GIF. (DEFAULT: 'Electrode Data')
PlotRange	Range to plot data. (DEFAULT: [] i.e. all data)
GridScale	Grid scale for the sclap map. (DEFAULT: 64)
Outputs	**Description**

readEvt_7_0 (v1.0)

Read .evt file exported from BESA. This works with BESA 7.0, since this BESA version produces a 4th column, but in contrast to 6.1, this column includes sporadic comments.

Required Inputs	Description
Ename	Event file name.
Optional Inputs	**Description**
Outputs	**Description**
E	Matlab array of events.

STUDY_BackProject (v1.0)

Back projectes IC clusters onto the scalp. There are two ways to do this, depending on how the data has been analysed will depend on what you are able to do:

1) Automatic Back Projection - If you do not exclude dipoles based on residual variance, then the resulting clusters will comprise all ICs across all subjects. Hence, you can use the STUDY 'Remove Artifactual Clusters' protocol to remove all the clusters, including the outlier cluster, besides the cluster you are interested in from the channel ERP data. This will leave you with scalp level data for the cluster.

2)   Manual Back Projection - If dipoles were removed due to residual variance exclusion, then the resulting clusters will only be comprised of the ICs that passed the residual variance threshold. Hence, even if you removed all ICs from the scalp level data that comprised the clusters, then you would still have scalp level data that included IC data from the dipoles that did not pass the residual variance threshold. Therefore, this script will make a note of the components that are included in each cluster and load up the

original set file, make a copy, and remove all components that were not contributing to each cluster. This will only do this for the subjects that contributed ICs, since not all subjects contribute ICs to a cluster.

Required Inputs	Description
STUDY	EEGLab STUDY structure.
ALLEEG	EEGLab ALLEEG structure.
Clusters	Clusters to back-project.
Optional Inputs	**Description**
ResaveStudy	Whether to resave STUDY in event of AutomaticBackProjection. (DEFAULT: 1)
ManualBackProjection	Whether to force ManualBackProjection. (DEFAULT: 0)
ManualBackProjection_Folder	Folder to save data regarding ManualBackProjection. (DEFAULT: [])
Outputs	**Description**
STUDY	EEGLab STUDY structure.
currentPlotDataSGA	Super grand average electrode data.
currentPlotDataGFP	Super grand average GFP.
CLS_DATA_ERP	All data for all conditions, subjects & clusters.

STUDY_ExtractClusterICs (v1.0)

Extract the independent components that belong to each cluster.

Required Inputs	Description
STUDY	EEGLab STUDY structure.
Clusters	Cluster(s) to extract independent components.
Optional Inputs	**Description**
Outputs	**Description**
CLS_DATA_IC	Cluster ICs.

Cogent

vasScale (v2.4)

Draw VAS in Cogent. Has ability to draw multiple scales in single call with varying orientations, as well as draw images to screen.

Required Inputs	Description
origin	Origin of centres of scale. e.g. [0 300; 0 -300]
w	Width of scales in pixels. e.g. [500 300]
h	Height of scales in pixels. e.g. [50 50]
Anchor	Anchors for scales. e.g. { {'0' '100'} {'None' 'All'} }

Optional Inputs	Description
orientation	Orientation of the scale. ("horizontal" or "vertical"; DEFAULT: "horizontal")
type	Whether you can drag the scale or only single clicks are registered. ("single", "continuous" or "box"; DEFAULT: "single")
scaleColour	Colour of the scale background. (DEFAULT: [1 1 1])
fillColour	Colour of scale fill. (DEFAULT: [1 0 0])
frontSize	Font size of anchors. (DEFAULT: 48)
incrementLines	Number of increment lines per scale. (DEFAULT: [0; 0; 0; ...])
incrementSize	Length of increment lines. (DEFAULT: 25)
incrementColour	Colour of increment lines. (DEFAULT: [scaleColour])
incrementWidth	Thickness of increment lines. (DEFAULT: 1)
textColour	Colour of anchors. (DEFAULT: [1 1 1])
clickRegister	Where to register clicking ("box" or "increment"; DEFAULT: "box") Current bug known for "increment" parameter wherein the scale will be highlighted beyond the scale box, but only if increment lock is off.
drawOnly	Whether to draw scales only and present, or to draw scales and allow selection. (1 or 0; DEFAULT: 0)
incrementLock	Whether to lock ratings to specific points. (0 or 1; DEFAULT: 0)
incrementLockPoints	How many points to allow rating to lock to. (DEFAULT: 10)
forceChoice	Whether to allow continuing without making a rating. (1 or 0; DEFAULT: 1)
contBoxOrigin	Origin of continue box. (DEFAULT: [550 -450])
contBoxSize	Size of continue box. (DEFAULT: [50 50])
contBoxColour	Colour of continue box. (DEFAULT: [0.5 0.5 0.5])
scaleMaxTime	Max amount of time to present scale for. (DEFAULT: [])
mouseTrack	Whether to track mouse during rating or not. Note that if you want to concatenate MOUSETRACK across several trials, MOUSETRACK will need to be initialized outside of this function, input into this variable as "MOUSETRACK", and output into the global workspace. This allows the same variable to be input into each instance of this function and each subsequent sample will be added to the bottom of the MOUSETRACK.xy structure. Otherwise, leave this parameter empty and a new MOUSETRACK structure will be produced for each instance of this function. (DEFAULT: []).
mouseTrackHz	Sampling rate at which to take mouse samples. (DEFAULT: 256)
cogentSXY	Sprite number to draw image onto screen each time scale is selected as well as X and Y location. Format should be Nx3 array with [SPRITE X Y] on each row for each image. (DEFAULT: [])
cogentImageAlign	Position to which images should be aligned to. (DEFAULT: {'c' 'c'})

fixMousePosition	Position as to which the mouse position should be fixed whilst the scale is being presented. (DEFAULT: [])
fixMousePositionDuration	How long the mouse position should be fixed for. Note that this parameter must be input if the mouse movement is to be limited for a set duration. Otherwise, the mouse position will just be moved to the location. (DEFAULT: [])
triggerForScale	Whether to input a trigger for the onset of the scale. Input must include the DIO object, the TRIGGER and the TIME to wait before resetting the port to zero, and must be in the format of {'DIO' TRIGGER TIME}. (DEFAULT: [])
triggerForClick	Whether to input a trigger for the onset of each mouse click. Input must include the DIO object, the TRIGGER and the TIME to wait before resetting the port to zero, and must be in the format of {'DIO' TRIGGER TIME}. (DEFAULT: [])
mouseAutoCont	This allows for the scale to continue automatically if an option has been selected and the mouse has not been moved in a set amount of time. This allows us to limit mouse movement (For example, if this parameter is set to 3, the scale will report its final rating if the mouse does not move for three seconds after making the last selection). (DEFAULT: [])
forceOption	If using a box scale, this will force a specific option to be selected. (DEFAULT: [])
presentText	Draw text in specified location. Requires the text (char array), x-location (numeric), y-location (numeric), plus any number of optional inputs detailed in 'cog_InsertText' function, such as fontSize, font, colour, etc. For example, {'TEXT_TO_INSERT',0,-150,'fontSize',64}. (DEFAULT: [])
Outputs	**Description**
ratings	The rating for each scale.
MOUSETRACK	The mouse tracking structure containing data of mouse locations.
flipTime	The time (using cogstd) at which the flip command was issued.
boxSync	If scale type 'box' is used, this will report the anchor that is selected for each scale.

fixMousePos (v1.0)

Fix mouse position for set amount of time.

Required Inputs	**Description**
Duration	Seconds to fix mouse for.
x	X coordinate to fix.
y	Y coordinate to fix.
Optional Inputs	**Description**
Outputs	**Description**

organiseCoordsForCogent (v1.0)

Organise coordinates for rectangle comprised of 4 points into clockwise order, with first row being top left point.

Required Inputs	Description
x	X coordinates of four points of rectangle.
y	Y coordinates of four points of rectangle.
Optional Inputs	**Description**
Outputs	**Description**
coordsNew	4x2 array of coordinates, in clockwise order with top left coordinate being first row.

wait (v1.0)

Wait specified amount of time in seconds. Utilises "cogstd".

Author: Andrej Stancak

Required Inputs	Description
deltatime	Time to wait in seconds.
Optional Inputs	**Description**
Outputs	**Description**

cog_FixationCross(v1.0)

Plot fixation cross on screen. This function may not require any parameters, as it will automatically detect the information required. It will use monitor size to automatically configure size, and default to the centre of the screen. If more than one monitor is detected, monintor parameter will need to be given.

Required Inputs	Description
Optional Inputs	**Description**
x	Origin of cross on x-axis. (DEFAULT: 0)
y	Origin of cross on y-axis. (DEFAULT: 0)
monitor	What monitor to display on. (DEFAULT: [])
width	Width of cross. (DEFAULT: Monitor Width / 4)
height	Height of cross. (DEFAULT: Monitor Width / 4)
colour	Colour of cross (RGB). (DEFAULT: [1 1 1])
lineWidth	Width of line. (DEFAULT: 2)
Outputs	**Description**

cog_ImageLoad (v1.0)

Present image on Cogent window. You can give this function either:
     1) Image variable read into MATLAB, for example, using imread().
     2) Character array indicating location of image file.
     3) Cell array of charracter arrays indicating location of all image files to be read in.

Required Inputs	Description
sprite	Sprite ID(s) to draw images to.
image	Image variable, character array for image file or cell array of image file locations.

Optional Inputs	Description
resizeX	Width of image in pixels we wish to resize. (DEFAULT: [])
resizeY	Height of image in pixels we wish to resize. (DEFAULT: [])
xPos	X Position of image. (DEFAULT: 0)
yPos	Y Position of image. (DEFAULT: 0)
draw	Whether to flip screen. (DEFAULT: 0)
loadBMP	Whether to use 'cgloadbmp' function instead of loading up an array. (DEFAULT: 0)

Outputs	Description

cog_InsertText (v1.0)

This will take a single character array and present it on the Cogent window. To do this, it will first split the text into lines depending on a pre-defined wrap width. This wrap width is in number of characters rather than pixels.

Required Inputs	Description
text	Text to draw.

Optional Inputs	Description
x	X Position for text. (DEFAULT: 0)
y	Y Position for text. (DEFAULT: 0)
font	Text font. (DEFAULT: 'Arial')
fontSize	Text font size. (DEFAULT: 32)
colour	Text colour. (DEFAULT: [1 1 1])
wrapWidth	Wrap width for lines. (DEFAULT: 65)
alignment	Text alignment/ (DEFAULT: {'c' 'c'})
spaceBetweenLines	Pixels between lines. (DEFAULT: fontSize/4)

Outputs	Description

cog_InsertText (v1.0)

This will take a single character array and present it on the Cogent window. To do this, it will first split the text into lines depending on a pre-defined wrap width. This wrap width is in number of characters rather than pixels.

Required Inputs	Description
text	Text to draw.

Optional Inputs	Description
x	X Position for text. (DEFAULT: 0)
y	Y Position for text. (DEFAULT: 0)
font	Text font. (DEFAULT: 'Arial')
fontSize	Text font size. (DEFAULT: 32)
colour	Text colour. (DEFAULT: [1 1 1])
wrapWidth	Wrap width for lines. (DEFAULT: 65)
alignment	Text alignment/ (DEFAULT: {'c' 'c'})
spaceBetweenLines	Pixels between lines. (DEFAULT: fontSize/4)
Outputs	**Description**

Other

captureScreen (v1.0)	
Take screenshot of all screens and store in variable.	
Required Inputs	**Description**
Optional Inputs	**Description**
View	Whether to view screenshot in figure. If you want to view it, input view. If not, leave function input parameters empty.
Outputs	**Description**
IM	Cell array, with length corresponding to number of screens. Each array corresponds to a screenshot of each screen in RGB, with the size corresponding to the resolution of the screen.

excel_kill (v1.0)	
When reading in excel files to MATLAB, excel files can sometimes become non-openable outside of MATLAB because of being open in MATLAB, despite MATLAB being cleared. This will terminate all open excel applications. CAUTION: WILL TERMINATE EXCEL APPLICATIONS.	
Required Inputs	**Description**
Optional Inputs	**Description**
Outputs	**Description**

ListSubFolders (v1.0)	
List subfolders in directory.	
Required Inputs	**Description**
folder	Main directory to look for subfolders.
Optional Inputs	**Description**
Outputs	**Description**
subFolds	Subfolders in main folder.

restorePath (v1.0)

Restore default MATLAB path. Sometimes, the path becomes corrupted and you might be getting warnings when MATLAB starts up, this may fix it.

Required Inputs	Description
Optional Inputs	Description
Outputs	Description

testImageSimilarity (v1.0)

Given a directory of images, this will scan through all possible pairs of images and test for a high level of similarity. This comes in handy if you are gathering stimuli from multiple sources and images become mixed up.

Required Inputs	Description
directory	Directory containing images.
Optional Inputs	Description
Outputs	Description

GUIs

ERPScroll (v1.0)	
Plots EEG data and allows navigation.	
Required Inputs	**Description**
data	EEG data.
chanLocs	Channel locations variable.
Optional Inputs	**Description**
baseline	Baseline period, e.g. -300. (DEFAULT: [])
title	Title for GUI. (DEFAULT: 'ERP Data')
Outputs	**Description**

(v1.0)	
Required Inputs	**Description**
Optional Inputs	**Description**
Outputs	**Description**