Package ‘cin’

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Type     Package
Title    Causal Inference for Neuroscience
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Description Many experiments in neuroscience involve randomized and fast stimulation while the continuous outcome measures respond at much slower time scale, for example event-related fMRI. This package provide valid statistical tools with causal interpretation under these challenging settings, without imposing model assumptions.
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  cin  inference under interference

Description

Test for treatment effects under interference for fMRI time series

Usage

cin(X, k=5, type=c("sum", "correlation"), weight=NULL, TR=NULL, interp=FALSE)
Arguments

- **X**: Input list of blocks (see reference), where each block could be one subject in one scan session. Each atom in this list is also a list of 3 vectors in the order: fMRI response time series, control stimulus events and treatment stimulus events (both in scans). An example of such input with one block could be `list(list(fmri=fmri, stimc=stimc, stimt=stimt))` where `fmri`, `stimc`, and `stimt` are all R numerical vectors.

- **k**: k-1 controls and 1 treatment are compared. Default 5.

- **type**: Method to summarize the response times series for each event, weighted summation or correlation with weight. Default sum.

- **weight**: Weight used to summarize the time series points after each control or treatment event.

- **TR**: Repetition Time used to generate weight from Canonical HRF (see reference) if weight is not specified.

- **interp**: Whether interpolation of the fMRI time series will take place to produce observations at those event times. If FALSE, the event times will be rounded to nearest scans. Default FALSE.

Details

Performs causal inference test fMRI time series. The test is based on placement statistics (Orban and Wolfe, 1982). The test does not require model assumptions, and can provide valid inference on treatment effects even if there are interference between randomized stimuli.

Current implementation simply consolidates the test statistics from each subjects and each session. More complicated ways of aggregating these effects will be implemented in the future release.

Value

An object with S3 class "cin". You can also use it as a regular R list with the following fields:

- **Score**: Actual test score. The test statistics is Dev.
- **Exp**: Expected test score.
- **Var**: Expected variance of test score.
- **Dev**: Deviance or z-score.
- **p.value**: One-side p-value for Dev.

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References


Examples

```r
## simulation from the null
fmri.ts <- arima.sim(list(order = c(1,1,0), ar = 0.7), n = 1000)
events <- sample(1000, 400)
stimt <- sample(events, 100)
stimc <- setdiff(events, stimt)
cin(list(list(fmri=fmri.ts, stimc=stimc, stimt=stimt)), TR=2)
```

Description

Internal cin functions

Usage

```r
gammaHRF(TR, paras=NULL, len.seconds=32, onset.seconds=0)
intertest(x, y, k=5)
truncsum(stim, y, hrf, isinterp=F, iscor=F)
```

Arguments

- **TR**: Repetition time.
- **paras**: Parameters to specify the canonical HRF function, as in the Statistical Parametric Mapping package.
- **len.seconds**: Total length of the HRF in seconds.
- **onset.seconds**: Onset time of the first weight.
- **x**: Control response values.
- **y**: Treatment response values.
- **k**: k-1 control values are compared with 1 treatment.
- **stim**: Stimulus event times.
- **hrf**: Hemodynamic response function weights.
- **isinterp**: Whether to interpolate response values for non-integer event times (in scans).
- **iscor**: Whether to summarize using correlation.
Details

There are not intended for use by users.

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