Package ‘EffectsRelBaseline’

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Title Test changes of a grouped response relative to baseline.
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Description Functions to test for changes of a response to a stimulus grouping relative to a background or baseline response.
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Test changes of a grouped response relative to baseline.

Description

Functions to test for changes of a response to a stimulus grouping relative to a background or baseline response.

Details

Package: EffectsRelBaseline
Version: 0.4
Date: 2013-06-12
License: GPL version 3 or newer
Built: R 2.15.2; ; 2013-06-12 22:41:44 UTC; unix

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- ef: Example data of human single neuron responses to presentation of emotional faces.
- LL1WayAnova: Log-likelihood ratio statistic for grouped responses.
- relBackgroundLL: Log-likelihood ratio of grouped responses being drawn from a background distribution with known mean and variance.
- sumSqCat: Weighted sum of squared deviations test statistic, as used in the changes from background test (CBT).

This package provides functions for testing whether grouped responses have significant deviations from baseline. It allows testing using the non-parametric changes from background test (CBT), which doesn’t require multiple testing relative to baseline followed by a second test for an effect of group on the responses. Such double testing can lead to erroneous conclusions, as discussed in Steinmetz & Thorp, 2013.

The primary function is sumSqCat which computes the appropriate test statistic for use in the CBT. A variety of other test functions are provided which can be used for comparison of performance.

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References


See Also

Psumtsim-package boot

Description

This dataframe contains the responses of two neurons from the human medial temporal lobe to the presentation of synthetically generated faces which vary the emotion and race.

Usage

data(ef)

Format

A data frame with 1452 observations of the following 5 variables.

clustId Identifier of the neuron, a factor with levels ch26c13 ch28c13.
nname Name of the image file presented.
race Race of the face presented, a factor with levels ambigBlack ambigWhite black white
absResp Number of action potentials fired during presentation of the image, a numeric vector.
absBkg Number of action potentials fired prior to image presentation, a numeric vector

References

Valdez et al. 2013, "Race Selective Neurons in the Human Brain".

Examples

data(ef)
anova(glm(absResp~race,data=ef),test='Chisq')
fRatioStat  
F-ratio statistic for grouped responses

Description
Computes the F-ratio statistic for a log-likelihood ratio test of the null hypothesis that the responses are all drawn from one group, rather than the alternative hypothesis that each group has a separate mean.

Usage
fRatioStat(resp, groups)

Arguments
- resp: response values
- groups: grouping variables (will be treated as factors)

Value
F-ratio statistic

Note
This is the standard F-ratio for a 1-way ANOVA. It is included here for comparison to other statistics.

Author(s)
Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

References

See Also
- LL1WayAnova, relBackgroundLL, sumSqCat

Examples
```r
data(ef)
fRatioStat(ef$absResp, ef$race)
```
LL1WayAnova

**Description**

Computes the log-likelihood ratio statistic for a test of the null hypothesis that the responses are all drawn from one group, rather than the alternative hypothesis that each group has a separate mean.

**Usage**

`LL1WayAnova(resp, groups)`

**Arguments**

- `resp`: response values
- `groups`: grouping variables (will be treated as factors)

**Value**

log-likelihood ratio

**Note**

This is the normal likelihood-ratio which is used in performing a 1-way ANOVA. It is included here for comparison.

**Author(s)**

Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

**References**


**See Also**

`fRatioStat, relBackgroundLL, sumSqCat`

**Examples**

```r
data(ef)
LL1WayAnova(ef$absResp, ef$race)
```
raceEffectBootAdaptor  Boot adaptor for testing race effect.

Description

Provides an adaptor function for bootstrapping tests of an effect of race on neural responses in the sample dataset, ef. This function can be provided as an argument to the boot function.

Usage

raceEffectBootAdaptor(df, index, testFnc = relbackgroundLL, useResp = TRUE, ...)

Arguments

df      Dataframe containing data which testFnc will operate upon. This dataframe must contain a bkgResp and absResp column with the background and response firing rates, respectively.
index   The permutation of the rows of df to be applied before calling testFnc.
testFnc Function which will be used to compute the test statistic. Defaults to relBackgroundLL.
useResp Whether to use the absResp column of df, or the bkgResp column of df when computing responses.
...     Any other required arguments to testFnc.

Details

This is a specialized function to illustrate the use of the different test statistics provided in this package with the example dataset.

Value

The bootstrap result object returned by the boot function.

Author(s)

Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

See Also

ef, boot
Examples

# Test for an effect of race on the neural responses in the sample data
# using the SSC statistic. This effect is highly significant if computed while
# averaging over all neurons in the dataset.
require('boot')
data(ef)
boot(ef, raceEffectBootAdaptor, 1000, useResp=TRUE,
    testFnc=sumSqCat, backMean=mean(ef$absbkg),
    sum(bootRes$t > bootRes$t1) / 1000

relBackgroundLL

Description

Compute the log-likelihood ratio of the grouped responses being obtained from a background distribution given its mean and variance.

Usage

relBackgroundLL(resp, groups, backMean, backVar)

Arguments

<table>
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<th>Description</th>
</tr>
</thead>
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<td>response values</td>
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<tr>
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<tr>
<td>backMean</td>
<td>mean of the background distribution</td>
</tr>
<tr>
<td>backVar</td>
<td>variance of the background distribution</td>
</tr>
</tbody>
</table>

Value

log-likelihood ratio

Note

This is the log-likelihood ratio of the changes from background test (CBT). It is included here for comparison.

Author(s)

Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

References

sumSqCat

See Also

fratioStat, L1WayAnova, sumSqCat

Examples

# calculate test statistic for one cluster
data(ef)
df <- subset(ef, clustID == 'ch26c13')
relBackgroundLL <- function(absResp, df$race, mean(absBkg), var(absBkg))

sumSqCat <- Weighted sum of squared deviations by category, SSC, statistic.

Description

Compute the weighted sum of squared deviations of the group or category response means from the average background.

Usage

sumSqCat(resp, groups, backMean)

Arguments

- resp: response values
- groups: grouping variables (will be treated as factors)
- backMean: mean of background values

Details

The SSC statistic is the primary test statistic developed for the changes from background test (CBT) developed in Steinmetz & Thorp (2013).

Value

weighted sum of squared deviations of group means from background

Author(s)

Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

References

sumSqCat

See Also
fratioStat, relBackgroundLL, LL1WayAnova

Examples

data(ef)
sumSqCat(ef$absResp, ef$race, mean(ef$absBkg))
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