Package 'EffectsRelBaseline'

February 19, 2015

Version 0.5

Date 2013-08-26

Title Test changes of a grouped response relative to baseline.

Author Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

Maintainer Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

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

License GPL (>= 3)

Suggests boot

NeedsCompilation no

Repository CRAN

Date/Publication 2013-09-23 21:56:32

R topics documented:

`EffectsRelBaseline-package`

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

Index:

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.

Author(s)

Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org> Christopher Thorp <thorp@spacia.org>

Maintainer: Peter N. Steinmetz <PeterNSteinmetz@steinmetz.org>

References

Steinmetz, P.N. & Thorp, C.K. (2013) Testing for effects of different stimuli on neuronal firing relative to background activity. Journal of Neural Engineering, Sept. 2013.

See Also

PsumtSim-package boot

---

ef *Human single neuron responses to race.*

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 `ch26cl3` `ch28cl3`.

`name` 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

B. Lindgren, Statistical Theory, 4th Ed. (1993), section 14.7.

See Also

LL1WayAnova, relBackgroundLL, sumSqCat

Examples

```
data(ef)
fRatioStat(ef$absResp,ef$race)
```

LL1WayAnova *Log-likelihood ratio statistic for grouped responses*

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

B. Lindgren, Statistical Theory, 4th Ed. (1993), section 14.7.

See Also

fRatioStat, relBackgroundLL, sumSqCat

Examples

```
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$absBkg))->bootRes
sum(bootRes$t>bootRes$t1)/1000
```

`relBackgroundLL` *Log-likelihood ratio of grouped responses being drawn from a background distribution.*

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

`resp`	response values
`groups`	grouping variables (will be treated as factors)
`backMean`	mean of the background distribution
`backVar`	variance of the background distribution

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

Steinmetz, P.N. & Thorp, C.K. (2013) Testing for effects of different stimuli on neuronal firing relative to background activity. Journal of Neural Engineering, in review.

See Also

fRatioStat,LL1WayAnova,sumSqCat

Examples

```
# calculate test statistic for one cluster
data(ef)
df<-subset(ef,clustId=='ch26cl3')
relBackgroundLL(df$absResp,df$race,mean(df$absBkg),var(df$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

Steinmetz, P.N. & Thorp, C.K. (2013) Testing for effects of different stimuli on neuronal firing relative to background activity. Journal of Neural Engineering, in review.

See Also

fRatioStat,relBackgroundLL,LL1WayAnova

Examples

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

Index