Package 'rhoR'

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Title Rho for Inter Rater Reliability

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Description Rho is used to test the generalization of inter rater reliability (IRR) statistics. Calculating rho starts by generating a large number of simulated, fully-coded data sets: a sizable collection of hypothetical populations, all of which have a kappa value below a given threshold -- which indicates unacceptable agreement. Then kappa is calculated on a sample from each of those sets in the collection to see if it is equal to or higher than the kappa in then real sample. If less than five percent of the distribution of samples from the simulated data sets is greater than actual observed kappa, the null hypothesis is rejected and one can conclude that if the two raters had coded the rest of the data, we would have acceptable agreement (kappa above the threshold).

Depends R (>= 3.0.0)

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LazyData true

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Suggests testthat

Collate 'rhoR.R' 'rho.R' 'rhoK.R' 'rhoSet.R' 'rhoCT.R' 'kappa.R' 'kappaSet.R' 'kappaCT.R' 'rhoMin.R' 'baserate.R' 'baserateSet.R' 'baserateCT.R' 'calcKappa.R' 'calcRho.R' 'checkBRPKcombo.R' 'contingencyTable.R' 'codeSet.R' 'contingencyToSet.R' 'createRandomSet.R' 'createSimulatedCodeSet.R' 'genPKcombo.R' 'genPcombo.R' 'generateKPs.R' 'getBootPvalue.R' 'getHandSet.R' 'getHandSetIndices.R' 'getR.R' 'getTestSet.R' 'prset.R'

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R topics documented:

`baserate` *Calculate Baserate*

Description

This function calculates the baserate of the first rater, second rater, and the average of both the raters.

Usage

```
baserate(data)
```

Arguments

`data`	The `testSet` or `contingencyTable` for which the baserate is calculated

Details

A baserate is the percentage, as a decimal, that a positive code appears in data (either a codeSet or contingencyTable) for a given rater. It is assumed that the first rater is more experienced and thus provides a better estimation of the actual baserate for a given code, so the first rater's baserate is often used as if it is the actual baserate. If the raters are assumed to have the same experience level, the average baserate may give a better estimation. If the second rater is more experienced, the second rater's baserate may give a better estimation. Functions assume that the first rater is the more experienced rater and thus uses the first rater's baserate as the overall baserate estimation.

Value

A list of the format:

firstBaserate The percentage of the data for which a positive code, or a 1, appears in the first rater

secondBaserate The percentage of the data for which a positive code, or a 1, appears in the second rater

averageBaserate The average of the firstBaserate and secondBaserate.

See Also

baserateSet and baserateCT

Examples

```
#Given a code set
baserate(data = codeSet)

#Given a contingency Table
baserate(data = contingencyTable)
```

---

baserateCT *Calculate Baserate (CT)*

Description

This function calculates the baserate of the first rater, second rater, and the average of both the raters. Called by baserate.

Usage

```
baserateCT(CT)
```

Arguments

CT	The contingencyTable for which the baserate is calculated

Value

A list of the format:

firstBaserate The percentage of the data for which a positive code, or a 1, appears in the first rater

secondBaserate The percentage of the data for which a positive code, or a 1, appears in the second rater

averageBaserate The average of the firstBaserate and secondBaserate.

See Also

baserate and baserateSet

---

baserateSet *Calculate Baserate (Set)*

Description

This function will calculate the baserate of the first rater, second rater, and the average of both the raters. Called by baserate.

Usage

```
baserateSet(set)
```

Arguments

set	The codeSet for which the baserate is calculated

Value

A list of the format:

firstBaserate The percentage that a positive code, or a 1, appears in the first rater

secondBaserate The percentage that a positive code, or a 1, appears in the second rater

averageBaserate The average percentage that a positive code, or a 1, appears in either of the two raters

See Also

baserate and baserateCT

codeSet *codeSet*

Description

A codeSet is a Nx2 binary matrix in which the first column corresponds to the first rater and the second column corresponds to the second rater.

Usage

```
codeSet
```

Format

The codeSet is an object of class matrix with n rows and two columns.

Examples

```
#An example codeSet
firstRater = c(1,1,1,1,rep(0,36))
secondRater = c(1,1,1,0,1,1,rep(0,34))
exampleSet = cbind(firstRater,secondRater)

#This set is included in the package under the variable name "codeSet".
```

contingencyTable *contingencyTable*

Description

A contingency Table is a 2x2 matrix that contains the counts of all combinations of positive and negative ratings made by two raters.

Usage

```
contingencyTable
```

Format

The contingency Table is an object of class matrix with two rows and two columns. The ordering of the combination vector input to the matrix is as follows: c(Rater1Positive & Rater2Positive, Rater1Negative & Rater2Positive, Rater1Positive & Rater2Negative, Rater1Negative & Rater2Negative).

Examples

```
#An example contingencyTable
ct = matrix(c(3,2,1,34), nrow = 2, ncol = 2)

#This contingencyTable is included in the package under the variable name "contingencyTable".
```

`createSimulatedCodeSet` *Create Simulated codeSet*

Description

Creates a simulated `codeSet` with the given parameters

Usage

```
createSimulatedCodeSet(length, baserate, kappaMin, kappaMax, precisionMin,
  precisionMax, tries = 50)
```

Arguments

`length`	the length of the simulated `codeSet` to be created
`baserate`	the `baserate` of the simulated `codeSet`
`kappaMin`	the minimum kappa of the simulated `codeSet`
`kappaMax`	the maximum kappa of the simulated `codeSet`
`precisionMin`	the minimum precision of the simulated `codeSet`
`precisionMax`	the maximum precision of the simulated `codeSet`
`tries`	the maximum number of tries to generate a valid set, smaller set lengths may require an increased number of tries

Details

`codeSet`s are generated by first picking a random kappa within its range and a random precision within its range. If the random kappa, random precision, and baserate are not mathematically possible, then the precision is resampled from a range of mathematically possible values within its range. A unique simulated `codeSet` is then constructed given these parameters.

Value

A `codeSet` that fulfills the given parameters

getHandSet *Get Handset*

Description

This function is to get a handset of a set and calculate the kappa

Usage

```
getHandSet(set, handSetLength, handSetBaserate, returnSet = FALSE)
```

Arguments

set	This is the set to take a handset of
handSetLength	This is the length of the handset to take
handSetBaserate	This is the minimum baserate to inflate the handset to
returnSet	If TRUE, then return the handSet if FALSE, return the kappa of the handSet

Value

The function returns the handSet if returnSet is TRUE or the kappa of the handSet if not

getHandSetIndices *Generate a Handset*

Description

Generate a vector representing indices of set, using the handSetBaserate to determine the minimum number of indices that are positive

Usage

```
getHandSetIndices(set, handSetLength = 20, handSetBaserate = 0.2)
```

Arguments

set	matrix of two columns
handSetLength	number of indices to find
handSetBaserate	number between 0 and 1 to use as a minimum number of positive indices

Value

vector of indices from set

getTestSet *Get Test Set*

Description

This function gets a *testSet* from a larger codeSet given certain sampling parameters.

Usage

```
getTestSet(set, testSetLength, testSetBaserateInflation = 0)
```

Arguments

set	The codeSet from which the *testSet* is taken
testSetLength	The length of the *testSet* to be taken
testSetBaserateInflation	The minimum guaranteed baserate of the *testSet*. Default to 0

Details

A *testSet* is a codeSet that is a subset of a larger codeSet with a given set of properties. A *testSet* is constructed by sampling (without replacement) P rows from rows in the larger codeSet where the first rater's code was 1, and then appending an additional sample (without replacement) of R rows taken at random from the larger codeSet excluding rows included in the first P rows sampled. P is computed as the minbaserate * length of the *testset*. R is computed as testSetLength - P. The result of this sampling procedure is to create a sample with a minimum baserate regardless of the baserate of the larger codeSet.If *testSetBaserateInflation* is set to zero, the function selects rows at random.

Value

A codeSet with the properties specified

kappa *Calculate kappa*

Description

This function calculates Cohen's kappa on a contingencyTable or a codeSet.

Usage

```
kappa(data)
```

Arguments

data	A contingencyTable or a codeSet

Value

The kappa of the contingencyTable or codeSet

See Also

kappaSet and kappaCT

Examples

```
#Given a code set
kappa(data = codeSet)

#Given a contingency Table
kappa(data = contingencyTable)
```

---

kappaCT *Calculate kappa (contingency Table)*

Description

This function calculates Cohen's kappa on a contingencyTable. Called by kappa.

Usage

```
kappaCT(ct)
```

Arguments

ct	A contingencyTable

Value

The kappa of the contingencyTable

See Also

kappa and kappaSet

kappaSet *Calculate kappa (Set)*

Description

This function calculates Cohen's kappa for a given codeSet. Called by kappa.

Usage

```
kappaSet(set)
```

Arguments

set	A codeSet

Value

The kappa of the codeSet

See Also

kappa and kappaCT

rho *Rho*

Description

This function calculates rho for a testSet, contingencyTable, or an observed kappa value with associated set parameters (testSetLength and OcSBaserate).

Usage

```
rho(data, OcSBaserate = NULL, testSetLength = NULL,
  testSetBaserateInflation = 0, OcSLength = 10000, replicates = 800,
  ScSKappaThreshold = 0.65, ScSKappaMin = 0.4, ScSPrecisionMin = 0.6,
  ScSPrecisionMax = 1)
```

Arguments

data	The observed kappa value, testSet or contingencyTable that will be tested with rho
OcSBaserate	The baserate of the observed codeSet (defaults to baserate of testSet or contingencyTable)
testSetLength	The length of the testSet (ignored unless *data* is an observed kappa value)

testSetBaserateInflation
: The minimum baserate from the sampling procedure

OcSLength
: The length of the observed codeSet

replicates
: The number of simulated codeSets to use in the null hypothesis distribution for rho; similar to replicates in a Monte Carlo study

ScSKappaThreshold
: The maximum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho

ScSKappaMin
: The minimum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho

ScSPrecisionMin
: The minimum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho

ScSPrecisionMax
: The maximum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho

Details

Rho is a Monte Carlo rejective method of interrater reliability statistics, implemented here for Cohen's Kappa. Rho constructs a collection of data sets in which kappa is below a specified threshold, and computes the empirical distribution on kappa based on the specified sampling procedure. Rho returns the percent of the empirical distribution greater than or equal to an observed kappa. As a result, Rho quantifies the type 1 error in generalizing from an observed test set to a true value of agreement between two raters.

Rho starts with an observed kappa value, calculated on a subset of a codeSet, known as an observed testSet, and a *kappa threshold* which indicates what is considered significant agreement between raters.

It then generates a collection of fully-coded, simulated codeSets (ScS), further described in createSimulatedCodeSet, all of which have a kappa value below the kappa threshold and similar properties as the original codeSet.

Then, kappa is calculated on a testSet sampled from each of the ScSs in the collection to create a null hypothesis distribution. These testSets mirror the observed testSets in their size and sampling method. How these testSets are sampled is futher described in getTestSet.

The null hypothesis is that the observed testSet, was sampled from a data set, which, if both raters were to code in its entirety, would result in a level of agreement below the kappa threshold.

For example, using an alpha level of 0.05, if the observed kappa is greater than 95 percent of the kappas in the null hypothesis distribution, the null hypothesis is rejected. Then one can conclude that the two raters would have acceptable agreement had they coded the entire data set.

Value

rho and kappa for the given data and parameters (unless kappa is given)

See Also

rhoK and rhoSet and rhoCT

Examples

```
# Given an observed kappa value
rho(data = 0.88, OcSBaserate = 0.2, testSetLength = 80)

# Given a test Set
rho(data = codeSet)

# Given a contingency Table
rho(data = contingencyTable)
```

---

rhoCT *Rho (contingency Table)*

Description

This function calculates rho and kappa for a given `contingencyTable`, and returns a list containing both values. Called by `rho`.

Usage

```
rhoCT(contingencyTable, OcSBaserate = NULL,
  testSetBaserateInflation = 0, OcSLength = 10000, replicates = 800,
  ScSKappaThreshold = 0.65, ScSKappaMin = 0.4, ScSPrecisionMin = 0.6,
  ScSPrecisionMax = 1)
```

Arguments

`contingencyTable`
: The `contingencyTable` used to calculate rho

`OcSBaserate`
: The `baserate` of the observed `codeSet` (defaults to `baserate` of the `contingencyTable`)

`testSetBaserateInflation`
: The minimum `baserate` from the sampling procedure

`OcSLength`
: The length of the observed `codeSet`

`replicates`
: The number of simulated `codeSets` to use in the null hypothesis distribution for rho; similar to replicates in a Monte Carlo study

`ScSKappaThreshold`
: The maximum kappa value used to generate simulated `codeSets` in the null hypothesis distribution for rho

`ScSKappaMin`
: The minimum kappa value used to generate simulated `codeSets` in the null hypothesis distribution for rho

`ScSPrecisionMin`
: The minimum precision to be used for generation of simulated `codeSets` in the null hypothesis distribution for rho

`ScSPrecisionMax`
: The maximum precision to be used for generation of simulated `codeSets` in the null hypothesis distribution for rho

Value

A list of the format:

rho The rho of the contingencyTable

kappa The Cohen's Kappa of the contingencyTable

See Also

rho and rhoK and rhoSet

---

rhoK *Rho (kappa)*

Description

This function calculates rho for an observed kappa value with associated set parameters (testSetLength and OcSBaserate). Called by rho.

Usage

```
rhoK(observedKappa, OcSBaserate, testSetLength,
  testSetBaserateInflation = 0, OcSLength = 10000, replicates = 800,
  ScSKappaThreshold = 0.65, ScSKappaMin = 0.4, ScSPrecisionMin = 0.6,
  ScSPrecisionMax = 1)
```

Arguments

observedKappa	The observed kappa value used to calculate rho
OcSBaserate	The baserate of the observed codeSet (defaults to baserate of testSet or contingencyTable)
testSetLength	The length of the testSet (ignored unless *data* is an observed kappa value)
testSetBaserateInflation	The minimum baserate from the sampling procedure
OcSLength	The length of the observed codeSet
replicates	The number of simulated codeSets to use in the null hypothesis distribution for rho; similar to replicates in a Monte Carlo study
ScSKappaThreshold	The maximum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho
ScSKappaMin	The minimum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho
ScSPrecisionMin	The minimum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho
ScSPrecisionMax	The maximum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho

Value

rho for the given parameters

See Also

rho and rhoSet and rhoCT

---

rhoMin *Rho Min*

Description

This function calculates the minimum testSetLength where it is possible to get a rho less than alpha for the given parameters of rho.

Usage

```
rhoMin(baserate, alpha = 0.05, inc = 10, printInc = FALSE, ...)
```

Arguments

baserate	A baserate
alpha	The threshold of significance for rho (similar to an alpha level for a p value), defaulted to 0.05
inc	An integer indicating by how much the testSetLength should increase each iteration
printInc	A boolean indicating whether to print out each increment value with it's corresponding significance for rho
...	Any additional parameters passed into rho

Value

The minimum length of testSet, to the nearest multiple of inc, greater than the minimum length, that would give a value where rho less than alpha becomes mathematically possible.

Examples

```
#Add testSetBaserateInflation as an additional parameter
rhoMin(0.2, testSetBaserateInflation = 0.33)

#Add testSetBaserateInflation as well as changing inc and selecting printInc
rhoMin(0.2, inc = 5, printInc = TRUE, testSetBaserateInflation = 0.33)
```

rhoR *rhoR: A package for computing rho.*

Description

Rho is used to test the generalization of inter rater reliability (IRR) statistics, in this case Cohen's Kappa.

Details

Rho is a Monte Carlo rejective method of interrater reliability statistics, implemented here for Cohen's Kappa. Rho constructs a collection of data sets in which kappa is below a specified threshold, and computes the empirical distribution on kappa based on the specified sampling procedure. Rho returns the percent of the empirical distribution greater than or equal to an observed kappa. As a result, Rho quantifies the type 1 error in generalizing from an observed test set to a true value of agreement between two raters.

Rho starts with an observed kappa value, calculated on a subset of a `codeSet`, known as an observed `testSet`, and a *kappa threshold* which indicates what is considered significant agreement between raters.

It then generates a collection of fully-coded, simulated `codeSets` (ScS), further described in `createSimulatedCodeSet`, all of which have a kappa value below the kappa threshold and similar properties as the original `codeSet`.

Then, kappa is calculated on a `testSet` sampled from each of the ScSs in the collection to create a null hypothesis distribution. These `testSets` mirror the observed `testSet` in their size and sampling method. How these `testSets` are sampled is futher described in `testSet`.

The null hypothesis is that the observed `testSet`, was sampled from a data set, which, if both raters were to code in its entirety, would result in a level of agreement below the kappa threshold.

For example, using an alpha level of 0.05, if the observed kappa is greater than 95 percent of the kappas in the null hypothesis distribution, the null hypothesis is rejected. Then one can conclude that the two raters would have acceptable agreement had they coded the entire data set.

rho

Use `rho` `rhoK` `rhoSet` `rhoCT`

kappa

Use `kappa` `kappaSet` `kappaCT`

rhoMin

Use `rhoMin`

rhoSet *Rho (set)*

Description

This function calculates rho and kappa for a given testSet, and returns a list containing both values. Called by rho.

Usage

```
rhoSet(set, OcSBaserate = NULL, testSetBaserateInflation = 0,
  OcSLength = 10000, replicates = 800, ScSKappaThreshold = 0.65,
  ScSKappaMin = 0.4, ScSPrecisionMin = 0.6, ScSPrecisionMax = 1)
```

Arguments

set	The testSet used to calculate rho
OcSBaserate	The baserate of the observed codeSet (defaults to baserate of testSet)
testSetBaserateInflation	The minimum baserate from the sampling procedure
OcSLength	The length of the observed codeSet
replicates	The number of simulated codeSets to use in the null hypothesis distribution for rho; similar to replicates in a Monte Carlo study
ScSKappaThreshold	The maximum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho
ScSKappaMin	The minimum kappa value used to generate simulated codeSets in the null hypothesis distribution for rho
ScSPrecisionMin	The minimum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho
ScSPrecisionMax	The maximum precision to be used for generation of simulated codeSets in the null hypothesis distribution for rho

Value

A list of the format:

rho The rho of the codeSet

kappa The Cohen's Kappa of the codeSet

See Also

rho and rhoK and rhoCT

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