Package ‘testCompareR’

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Type Package
Title Comparing Two Diagnostic Tests with Dichotomous Results using Paired Data
Version 1.0.3
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Description Provides a method for comparing the results of two binary diagnostic tests using paired data. Users can rapidly perform descriptive and inferential statistics in a single function call. Options permit users to select which parameters they are interested in comparing and methods for correction for multiple comparisons. Confidence intervals are calculated using the methods with the best coverage. Hypothesis tests use the methods with the best asymptotic performance. A summary of the methods is available in Roldán-Nofuentes (2020) <doi:10.1186/s12874-020-00988-y>. This package is targeted at clinical researchers who want to rapidly and effectively compare results from binary diagnostic tests.
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Description

This data from the Coronary Artery Surgery Study evaluates two tests to determine the presence or absence of coronary artery disease by comparing to coronary angiography, the gold standard. Test 1 is an exercise stress test and Test 2 is a clinical history of chest pain.

Usage

cass

Format

A data frame with 871 rows and 3 columns:

- **exercise**  Dichotomous result on exercise stress testing.
- **cp**  Presence of absence of chest pain based on medical history.
- **angio**  Dichotomous result on coronary angiography.

Details

All three variables are dichotomous. 1 indicates a positive result; 0 indicates a negative result. This data was originally presented in Weiner et al. (1979).

Source

doi:10.1056/NEJM197908023010502

References

Description

This data from the Cystic Fibrosis Foundation’s Patient Registry (USA) evaluates risk factors for pulmonary exacerbation in patients with cystic fibrosis. The two risk factors evaluated are previous pulmonary exacerbation and previous colonisation with Pseudomonas aeruginosa. Each of the two risk factors was evaluated using data from 1995. If an instance occurred at any point in 1995 the ‘test’ was considered positive. If negative throughout 1995 the ‘test’ was considered negative. The gold standard was evidence of pulmonary exacerbation at any point in 1996.

Usage

cfpr

Format

A data frame with 11,960 rows and 3 columns:

- **pulm.exac** Presence or absence of previous pulmonary exacerbation.
- **pseudomonas** Presence or absence of Pseudomonas aeruginosa infection.
- **infection** Presence or absence of severe infection (gold standard).

Details

All three variables are dichotomous. 1 indicates presence; 0 indicates absence.

This data was originally presented in Moskowitz and Pepe (2006).

Source

Data was sourced directly from the referenced paper. For up-to-date data requests contact: Cystic Fibrosis Foundation

References

compareR

Description


Usage

```r
compareR(
  df,
  alpha = 0.05,
  margins = FALSE,
  multi_corr = "holm",
  cc = TRUE,
  dp = 1,
  sesp = TRUE,
  ppvnpv = TRUE,
  plrnlr = TRUE,
  conf.int = "contemporary",
  test.names = c("Test 1", "Test 2"),
  ...
)
```

Arguments

- **df**: A data frame or matrix with 3 columns (test1, test2, gold). Flexible coding of positive and negative results permitted.
- **alpha**: An alpha value. Defaults to 0.05.
- **margins**: A Boolean value indicating whether the contingency tables should have margins containing summed totals of rows and columns.
- **cc**: A Boolean value indicating whether McNemar’s test should be applied with continuity correction.
- **dp**: Number of decimal places of output in summary tables. Defaults to 1.
- **sesp**: A Boolean value indicating whether output should include sensitivity and specificity.
- **ppvnpv**: A Boolean value indicating whether output should include positive and negative predictive values.
- **plrnlr**: A Boolean value indicating whether output should include positive and negative likelihood ratios.
- **conf.int**: A character string, either "contemporary" or "classic". Indicates whether function should use contemporary or classic statistical methods to calculate confidence intervals.
**compareR**

**test.names** A vector of length two giving the names of the two different binary diagnostic tests. This argument is not relevant when testing a single binary diagnostic test.

... Rarely needs to be used. Allows additional arguments to be passed to internal functions.

**Details**

Confidence intervals for prevalence, diagnostic accuracies and predictive values are calculated using the interval for binomial proportions described by Yu et al. (2014) by default. Setting `conf.int = "classic"` uses the Clopper-Pearson method. Confidence intervals for likelihood ratios are calculated using the methods recommended by Martín-Andrés and Álvarez-Hernández (2014). Hypothesis testing for diagnostic accuracies uses different methods depending on disease prevalence and number of participants or samples as described by Roldán-Ofuentes and Sidaty-Regad (2019). Global hypothesis testing for predictive values uses a method described by Roldán-Ofuentes et al. (2012), with subsequent individual tests (where indicated) performed using methods described by Kosinski (2012). The methods for hypothesis testing - for likelihood ratios are taken from Roldán-Ofuentes & Luna del Castillo (2007).

An excellent summary of these methods is provided by Roldán-Ofuentes (2020) along with an open-source program (combdet) licensed under GPL-2. This R package can be considered an extension of this work and is therefore distributed under the same license. Please consider citing Roldán-Ofuentes (2020) when you are citing this package.

**Value**

A list object summarising all calculated descriptive and inferential statistics.

**References**


**Examples**

```r
# load data
df <- cfpr

# run compareR function
compareR(df,
  margins = TRUE, multi_corr = "bonf",
```
test.names = c("pulm.exac", "pseudomonas")
)

Description

Produces a data frame which can be used by the compareR function using values commonly found in published literature. Useful for reviews and meta-analyses.

Usage

dataframeR(s11, s10, s01, s00, r11, r10, r01, r00)

Arguments

s11  Number of cases where Test 1 is positive, Test 2 is positive and gold standard is positive.
s10  Number of cases where Test 1 is positive, Test 2 is negative and gold standard is positive.
s01  Number of cases where Test 1 is negative, Test 2 is positive and gold standard is positive.
s00  Number of cases where Test 1 is negative, Test 2 is negative and gold standard is positive.
r11  Number of cases where Test 1 is positive, Test 2 is positive and gold standard is negative.
r10  Number of cases where Test 1 is positive, Test 2 is negative and gold standard is negative.
r01  Number of cases where Test 1 is negative, Test 2 is positive and gold standard is negative.
r00  Number of cases where Test 1 is negative, Test 2 is negative and gold standard is negative.

Details

Understanding the parameter names: s & r represent positive and negative results for the gold standard test, respectively. The first digit represents a positive (1) or negative (0) result for Test 1. The second digit represents a positive (1) or negative (0) result for Test 2.

Value

A data frame populated with zeros and ones indicating positive or negative test results which can be passed to the compareR function.
Examples

# build data frame using numbers
dataframeR(3, 3, 3, 3, 3, 3, 3, 3)

Description

Provides a plain English readout of the results of the compareR function.

Usage

interpretR(result)

Arguments

result A list object with class 'compareR' output from the compareR function.

Value

A plain English summary of the findings produced by the compareR function.

Examples

# simulate data
test1 <- c(rep(1, 300), rep(0, 100), rep(1, 55), rep(0, 145))
test2 <- c(rep(1, 280), rep(0, 120), rep(1, 45), rep(0, 155))
gold <- c(rep(1, 400), rep(0, 200))
dat <- data.frame(test1, test2, gold)

# compare with compareR
result <- compareR(dat)

# provide a plain English readout with interpretR
interpretR(result)
summariseR

Description
Summarises descriptive statistics associated with a single binary diagnostic test.

Usage
summariseR(df, dp = 1)

Arguments
df A data frame or matrix with 2 columns (test1, gold). Flexible coding of positive and negative results permitted.
dp Number of decimal places of output in summary tables. Defaults to 1. Kappa defaults to 3 decimal places unless user selects more.

Details
Confidence intervals for prevalence, diagnostic accuracies and predictive values are calculated using the interval for binomial proportions described by Yu et al. (2014). Confidence intervals for likelihood ratios are calculated using the methods recommended by Martín-Andrés and Álvarez-Hernández (2014). Cohen’s kappa is a value between -1 and 1 which describes the agreement of the two tests, taking account of random agreement. A score of zero or less indicates the agreement could be entirely due to chance.

Value
A summary of the descriptive statistics of a binary diagnostic test, compared to a gold standard.

References

Examples
# simulate data
test1 <- c(rep(1, 300), rep(0, 100), rep(1, 55), rep(0, 145))
gold <- c(rep(1, 400), rep(0, 200))
dat <- data.frame(test1, gold)

# summarise descriptive statistics
result <- summariseR(dat, dp = 4)
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