Package ‘CIfinder’

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Type Package

Title Estimate the Confidence Intervals for Predictive Values

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Description Computes confidence intervals for the positive predictive value (PPV) and negative predictive value (NPV) based on varied scenarios. In prospective studies where the proportion of diseased subjects is an unbiased estimate of the disease prevalence, this package provides several methods for calculating the confidence intervals for PPV and NPV including Clopper-Pearson, Wald, Wilson, Agresti-Coull, and Beta. In situations where the proportion of diseased subjects does not correspond to the disease prevalence (e.g. case-control studies), this package provides two types of solutions: 1) three methods for estimating confidence intervals for PPV and NPV via ratio of two binomial proportions including Gart & Nam (1988), Walter (1975), and MOVER-J (Laud, 2017); 2) three direct methods that compute the confidence intervals including Pepe (2003), Zhou (2007), and Delta. See the Details and References sections in the corresponding functions.

License GPL (>= 3)

Encoding UTF-8

RoxygenNote 7.2.0

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

Imports ratesci, stats, Rdpack, kableExtra

RdMacros Rdpack

Depends R (>= 3.6.0)

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R topics documented:

ppv_npv_ci .................................................. 2
single_prop_ci ............................................. 4

Index

ppv_npv_ci  Estimate the confidence intervals for positive predictive value (PPV)
and negative predictive value (NPV) based on different methods

Description

Estimate the confidence intervals for positive predictive value (PPV) and negative predictive value
(NPV) based on different methods

Usage

ppv_npv_ci(
  x1,
  n1,
  x0,
  n0,
  prevalence,
  method = "gart and nam",
  conf.level = 0.95,
  bias_correction = FALSE,
  continuity.correction = FALSE,
  ...
)

Arguments

x1  number of positives for both reference(true) marker and testing marker.

n1  number of positives for reference (true) marker.

x0  number of negatives for both reference(true) marker and testing marker.

n0  number of positives for reference (true) marker.

prevalence  disease prevalence.

method  current support "gart and nam", "walter", "mover-j", "pepe", "zhou", or "delta";
Default is "gart and nam"; Check the Details for additional information for
each method.

conf.level  confidence level. default 0.95.

bias_correction  Logical, indicating whether to apply bias correction in the score denominator.
default FALSE. This argument can be used only for ‘gart and nam’ method.
continuity.correction

logical. default FALSE. 0.5 will be applied if TRUE except the zhou’s method
where \( \frac{z^2}{2} \) is used.

Other arguments passed on to method (e.g., defining the ‘Beta(ai,bi)’ prior distributions in mover-j method for each group (default ‘ai = bi = 0.5’ for Jeffreys method))

Details

Six methods are supported in current version: "gart and nam", "walter", "mover-j", "pepe", "zhou", and "delta".

Among those, gart and nam, walter, and mover-j construct the confidence intervals for PPV and NPV by converting the confidence intervals for the ratio of two binomial proportions (\( \phi = \frac{p_1}{p_0} \)) where \( \phi_{PPV} = \frac{(1-specificity)}{sensitivity} \) and \( \phi_{NPV} = \frac{(1-sensitivity)}{specificity} \). The sensitivity is estimated by \( sensitivity = \frac{x_1}{n_1} \) and the specificity by \( specificity = \frac{x_0}{n_0} \). The confidence intervals for \( \phi_{PPV} \) and \( \phi_{NPV} \) are converted to the corresponding confidence intervals for PPV and NPV using the following equations:

- \( PPV = \frac{\rho}{\rho + (1-\rho) \cdot \phi_{PPV}} \)
- \( NPV = \frac{1-\rho}{(1-\rho) + \rho \cdot \phi_{NPV}} \)

where \( \rho \) denotes the prevalence.

1. The gart and nam method constructs the confidence interval for \( \phi \) based on score method with skewness correction. See the details in the paper listed in the Reference section. This method can be applied to special situations where ‘x1=n1’ or ‘x0=n0’ but not for ‘x1=0’ and/or ‘x0=0’. ‘continuity.correction’ can be considered where ‘x1=0’ and/or ‘x0=0’.

2. The walter method constructs the confidence interval for \( \phi \) based on \( \log(\phi) \). 0.5 is added to ‘x1’, ‘x0’, ‘n1’, and ‘n0’. Thus, no continuity correct should be applied additionally. This method has shown skewness concerns for small ratios and sample sizes.

3. The mover-j method constructs the confidence interval for \( \phi \) from separate intervals for the individual group rates (i.e., \( p_1 \) and \( p_0 \)). By applying the equal-tailed Jeffreys method (default 0.5 to each group), it may achieve a skewness-corrected interval for \( \phi \).

The pepe, zhou, and delta are three direct confidence interval methods for PPV and NPV.

4. The pepe method finds the confidence intervals for PPV and NPV via diagnostic likelihood ratios (DLR) and associated \( \logit(PPV) \) and \( \logit(NPV) \). This method is not applicable for special cases when ‘x1=0’, ‘x0=0’, ‘x1=n1’ or ‘x0=n0’. Continuity correction should be considered for those special cases.

5. The zhou method can return confidence intervals from the four methods described in the paper. Without continuity correction, it will return the confidence intervals for PPV and NPV based on standard delta method and based on logit transformed method. If continuity.correction=TRUE, \( \frac{z^2}{2} \) will be added to ‘x1’, ‘x0’, ‘n1’, and ‘n0’, and the function will return the adjusted and adjusted logit confidence intervals as described in the paper.

6. The delta method constructs the confidence intervals based on the Wald-type formulation. The estimates and variances of PPV and NPV are calculated based equations described in the Zhou’s paper listed in the Reference section.
Value

A list object contains the method and the estimates of sensitivity, specificity, PPV, NPV and their confidence intervals.

References


Examples

ppv_npv_ci(60, 65, 113, 113, prevalence = 0.02)

```
single_prop_ci

Compute the confidence interval for a single proportion based on different methods

Description

Compute the confidence interval for a single proportion based on different methods

Usage

single_prop_ci(
  x, 
n, 
method = "all", 
alternative = "two.sided", 
conf.level = 0.95, 
prior = c(1, 1)
)

Arguments

x number of successes
n number of trials
method one of these options "all", "clopper.pearson", "wald", "wislon", "wislon.correct", "agresti", or "beta"
alternative indicates "two.sided", "one.sided"
conf.level confidence level
prior the prior values for "beta" method
single_prop_ci

Value

Estimated confidence intervals for the probability of success

Examples

single_prop_ci(53, 57, method = "all")
Index

ppv_npv_ci, 2

single_prop_ci, 4