

Package ‘scindex’

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Title Strategic Convergence Index for Inter-Rater Reliability

Version 0.1.0

Description Inter-rater reliability analysis for binary classification tasks involving two or more raters within a signal detection-theoretic framework. User-supplied rating data are standardised into a common long-format structure. The package automatically computes Cohen's kappa for two raters and Fleiss' kappa for multiple raters. When ground-truth labels are available, rater-specific hit rates, false-alarm rates, sensitivity, specificity, and decision thresholds are estimated from observed classification responses using standard signal detection-theoretic transformations (DeCarlo, 1998) [<doi:10.1037/1082-989X.3.2.186>](https://doi.org/10.1037/1082-989X.3.2.186). The package implements the Strategic Convergence Index (SCI; Ganeselli, 2026) [<doi:10.1177/00131644261417643>](https://doi.org/10.1177/00131644261417643), defined as $SCI = 1 - [\text{Var}(t_i) / \text{Var}_{\text{max}}]$, where $\text{Var}(t_i)$ denotes the variance of rater-specific decision thresholds and Var_{max} denotes the reference variance under maximal threshold dispersion. SCI quantifies convergence in rater decision criteria beyond observed agreement alone and complements classical agreement coefficients by distinguishing agreement in observed categorical outcomes from convergence in latent decision thresholds under an explicit signal detection-theoretic model of categorical judgment. The package provides structured summaries and threshold-based diagnostics for applications in which similar agreement coefficients may reflect substantively different underlying decision criteria across raters.

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Encoding UTF-8

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estimate_sdt_thresholds

Estimate SDT Decision Thresholds

Description

Internal utility for estimating signal-detection-theoretic decision thresholds from binary ratings and observed truth labels.

Usage

```
estimate_sdt_thresholds(
  data,
  item_col,
  rater_col,
  rating_col,
  truth_col,
  positive = 1
)
```

Arguments

data	Standardized long-format data frame.
item_col	Character string identifying the item column.
rater_col	Character string identifying the rater column.
rating_col	Character string identifying the rating column.
truth_col	Character string identifying the truth column.
positive	Positive class value.

Details

For each rater, the function computes:

- hit rate;
- false-alarm rate;
- SDT decision threshold.

Thresholds are estimated as:

$$t_i = -\frac{1}{2}[z(H_i) + z(F_i)]$$

where:

- H_i is the hit rate;
- F_i is the false-alarm rate;
- $z(\cdot)$ is the inverse standard normal CDF.

A log-linear correction is applied to avoid infinite z-values.

Value

A list containing:

thresholds Data frame with SDT quantities for each rater.

mean_threshold Mean threshold across raters.

threshold_variance Variance of thresholds.

References

- DeCarlo, L. T. (1998). Signal detection theory and generalized linear models. *Psychological Methods*, 3(2), 186–205. <https://doi.org/10.1037/1082-989X.3.2.186>
- Macmillan, N. A., & Creelman, C. D. (2004). *Detection theory: A user's guide* (2nd ed.). New York, NY: Psychology Press. <https://doi.org/10.4324/9781410611147>

print.scindex_fit *Print a scindex Object*

Description

Print method for objects of class "scindex_fit".

Usage

```
## S3 method for class 'scindex_fit'  
print(x, digits = 3, ...)
```

Arguments

x	An object of class "scindex_fit".
digits	Number of digits to print.
...	Additional arguments (unused).

Details

The method displays:

- agreement coefficient;
- agreement type;
- SCI when available;
- basic sample information.

Value

Invisibly returns x.

scindex *Compute Agreement and the Strategic Convergence Index*

Description

scindex() computes classical inter-rater agreement and, when a ground-truth variable is available, the Strategic Convergence Index (SCI). The function automatically returns Cohen's kappa for two raters and Fleiss' kappa for more than two raters.

Usage

```
scindex(
  data,
  item,
  rater,
  rating,
  truth = NULL,
  positive = 1,
  variance_bounds = NULL
)
```

Arguments

<code>data</code>	A data frame containing item identifiers, rater identifiers, ratings, and optionally ground-truth labels.
<code>item</code>	Unquoted column name identifying the rated item or case.
<code>rater</code>	Unquoted column name identifying the rater.
<code>rating</code>	Unquoted column name containing the categorical rating. In the current version, ratings must be binary.
<code>truth</code>	Optional unquoted column name containing the ground-truth label. If supplied, SDT thresholds and SCI are computed.
<code>positive</code>	Value identifying the positive class. Defaults to 1.
<code>variance_bounds</code>	Optional numeric vector of length 2 defining the lower and upper bounds used to compute the reference variance for SCI. If NULL, bounds are derived from the estimated thresholds.

Details

SCI is computed from signal-detection-theoretic decision thresholds and should be interpreted as a model-based index of convergence in rater decision criteria, not as a replacement for agreement coefficients.

Value

An object of class "scindex_fit" containing the agreement coefficient, its type, SDT thresholds when available, SCI when available, and diagnostic information.

Examples

```
ratings <- data.frame(
  item = rep(1:6, each = 2),
  rater = rep(c("A", "B"), times = 6),
  rating = c(1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1),
  truth = rep(c(1, 0, 1, 1, 0, 1), each = 2)
)

fit <- scindex(
```

```
data = ratings,  
item = item,  
rater = rater,  
rating = rating,  
truth = truth  
)  
  
fit
```

scindex_example

Example Binary Inter-Rater Dataset

Description

Simulated binary classification ratings from two raters across eight items, including ground-truth labels.

Usage

```
data(scindex_example)
```

Format

A data frame with 16 rows and 4 variables:

item Item identifier.

rater Rater identifier.

rating Binary rating assigned by the rater.

truth Ground-truth binary classification.

Details

The dataset illustrates the computation of Cohen's kappa and the Strategic Convergence Index (SCI).

Source

Simulated example data.

Examples

```
data(scindex_example)  
  
fit <- scindex(  
  data = scindex_example,  
  item = item,  
  rater = rater,
```

```
    rating = rating,  
    truth = truth  
  )  
  
  fit  
  summary(fit)
```

scindex_example_multi *Example Binary Inter-Rater Dataset with Multiple Raters*

Description

Simulated binary classification ratings from three raters across eight items, including ground-truth labels.

Usage

```
data(scindex_example_multi)
```

Format

A data frame with 24 rows and 4 variables:

item Item identifier.

rater Rater identifier.

rating Binary rating assigned by the rater.

truth Ground-truth binary classification.

Details

The dataset illustrates the computation of Fleiss' kappa and the Strategic Convergence Index (SCI) in a multi-rater setting.

Source

Simulated example data.

Examples

```
data(scindex_example_multi)  
  
fit <- scindex(  
  data = scindex_example_multi,  
  item = item,  
  rater = rater,  
  rating = rating,  
  truth = truth
```

```
)  
fit  
summary(fit)
```

summary.scindex_fit *Summarize a scindex Object*

Description

Summary method for objects of class "scindex_fit".

Usage

```
## S3 method for class 'scindex_fit'  
summary(object, digits = 3, ...)
```

Arguments

object	An object of class "scindex_fit".
digits	Number of digits to print.
...	Additional arguments (unused).

Details

The method returns a structured summary including the agreement coefficient, SCI when available, SDT threshold estimates, and basic diagnostic information.

Value

Invisibly returns object.

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