Package 'neutroSurvey'

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Type Package

Title Neutrosophic Survey Data Analysis

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Description Apply neutrosophic regression type estimator and performs neutrosophic interval analysis including metric calculations for survey data.

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Encoding UTF-8

Depends R (>= 3.5.0)

Imports moments, stats

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

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NeedsCompilation no

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Contents

`calculate_all_mse_neutrosophic` *Calculate All MSE Neutrosophic*

Description

Computes various Mean Squared Error (MSE) estimates for neutrosophic interval data using different adjustment methods.

Usage

```
calculate_all_mse_neutrosophic(
  theta_L,
  theta_U,
  Y_L,
  Y_U,
  X_L,
  X_U,
  Cx_L,
  Cx_U,
  Cy_L,
  Cy_U,
  rho_L,
  rho_U,
  B_L,
  B_U
)
```

Arguments

`theta_L`	Lower theta value (1/n_L - 1/N_L)
`theta_U`	Upper theta value (1/n_U - 1/N_U)
`Y_L`	Lower study mean
`Y_U`	Upper study mean
`X_L`	Lower auxiliary mean
`X_U`	Upper auxiliary mean
`Cx_L`	Lower auxiliary CV
`Cx_U`	Upper auxiliary CV
`Cy_L`	Lower study CV
`Cy_U`	Upper study CV
`rho_L`	Lower correlation
`rho_U`	Upper correlation
`B_L`	Lower kurtosis
`B_U`	Upper kurtosis

Value

A list containing five types of MSE estimates:

- MSE - Standard MSE estimates (Lower, Upper)
- MSE1 - Ratio-adjusted MSE estimates
- MSE2 - Kurtosis-adjusted MSE estimates
- MSE_exp - Exponential MSE estimates
- MSE_r - Regression MSE estimates

Author(s)

Neha Purwar, Kaustav Aditya, Pankaj Das and Bharti

Examples

```
# First compute metrics from data
data(japan_neutro)
metrics <- compute_all_metrics(japan_neutro)

# Define population parameters (non-interactive example)
inputs <- list(theta_L = 0.01, theta_U = 0.02)

# Calculate all MSE types
mse_results <- calculate_all_mse_neutrosophic(
  inputs$theta_L, inputs$theta_U,
  metrics$mean_interval_Y[1], metrics$mean_interval_Y[2],
  metrics$mean_interval_X[1], metrics$mean_interval_X[2],
  metrics$cv_interval_X[1], metrics$cv_interval_X[2],
  metrics$cv_interval_Y[1], metrics$cv_interval_Y[2],
  metrics$correlation_results[1], metrics$correlation_results[2],
  metrics$kurtosis_interval_X[1], metrics$kurtosis_interval_X[2]
)

# Print results
print(mse_results)
```

---

calculate_pre *Calculate Percentage Relative Efficiency (PRE)*

Description

Computes the Percentage Relative Efficiency (PRE) of different MSE estimators relative to the regression estimator MSE. PRE values greater than 100 indicate better efficiency than the regression estimator, while values less than 100 indicate worse efficiency.

Usage

```
calculate_pre(result_all_mse)
```

Arguments

`result_all_mse` A list containing MSE results from `calculate_all_mse_neutrosophic`

Value

A list containing PRE values for each estimator type:

- PRE_t0 - PRE for standard MSE estimator
- PRE_t1 - PRE for ratio-adjusted MSE estimator
- PRE_t2 - PRE for kurtosis-adjusted MSE estimator
- PRE_exp - PRE for exponential MSE estimator
- PRE_r - Reference value (100) for regression estimator

See Also

`calculate_all_mse_neutrosophic` for generating the input MSE values

Examples

```
data(japan_neutro)
metrics <- compute_all_metrics(japan_neutro)
mse_results <- calculate_all_mse_neutrosophic(
  0.01, 0.02,
  metrics$mean_interval_Y[1], metrics$mean_interval_Y[2],
  metrics$mean_interval_X[1], metrics$mean_interval_X[2],
  metrics$cv_interval_X[1], metrics$cv_interval_X[2],
  metrics$cv_interval_Y[1], metrics$cv_interval_Y[2],
  metrics$correlation_results[1], metrics$correlation_results[2],
  metrics$kurtosis_interval_X[1], metrics$kurtosis_interval_X[2]
)
pre_results <- calculate_pre(mse_results)
print(pre_results)
```

`compute_all_metrics` *Compute Neutrosophic Interval Metrics*

Description

Calculates various metrics for neutrosophic interval data including means, standard deviations, CVs, kurtosis, and correlations between interval-valued variables.

Usage

```
compute_all_metrics(data)
```

Arguments

`data`	A data frame containing columns 'Auxili_min', 'Auxili_max', 'Study_min', and 'Study_max'

Value

A list containing all calculated metrics with components:

- mean_interval_X - Mean interval for auxiliary variable (min, max)
- subtracted_intervals_X - Data frame of subtracted intervals for auxiliary
- sd_interval_X - Standard deviations for auxiliary (min, max)
- cv_interval_X - Coefficients of variation for auxiliary (min, max)
- kurtosis_interval_X - Kurtosis values for auxiliary (min, max)
- mean_interval_Y - Mean interval for study variable (min, max)
- subtracted_intervals_Y - Data frame of subtracted intervals for study
- sd_interval_Y - Standard deviations for study (min, max)
- cv_interval_Y - Coefficients of variation for study (min, max)
- correlation_results - Correlation between intervals (rho_L, rho_U)

Author(s)

Neha Purwar, Kaustav Aditya, Pankaj Das and Bharti

Examples

```
data(japan_neutro)
metrics <- compute_all_metrics(japan_neutro)

# View mean intervals
cat("Auxiliary Mean Interval:", metrics$mean_interval_X, "\n")
cat("Study Mean Interval:", metrics$mean_interval_Y, "\n")

# View correlation results
cat("Correlation between intervals (rho_L, rho_U):",
    metrics$correlation_results, "\n")
```

`format_mse_results` *Format MSE Results for Neutrosophic Survey Data Analysis*

Description

Formats the output of `calculate_all_mse_neutrosophic` into a human-readable string that clearly displays all five types of MSE estimates with their interval values.

Usage

```
format_mse_results(mse_results)
```

Arguments

`mse_results`	A list containing MSE results from `calculate_all_mse_neutrosophic`

Details

The function takes the MSE results list and formats it to show:

- Standard MSE estimates
- Ratio-adjusted MSE estimates
- Kurtosis-adjusted MSE estimates
- Exponential MSE estimates
- Regression MSE estimates

Value

A formatted character string ready for printing, showing all MSE types with their lower and upper bounds

See Also

`calculate_all_mse_neutrosophic` for generating the input for this function

Examples

```
# First calculate MSE results
data(japan_neutro)
metrics <- compute_all_metrics(japan_neutro)
mse <- calculate_all_mse_neutrosophic(
  0.01, 0.02,
  metrics$mean_interval_Y[1], metrics$mean_interval_Y[2],
  metrics$mean_interval_X[1], metrics$mean_interval_X[2],
  metrics$cv_interval_X[1], metrics$cv_interval_X[2],
  metrics$cv_interval_Y[1], metrics$cv_interval_Y[2],
  metrics$correlation_results[1], metrics$correlation_results[2],
  metrics$kurtosis_interval_X[1], metrics$kurtosis_interval_X[2]
)

# Format and print results
cat(format_mse_results(mse))
```

---

get_user_inputs *Get User Inputs for Population and Sample Sizes*

Description

Interactively prompts user for population and sample sizes and calculates theta values (1/n - 1/N) used in MSE calculations.

Usage

```
get_user_inputs()
```

Value

A list containing:

- theta_L - Lower theta value
- theta_U - Upper theta value

Author(s)

Neha Purwar, Kaustav Aditya, Pankaj Das and Bharti

Examples

```
if(interactive()){
# Interactive example (run in console)
inputs <- get_user_inputs()

# The function will prompt:
# Enter value for population size_L: 1000
# Enter value for population size_U: 2000
# Enter value for sample_size_L: 100
# Enter value for sample_size_U: 200
}
```

---

japan_neutro *Japan Neutrosophic Interval Dataset*

Description

A dataset containing interval-valued measurements from Japan, suitable for neutrosophic statistical analysis. The data includes both auxiliary and study variables with their minimum and maximum bounds.

Usage

```
data(japan_neutro)
```

Format

A data frame with 31 observations and 4 variables:

Auxili_min Numeric vector representing the lower bounds of the auxiliary variable

Auxili_max Numeric vector representing the upper bounds of the auxiliary variable

Country Non-numeric vector representing country names

Sex Non-numeric vector representing sex of particapant i.e. male or female

Study_min Numeric vector representing the lower bounds of the study variable

Study_max Numeric vector representing the upper bounds of the study variable

Year Numeric vector representing year on which the data is collected

Examples

```
# Load the dataset
data(japan_neutro)

# View the first few rows
head(japan_neutro)

# Calculate basic metrics
metrics <- compute_all_metrics(japan_neutro)
print(metrics$mean_interval_X)  # Mean of auxiliary variable
print(metrics$mean_interval_Y)  # Mean of study variable
```

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