Package ‘MethodCompare’

October 12, 2016

Type Package

Title Bias and Precision Plots to Compare Two Measurements with Possibly Heteroscedastic Measurement Errors

Version 0.1.0

Date 2015-11-6

Author Mingkai Peng, Patrick Taffe, Tyler Williamson

Maintainer Mingkai Peng <mpeng@ucalgary.ca>

Description Implementation of the methodology from the paper titled ``Effective plots to assess bias and precision in method comparison studies'' published in Statistical Methods in Medical Research, P. Taffe (2016) <doi:10.1177/0962280216666667>.

Depends R (>= 2.10),nlme

Imports graphics,stats

Repository CRAN

License GPL-3

LazyData TRUE

RoxygenNote 5.0.1

NeedsCompilation no

Date/Publication 2016-10-12 00:37:13

R topics documented:

bias_plot *Plot used to visually assess the amount of bias of a new measurement method relative to a reference standard*

Description

This function draws the "bias plot" which is used to visually assess the bias of the new method relative to a reference method. It is obtained by graphing a scatter plot of y_{1ij} (new method) and y_{2ij} (reference method) versus the BLUP of y2 along with the two regression lines, and adds a second scale on the right showing the relationship between the estimated amount of bias and BLUP of y2.

Usage

```
bias_plot(object)
```

Arguments

object	an object retunred by a call to measure_compare

Author(s)

Mingkai Peng

Examples

```
### load the data
data(data1)
### analysis
measure_model <- measure_compare(data1)
### Bias plot
bias_plot(measure_model)
```

bland_altman_plot *Bland and Atlman's limits of agreement plot*

Description

This function produces Bland and Altman's Limits of Agreement plot (LoA) when there are repeated measurements with possibly heteroscedastic measurement errors.

Usage

```
bland_altman_plot(data, new = "y1", Ref = "y2", ID = "id", fill = TRUE)
```

Arguments

`data`	a dataframe contains the object identification number (id), the measurement values from new measurement method (y1) and those from the reference standard (y2)
`new`	specify the variable name or location for the new measurement method
`Ref`	specify the variable name or location for the reference measuerment method
`ID`	specify the variable name for location for the subject identification number (id)
`fill`	logical. if `TRUE` use the avarage value for new methods to fill out the missing value (only useful for drawing a plot with all the measurements by the reference standard)

Details

This functions computes the limits of agreement (LoA) when there are repeated measurements and possibly the measurement error are heteroscedastic

Author(s)

Mingkai Peng

Examples

```
### Load the data
data(data1)
### Bland and Altman's plot
bland_altman_plot(data1)
```

`compare_plot` *Plot used to visualize the recalibration of the new method after estimating the bias*

Description

This function allows the visualization of the bias-corrected values (i.e. recalibrated values, variable y1_corr) of the new measurement method.

Usage

```
compare_plot(object)
```

Arguments

`object`	an object retunred by a call to measure_compare

Author(s)

Mingkai Peng

Examples

```
### load the data
data(data1)
### analysis
measure_model <- measure_compare(data1)
### compare plot
compare_plot(measure_model)
```

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data1 *Simulated dataset 1*

Description

In the simulated dataset 1, each subject has 1 measurement value from the new method and 10 to 15 measurement values from the reference method. Compared to the reference method, the new method has differential bias of -4 and proportional bias of 1.2. Variance of the new method is smaller than that for the referene method.

Usage

```
data1
```

Format

An object of class `data.frame` with 1255 rows and 3 columns.

Details

@format A data frame with three variables:

- `id` identification number for subjects
- `y1` values from the new measurement method
- `y2` values from the reference measurement method

Dataset 1 was created based on the following equations:

$$y_{1i} = -4 + 1.2x_i + \varepsilon_{1i}, \varepsilon_{1i} \mid x_i \sim N(0, (1 + 0.1x_i)^2)$$

$$y_{2ij} = x_i + \varepsilon_{2ij}, \varepsilon_{2ij} \mid x_i \sim N(0, (2 + 0.2x_i)^2)$$

$$x_i \sim Uniform[10 - 40]$$

for $i = 1, 2, \ldots, 100$, $j = 1, 2, \ldots, n_{2i}$ and the number of repeated measurements for each subject i from the reference standard was $n_{2i} \sim Uniform[10 - 15]$.

`data2` *Simulated dataset 2*

Description

In the simulated dataset 2, each subject has 1 to 5 measurement values from the new method and 10 to 15 measurement values from the reference method. Compared to the reference method, the new method has differential bias of -4 and proportional bias of 1.2. Variance of the new method is smaller than that for the referene method.

Usage

```
data2
```

Format

An object of class `data.frame` with 1239 rows and 3 columns.

Details

@format A data frame with three variables:

- `id` identification number for subjects
- `y1` values from the new measurement method
- `y2` values from the reference measurement method

Dataset 2 was created based on the following equations:

$$y_{1ij} = -4 + 1.2x_i + \varepsilon_{1ij}, \varepsilon_{1ij} \mid x_i \sim N(0, (1 + 0.1x_i)^2)$$

$$y_{2ij} = x_i + \varepsilon_{2ij}, \varepsilon_{2ij} \mid x_i \sim N(0, (2 + 0.2x_i)^2)$$

$$x_i \sim Uniform[10 - 40]$$

for $i = 1, 2, \ldots, 100$, $j = 1, 2, \ldots, n_{1i}/n_{2i}$ and the number of repeated measurements for each subject i from the new and reference method was $n_{1i} \sim Uniform[1-5]$ and $n_{2i} \sim Uniform[10-15]$ respectively.

data3 *Simulated dataset 3*

Description

In the simulated dataset 3, each subject has 1 to 5 measurement values from the new method and 10 to 15 measurement values from the reference method. Compared to the reference method, the new method has differential bias of 3 and proportional bias of 0.9. Variance of the new method is larger than that for the referene method.

Usage

```
data3
```

Format

An object of class `data.frame` with 1250 rows and 3 columns.

Details

@format A data frame with three variables:

- `id` identification number for subjects
- `y1` values from the new measurement method
- `y2` values from the reference measurement method

Dataset 3 was created based on the following equations:

$$y_{1ij} = 3 + 0.9x_i + \varepsilon_{1ij}, \varepsilon_{1ij} \mid x_i \sim N(0, (2 + 0.06x_i)^2)$$

$$y_{2ij} = x_i + \varepsilon_{2ij}, \varepsilon_{2ij} \mid x_i \sim N(0, (1 + 0.01x_i)^2)$$

$$x_i \sim Uniform[10 - 40]$$

for $i = 1, 2, \ldots, 100$, $j = 1, 2, \ldots, n_{1i}/n_{2i}$ and the number of repeated measurements for each subject i from the new and reference method was $n_{1i} \sim Uniform[1-5]$ and $n_{2i} \sim Uniform[10-15]$ respectively.

`measure_compare` *Estimation of the amount of bias of a new measurement method relative to a reference method with possibly heteroscedastic errors*

Description

This function implements the methodology reported in the paper entitled "Effective plots to assess bias and precision in method comparison studies" published in Statistical Methods in Medical Research (P. Taffe, 2015) (to appear).

Usage

```
measure_compare(data, new = "y1", Ref = "y2", ID = "id")
```

Arguments

`data`	a dataframe containing the identification number of the subject (id), the measurement values from the new measurement method (y1) and those from the reference methods).
`new`	specify the variable name or location of the new measurement method
`Ref`	specify the variable name or location of the reference standard
`ID`	specify the variable name for location of the subject identification number

Details

This functions implements the new estimation procedure to assess the agreement between the two measurement methods, as well as Bland & Altman's limits of agreement extended to the setting of possibly heteroscedastic measurement errors.

Value

The function return a list with the following iterms:

- Bias: differential and proportional bias for new method and the associated 95 percent confidence intervals
- Models: list of models fitted in estimation procedure
- Ref: a data frame containing the various variables used to compute the bias and precision plots, as well the smooth standard errors estimates of the reference standard
- New: a data frame containing the various variables used to compute the bias and precision plots, as well the smooth standard errors estimates of the new measurement method

Author(s)

Mingkai Peng

Examples

```
### Load the data
data(data1)
### Analysis
measure_model <- measure_compare(data1)
```

`precision_plot` *Precision plot used to compare the standard deviation of a new measurement method with that of a reference standard with possibly heteroscedastic errors*

Description

This plot allows the visual comparison of the precision (i.e. standard deviation) of the new measurement method with that of a reference standard by creating a scatter plot of the estimated standard deviation against the best linear prediction (BLUP) of the latent variable x.

Usage

```
precision_plot(object)
```

Arguments

`object`	an object retunred by a call to measure_compare

Author(s)

Mingkai Peng

Examples

```
### load the data
data(data1)
### analysis
measure_model <- measure_compare(data1)
### Precision plot
precision_plot(measure_model)
```

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