Package ‘vlda’

October 12, 2022

Type Package

Title Visualization of Multidimensional Longitudinal Data

Version 1.1.5

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Depends R (>= 3.6.0)

Imports dplyr, ggrepel, ggplot2, ggiraph, ggsci

Description Assists in producing a plot that more effectively expresses changes over time for two different types (long format and wide format) using a consistent calling scheme for longitudinal data. It provides the ability to projection supplementary information (supplementary objects and variables) that can often occur in longitudinal data to graphs, as well as provides a new interactive implementation to perform the additional interpretation, so it is also useful for longitudinal data visuals analysis (see <http://lib.pusan.ac.kr/resource/e-article/?app=eds&mod=detail&record_id=edsker.000004649097&db_id=edsker> for more information).

License MIT + file LICENSE

URL https://github.com/pnuwon/vlda

BugReports https://github.com/pnuwon/vlda/issues

Encoding UTF-8

LazyData true

RoxygenNote 7.1.0

NeedsCompilation yes

Repository CRAN

Date/Publication 2020-06-26 08:50:02 UTC

R topics documented:

Depression ......................................................... 2
Depression_column ............................................... 3
Depression data

Description
Data comparing two drugs to treat patients suffering from depression.

Usage

data(Depression)

Format

<table>
<thead>
<tr>
<th>Case</th>
<th>Diagnosis</th>
<th>Drug</th>
<th>1week</th>
<th>2weeks</th>
<th>4weeks</th>
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<tbody>
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</tbody>
</table>

Details
Patients in each group were randomly assigned to standard or new drugs, and the degree of each patient suffering from depression was classified as normal or abnormal after 1 week, 2 weeks, and 4 weeks of treatment.
A data frame with 800 rows and 6 variables
References

Depression_column

**Supplementary data to be added to Depression data**

**Description**
Artificially created data to add the degree and sex of depression after 6 weeks.

**Usage**
data(Depression_column)

**Format**
- **6week.1** A value of 1 indicates that depression is "Abnormal" after 6 weeks
- **6week.2** A value of 1 indicates that depression is "Normal" after 6 weeks
- **sex.1** A value of 1 indicates that the gender is "Male"
- **sex.2** A value of 1 indicates that the gender is "Female"

**Details**
As supplementary variables, for 800 patients, response at fourth time point (after 6 weeks) and gender that could affect depression were added to the columns. Indicator matrix of 800 rows and 4 dummy variables.

<table>
<thead>
<tr>
<th>6weeks.1</th>
<th>6weeks.2</th>
<th>sex.1</th>
<th>sex.2</th>
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<tbody>
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</tbody>
</table>
Supplementary data to be added to Depression data

Description

Artificially generated data to add a placebo effect that affects the degree of depression.

Usage

data(Depression_row)

Format

- **Diagnosis.1** A value of 1 indicates the "Severe" of depression
- **Diagnosis.2** A value of 1 indicates the "Mild" of depression
- **Drug.1** A value of 1 indicates that the drug being taken is a “New drug”
- **Drug.2** A value of 1 indicates that the drug being taken is a “Standard drug”
- **1week.1** A value of 1 indicates that depression is "Abnormal" after 1 week
- **1week.2** A value of 1 indicates that depression is "Normal" after 1 week
- **2week.1** A value of 1 indicates that depression is "Abnormal" after 2 weeks
- **2week.2** A value of 1 indicates that depression is "Normal" after 2 weeks
- **4week.1** A value of 1 indicates that depression is "Abnormal" after 4 weeks
- **4week.2** A value of 1 indicates that depression is "Normal" after 4 weeks

<p>| | | | | |</p>
<table>
<thead>
<tr>
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Details

Supplementary 100 objects are patients who take placebo.
Indicator matrix of 100 rows and 10 dummy variables
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</table>

---

### indicator

**Indicator matrix**

**Description**

Convert values of categorical variables into indicator matrix

**Usage**

indicator(x)

**Arguments**

x

A data frame of categorical data coded in numbers.

**Value**

Dummy_variables

**Examples**

```r
## Long form
data(PTSD)
PTSD <- as.data.frame(PTSD)
# Transform a string or continuous class variable into factor
PTSD[,2:4] <- apply(PTSD[,2:4], 2, function(x) ifelse(x >= 3, 1, 0))
PTSD[,5] <- ifelse(PTSD[,5] >= 6, 1, 0)
```
PTSD <- data.frame(lapply(PTSD[, -1], function(x) as.factor(x)))
indicator(PTSD)

## Wide form
data(Depression)
str(Depression)
indicator(Depression[, -1])

---

### Description

Print method for vlda

### Usage

```r
## S3 method for class 'vlda'
print(x, ...)
```

### Arguments

- `x`: A vlda object to print
- `...`: Other arguments not used by this method

### Value

Invisibly returns the result of vlda, which is a list of components that contain the data itself, information etc.

---

### PTSD

Post Traumatic Stress Disorder data

### Description

This data of 316 patients who survived the fire, each patient was measured at 3, 6 and 12 months after the fire.

### Usage

data(PTSD)
Format

- **subject**: Patient number
- **control**: Self-control (A numeric vector)
- **problems**: The number of life problems (A numeric vector)
- **stress**: The number of stress events (A numeric vector)
- **cohesion**: Family cohesion (A numeric vector)
- **time**: Measured at 3, 6 and 12 months after the fire (1: 3 months, 2: 6 months, 3: 12 months)
- **ptsd**: Post traumatic stress disorder, Outcome variable (Categorical vector) (0: No, 1: Yes)

Details

Control, problems, and stress were divided into upper and lower levels based on 3, and cohesion was divided into upper and lower levels based on 6. (0: Low, 1: high)

A data frame with 948 rows and 7 variables

<table>
<thead>
<tr>
<th>subject</th>
<th>control</th>
<th>problems</th>
<th>stress</th>
<th>cohesion</th>
<th>time</th>
<th>ptsd</th>
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<tr>
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<td>2.56</td>
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</table>

Source

Allison (1991, chapter 8).

References

Supplementary data to be added to PTSD data

Description
Artificially created data to add drinking level to PTSD data.

Usage
data(PTSD_column)

Format
Drinking.0 A value of 1 indicates that the degree of drinking is low
Drinking.1 A value of 1 indicates that the degree of drinking is high

Details
The degree of drinking (low, high) that can affect PTSD is added to the columns corresponding to the first to third time points for 316 patients. Indicator matrix of 948 rows and 2 dummy variables.

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<th>Drinking.0</th>
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</table>
Description
Artificially created data to add variables after 18 months to PTSD data.

Usage
data(PTSD_row)

Format
control.0  A value of 1 indicates low control
control.1  A value of 1 indicates high control
problems.0  A value of 1 indicates that the degree of problems is low
problems.1  A value of 1 indicates that the degree of problems is high
stress.0  A value of 1 indicates that the degree of stress is low
stress.1  A value of 1 indicates that the degree of stress is high
cohesion.0  A value of 1 indicates that the degree of stress is low
cohesion.1  A value of 1 indicates that the degree of stress is high
time.1  Zero vector (All elements is zero)
time.2  Zero vector (All elements is zero)
time.3  Zero vector (All elements is zero)
ptsd.0  A value of 1 indicates a low post-traumatic stress disorder
ptsd.1  A value of 1 indicates a high post-traumatic stress disorder

Details
This data is a long form of control, problem, stress, stress, stress and PTSD added to the row, and
is intended for 316 patients after 18 months.
Indicator matrix of 316 rows and 13 dummy variables.

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Respiratory

Patient’s respiratory status data

**Description**

This is part of the data on the patient’s respiratory status.

**Usage**

```r
data(Respiratory)
```

**Format**

- **subject**: Number of patients
- **gender**: Patient gender (0: Female, 1: Male)
- **age**: Patient age (0: Under 30, 1: Over 30)
- **month**: Measurement time (0: before, 1: 1 month, 2: 2 months)
- **status**: Measurement status after taking placebo, response variable (0: poor, 1: good)

**Details**

57 patients were measured for good and bad by taking 3 measurements before, 1 and 2 months after taking placebo. A data frame with 171 rows and 5 variables.

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Source


References


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vlda

*Visualization of Longitudinal Data Analysis*

---

**Description**

Visualization of multidimensional longitudinal data based on the projection method using the indicator matrix.

**Usage**

```r
vlda(x, object, time, type = c("long", "wide"))
```

**Arguments**

- `x`: A data frame consisting of categorical data coded in numbers. Its `n` samples(`object`) should have been repeatedly measured through multiple time points; its `p` variables will be represented as variable coordinate. To keep track of which observation occurred in which time point, you must have included a variable, `Time`.

- `object`: A vector of length `n` samples. The object who would have made repeatedly measure through multiple time points; the object is indicated by the name of the observation coordinate.

- `time`: A time point of longitudinal data. Accepts a character string that denotes the name of the time variable.

- `type`: A type of longitudinal data.

**Details**

The value returned by vlda is using as the main argument of vlda_plot and vlda_add function, the corresponding model. long-format is that each row is one time point per object So each object has `T` rows. All `T` values for each object are stacked–they’re all in the one column; wide-format is that a object repeated responses will be in a single row, and each response is in a separate column. so \((Y_1, \ldots, Y_T)\) are the response variables obtained at time \(t(= 1, \ldots, T).\) `type = c("long", "wide")`
Value

obs.coordinate  A tibble data class of row coordinates. Each row represents row coordinates and the observations corresponding to each row are included in the obs_list.

var.coordinate  The column coordinate.

Eigen  Summarize the principal inertias (Eigenvalues) that as a result of applying the above algorithm using the indicator matrix.

GOF  Goodness-of-fit of the Approximation for 2-dimensional VLDA plot.

See Also

vlda_add
vlda_plot

Examples

```r
## longform of the PTSD data
data(PTSD)
PTSD <- as.data.frame(PTSD)
PTSD[,2:4] <- apply(PTSD[,2:4], 2, function(x) ifelse(x >= 3, 1, 0))
PTSD[,5] <- ifelse(PTSD[,5] >= 6 , 1, 0)
PTSD <- data.frame(lapply(PTSD, function(x) as.factor(x))
vlda(x = PTSD, object = "subject", time = "time", type = "long")

## Wideform od the Depression data
data(Depression)
head(Depression)
vlda(Depression, object = "Case", time = c("1week", "2weeks", "4weeks"), type = "wide")
vlda(Depression, "Case", c("1week", "2weeks", "4weeks"), "wide")
```

vlda_add  Supplementary Objects and Variables

Description

Add objects or variables with new information to the two-dimensional VLDA plot proposed for multidimensional longitudinal data.

Usage

vlda_add(fit, add.col = NULL, add.row = NULL, time.name = NULL)
Arguments

fit  An object returned by vlda()
add.col  A data matrix. The type of indicator matrix. Additional data sets in column format. $p \geq 2$
add.row  A data matrix. The type of indicator matrix. Additional data sets in row format. Supplemental data should have the same variable name as fit$ind.mat returned by vlda, and if it is not an indicator matrix, you can use it after generate an indicator matrix using indicator function built into vlda.
time.name  If supplemental data to add contains a time variable, it requires argument a character string that specifies the name of the time variable.

Details

The longitudinal data inevitably has the characteristic that supplementary data is added such as:

- Outcome variables measured at additional time points, such as $T + 1, T + 2, \ldots$ after the last time point $T$.
- New objects that are not previously measured.
- Other covariates that indicate the characteristics of objects.

Find coordinates representing objects and variables that are added in the VLDA plot already provided, through a method obtain that find coordinates on low-dimensional space for supplementary elements.

Value

...  Same as the result of vlda
sup.coordinate  A tibble data class. The coordinates of the new object created when adding supplemental data to the already provided vlda plot.

See Also

vlda

Examples

#### Supplementary row and column indicator matrix added ####

```r
### long form ###
data(PTSD)
PTSD <- as.data.frame(PTSD)
PTSD[,2:4] <- apply(PTSD[,2:4], 2, function(x) ifelse(x >= 3, 1, 0))
PTSD[,5] <- ifelse(PTSD[,5] >= 6 , 1, 0)
PTSD <- data.frame(lapply(PTSD, function(x) as.factor(x)))
fit <- vlda(x = PTSD, object = "subject", time = "time", type = "long")
data(PTSD_column) # The degree of drinking that may affect PTSD
PTSD_column <- as.matrix(PTSD_column)
```
### vlda_plot ###

**VLDA Plot**

**Description**

Assists in producing a plot that more effectively expresses changes over time for two different types (long format and wide format) using a consistent calling scheme for longitudinal data. It provides the ability to projection supplementary information (supplementary objects and variables) that can often occur in longitudinal data to graphs, as well as provides a new interactive implementation to perform the additional interpretation, so it is also useful for longitudinal data visuals analysis.

**Usage**

```r
vlda_plot(fit, rename = NULL, interactive = TRUE,
          title = NULL, title.col = NULL, title.size = 15, title.hjust = 0,
          subtitle = NULL, sub.col = NULL, sub.size = 15, sub.hjust = 0,
          labels = NULL, lab.col = NULL, lab.size = NULL, lab.face = NULL,
```
legend.position = "bottom", legend.justification = NULL,
linetype = 2, line.col = "red", font.size = 1.0, var.size = 2.5,
obs.col = "darkgray", obs.size = 2.5, add.obs.col = "#666666",
arrow.col = "orange", arrow.size = 0.5, arrow.type = "closed")

Arguments

fit An object returned by vlda() or supplement()
rename Rename a variable to another name
interactive Use the interactive graphical elements (default TRUE)
title Plot title. If NULL, the title is not shown (default NULL)
title.col Title color (default color is black)
title.size Title font size (default size = 15)
title.hjust Alignment of title (Number from 0 (left) to 1 (right): left-aligned by default)
subtitle Subtitle for the plot which will be displayed below the title
sub.col Sub-title color (default color is black)
sub.size Sub-title font size (default size = 15)
sub.hjust Alignment of sub-title (Number from 0 (left) to 1 (right): left-aligned by default)
labels Legend labels
lab.col Legend labels color
lab.size Legend labels size
lab.face Legend labels font c("plain", "bold", "italic", "bold.italic") default = "plain"
legend.position The position of legends ("none", "left", "right", "bottom", "top", or two-element numeric vector) default is "bottom"
legend.justification Anchor point for positioning legend inside plot ("center" or two-element numeric vector) or the justification according to the plot area when positioned outside the plot
linetype Line types can be specified with: An integer or name: 0 = blank, 1 = solid, 2 = dashed, 3 = dotted, 4 = dotdash, 5 = longdash, 6 = twodash, as shown below:
line.col Axis line color
font.size Font size (left-aligned by default size = 1.0)
var.size Variable coordinate point size of plot
obs.col Observation coordinate point color of plot
obs.size Observation coordinate point size on plot
add.obs.col Color of added observation coordinate points
arrow.col Arrow color (default color = "orange")
arrow.size Arrow size (default size = 0.5)
arrow.type One of "open" or "closed" indicating whether the arrow head should be a closed triangle
Details

Coordinates in opposite directions on each axis can be considered to be different groups. And if the
distance between the coordinates is close, it indicates that the group has a similar tendency. Even if
the explanatory variable is not significant, a small tendency can confirm because the coordinate is
placed in consideration of the relative influence.

Value

\[ \text{Same as the result of vlda} \]

graphics

As a result of vlda, it creates a two-dimensional graph. provides interactive
graphics, so when the mouse cursor points to the observation coordinates, it
provides a tooltip that displays observations of having the same coordinates and
displays the row and column coordinate. In the case of long-form, the tooltip
displays a time point, besides, coordinate having the same time point are filled
with the yellow color on the graph, to make it easier to distinguish the same time
points of observations with colors. In the case of a wide form, the combinations
that the explanatory variables can have are grouped and the coordinates points
of the corresponding observations are shown in yellow on the graph. changes in
time points are indicated by orange arrows on the graph.

See Also

vlda

Examples

### Long form ###

data(PTSD)
PTSD[,2:4] <- apply(PTSD[,2:4], 2, function(x) ifelse(x >= 3, 1, 0))
PTSD[,5] <- ifelse(PTSD[,5] >= 6 , 1, 0)
PTSD <- data.frame(lapply(PTSD, function(x) as.factor(x)))
PTSD
str(PTSD)
head(PTSD, 10)
fit <- vlda(x = PTSD, object = "subject", time = "time", type = "long")
vlda_plot(fit)

### Row and column ###

data(PTSD_row)
data(PTSD_column)
PTSD_row <- as.matrix(PTSD_row)
PTSD_column <- as.matrix(PTSD_column)

fit2 <- vlda_add(fit, add.row = PTSD_row, add.col = PTSD_column)
vlda_plot(fit2)

### Wide form ###

data(Depression)
wide.fit <-
vlda(
  x = Depression,
  object = "Case",
  time = c("1week", "2weeks", "4weeks"),
  type = "wide"
)

vlda_plot(wide.fit)
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