Package ‘TriMatch’

April 8, 2015

License GPL (>= 2)
Title Propensity Score Matching of Non-Binary Treatments
Type Package
Author Jason Bryer <jason@bryer.org>
Maintainer Jason Bryer <jason@bryer.org>
Description Propensity score matching for non-binary treatments.
Version 0.9.4
BugReports https://github.com/jbryer/TriMatch/issues
Depends ggplot2, scales, reshape2, ez, R (>= 3.0)
Imports psych, stats, PSAgraphics, compiler, grid, gridExtra
Suggests MASS, xtable
Date 2013-09-19
NeedsCompilation no
Repository CRAN
Date/Publication 2015-04-08 00:41:04

R topics documented:

TriMatch-package ....................................................... 2
as.data.frame.list .................................................. 3
balance.plot ......................................................... 4
boxdiff.plot ........................................................ 5
covariateBalance ..................................................... 6
distance.euclid ....................................................... 7
distances.plot ........................................................ 8
loess3.plot ........................................................... 8
maximumTreat ........................................................ 9
merge.triangle.matches ............................................. 10
merge.triangle.psa .................................................. 10
This packages provides functions to estimate and visualize propensity score analyses including matching for non-binary treatments.

Author(s)

Jason Bryer <jason@bryer.org>

See Also

PSAgraphics multilevelPSA
as.data.frame.list

Convert a list of vectors to a data frame.

Description

This function will convert a list of vectors to a data frame. This function will handle three different
types of lists of vectors. First, if all the elements in the list are named vectors, the resulting data
frame will have have a number of columns equal to the number of unique names across all vectors.
In cases where some vectors do not have names in other vectors, those values will be filled with NA.

Usage

### S3 method for class 'list'
as.data.frame(x, row.names = NULL, optional = FALSE, ...)

Arguments

- **x** a list to convert to a data frame.
- **row.names** a vector equal to length(x) corresponding to the row names. If NULL, the row
  names will be set to names(x).
- **optional** not used.
- **...** other parameters passed to `data.frame`.

Details

The second case is when all the vectors are of the same length. In this case, the resulting data frame
is equivalent to applying `rbind` across all elements.

The third case handled is when there are varying vector lengths and not all the vectors are named.
This condition should be avoided. However, the function will attempt to convert this list to a data
frame. The resulting data frame will have a number of columns equal to the length of the longest
vector. For vectors with length less than this will fill the row with NAs. Note that this function will
print a warning if this condition occurs.

Value

- a data frame.

Author(s)

- Jason Bryer jason@bryer.org

References

balance.plot

Balance plot for the given covariate.

Description

If the covariate is numeric, boxplots will be drawn with red points for the mean and green error bars for the standard error. For non-numeric covariates a barplot will be drawn.

Usage

balance.plot(x, covar, model, nstrata = attr(attr(tmatch, "triangle.psa"), "nstrata"), label = "Covariate", ylab = "", xlab = NULL, se.ratio = 2, print = TRUE, legend.position = "top", x.axis.labels, x.axis.angle = -45, ...)

Arguments

x results from trimatch.
covar vector of the covariate to check balance of.
model an integer between 1 and 3 indicating from which model the propensity scores will be used.
boxdiff.plot

nstrata  number of strata to use.
label    label for the legend.
ylab     label of the y-axis.
xlab     label of the x-axis.
se.ratio a multiplier for how large standard error bars will be.
print    print the output if the Friedman Rank Sum Test and repeated measures ANOVA
         (for continuous variables).
legend.position
         the position of the legend. See theme.
x.axis.labels labels for the x-axis.
x.axis.angle  angle for x-axis labels.
...    parameters passed to plot.balance.plots.

details

A Friedman rank sum test will be performed for all covariate types, printed, and stored as an attribute
to the returned object named friedman. If a continuous covariate a repeated measures ANOVA will
also be performed, printed, and returned as an attribute named rmanova.

value

a ggplot2 figure or a list of ggplot2 figures if covar is a data frame.

boxdiff.plot  Returns a ggplot2 box plot of the differences.

description

A boxplot of differences between each pair of treatments.

usage

boxdiff.plot(tmatch, out, plot.mean = TRUE, ordering = attr(tmatch, "match.order"), ci.width = 0.5)

arguments

tmatch  the results from trimatch.
out     a vector of the outcome measure of interest.
plot.mean logical indicating whether the means should be plotted.
ordering specify the order for doing the paired analysis, that is analysis will be con-

Description

A boxplot of differences between each pair of treatments.

Usage

boxdiff.plot(tmatch, out, plot.mean = TRUE, ordering = attr(tmatch, "match.order"), ci.width = 0.5)

Arguments

tmatch  the results from trimatch.
out     a vector of the outcome measure of interest.
plot.mean logical indicating whether the means should be plotted.
ordering specify the order for doing the paired analysis, that is analysis will be con-

ci.width  the width for the confidence intervals.
Value

a ggplot2 boxplot of the differences.

covariateBalance Calculate covariate effect size differences before and after stratification.

Description

This function is modified from the cv.bal.psa function in the PSAgraphics package.

Usage

```r
covariateBalance(covariates, treatment, propensity, strata = NULL, int = NULL, tree = FALSE, minsize = 2, universal.psd = TRUE, trM = 0, absolute.es = TRUE, trt.value = NULL, use.trt.var = FALSE, verbose = FALSE, xlim = NULL, plot.strata = TRUE, ...)
```

Arguments

- **covariates**: dataframe of interest
- **treatment**: binary vector of 0s and 1s (necessarily? what if character, or 1, 2?)
- **propensity**: PS scores from some method or other.
- **strata**: either a vector of strata number for each row of covariate, or one number n in which case it is attempted to group rows by ps scores into n strata of size approximately 1/n. This does not seem to work well in the case of few specific propensity values, as from a tree.
- **int**: either a number m used to divide [0,1] into m equal length subintervals, or a vector of cut points between 0 an 1 defining the subintervals (perhaps as suggested by loess.psa). In either case these subintervals define strata, so strata can be of any size.
- **tree**: logical, if unique ps scores are few, as from a recursively partitioned tree, then TRUE will force each ps value to define a stratum.
- **minsize**: smallest allowable stratum-treatment size. If violated, strata is removed.
- **universal.psd**: If 'TRUE', forces standard deviations used to be unadjusted for stratification.
- **trM**: trimming proportion for mean calculations.
- **absolute.es**: logical, if 'TRUE' routine uses absolute values of all effect sizes.
- **trt.value**: allows user to specify which value is active treatment, if desired.
- **use.trt.var**: logical, if true then Rubin-Stuart method using only treatment variance with be used in effect size calculations.
- **verbose**: logical, controls output that is visibly returned.
- **xlim**: limits for the x-axis.
- **plot.strata**: logical indicating whether to print strata.
- **...**: currently unused.
**distance.euclid**

**Details**

Note: effect sizes are calculated as treatment 1 - treatment 0, or treatment B - treatment A.

**Author(s)**

Robert M. Pruzek RMPruzek@yahoo.com
James E. Helmreich James.Helmreich@Marist.edu
KuangNan Xiong harryxkn@yahoo.com

---

**distance.euclid**  
*Euclidean distance calculation.*

**Description**

This method uses a simple Euclidean distance calculation for determining the distances between two matches. That is, |ps1 - ps2|.

**Usage**

```r
distance.euclid(x, grouping, id, groups, caliper, nmatch = Inf)
```

**Arguments**

- `x`  
  vector of propensity scores.
- `grouping`  
  vector or factor identifying group membership.
- `id`  
  vector corresponding to unique identifier for each element in `x` and `grouping`.
- `groups`  
  vector of length two indicating the unique groups to calculate the distance between. The first element will be the rows, the second columns.
- `caliper`  
  a scaler indicating the caliper to use for matching within each step.
- `nmatch`  
  number of smallest distances to retain.

**Value**

a list of length equal to `x`. Each element of the list is a named numeric vector where the values correspond to the distance and the name to the `id`. 
distances.plot  Barplot for the sum of distances.

Description

Barplot for the sum of distances.

Usage

distances.plot(tmatch, caliper = 0.25, label = FALSE)

Arguments

tmatch the results of trimatch.
caliper a vector indicating where vertical lines should be drawn as a factor of the standard deviation. Rosenbaum and Rubin (1985) suggested one quarter of one standard deviation.
label label the bars that exceed the minimum caliper.

See Also

triangle.match

loess3.plot  Loess plot for matched triplets.

Description

This function will create a ggplot2 figure with propensity scores on the x-axis and the outcome on the y-axis. Three Loess regression lines will be plotted based upon the propensity scores from model. Since each model produces propensity scores for two of the three groups, the propensity score for the third group in each matched triplet will be the mean of the other two. If model is not specified, the default will be to use the model that estimates the propensity scores for the first two groups in the matching order.

Usage

loess3.plot(tmatch, outcome, model, ylab = "Outcome",
plot.connections = FALSE, connections.color = "black",
connections.alpha = 0.2, plot.points = geom_point, points.alpha = 0.1,
points.palette = "Dark2", ...)
**Arguments**

- `tmatch`: the results of `trimatch`.
- `outcome`: a vector representing the outcomes.
- `model`: an integer between 1 and 3 indicating from which model the propensity scores will be used.
- `ylab`: the label for the y-axis.
- `plot.connections`: boolean indicating whether lines will be drawn connecting each matched triplet.
- `connections.color`: the line color of connections.
- `connections.alpha`: number between 0 and 1 representing the alpha levels for connection lines.
- `plot.points`: a `ggplot2` function for plotting points. Usually `geom_point` or `geom_jitter`. If NULL no points will be drawn.
- `points.alpha`: number between 0 and 1 representing the alpha level for the points.
- `points.palette`: the color palette to use. See `scale_colour_brewer` and `http://colorbrewer2.org/` for more information.
- `...`: other parameters passed to `geom_smooth` and `stat_smooth`.

**Value**

a `ggplot2` figure.

---

**maximumTreat**

*This method will return at least one treatment from groups one and two within the caliper.*

**Description**

This method will attempt to return enough rows to use each treatment (the first two groups in the matching order) at least once. Assuming `treat1` is the first group in the match order and `treat2` the second, all duplicate `treat1` rows are removed. Next, all `treat2` units not in present in after removing duplicate `treat1` units are identified. For each of those `treat2` units, the matched triplet with the smallest overall distances where `treat2` is one of the matched units is retained.

**Usage**

`maximumTreat(tmatch, ...)`

**Arguments**

- `tmatch`: initial results from `trimatch` that contains all possible matches within the specified caliper.
- `...`: currently unused.
merge.triangle.matches

Merges outcomes with the matched set.

Description

The y parameter should be a subset of the original data used.

Usage

```r
## S3 method for class 'triangle.matches'
merge(x, y, ...)
```

Arguments

- `x`: the result of `trimatch`
- `y`: another data frame or vector to merge with.
- `...`: unused

Value

`x` with the additional column(s) added.

merge.triangle.psa

Merges covariate(s) with the results of `trips`.

Description

The y parameter should be a subset of the original data used.

Usage

```r
## S3 method for class 'triangle.psa'
merge(x, y, ...)
```

Arguments

- `x`: the result of `trips`
- `y`: another data frame or vector to merge with.
- `...`: unused

Value

`x` with the additional column(s) added.
multibalance.plot

Description

A graphic based upon cv_bal_psa function in the PSAGraphics package. This graphic plots the effect sizes for multiple covariated before and after propensity score adjustment.

Usage

multibalance.plot(tpsa, grid = TRUE, cols)

Arguments

tpsa results of trips.
grid if TRUE, then a grid of three plots for each model will be displayed.
cols character vector of covariates (i.e. column names) from the original data to include in the plot. By default all covariates used in the logistic regression model are used.

Value

a ggplot2 figure.

names Results from the 1987 National Medical Expenditure Study

Description

This file was originally prepared by Anders Corr (corr@fas.harvard.edu) who reports on December 8, 2007 that the resulting numbers closely match with those reported in the published article. It was later modified by Jason Bryer (jason@bryer.org) to an R data object to be included in this package. See http://imai.princeton.edu/research/pscore.html for more information

Format

a data frame with 9,708 observations of 12 variables.

Author(s)

United States Department of Health and Human Services. Agency for Health Care Policy and Research

Source

http://imai.princeton.edu/research/pscore.html
References


---

**OneToN**

This method will use a M1-to-M2-to-1 matching.

**Description**

In this method, M2 corresponds to the number of times a treat1 unit can be matched with a treat2 unit. The M1 parameter corresponds to the number of times a treat1 unit can be used in total.

**Usage**

`OneToN(tmatch, M1 = 2, M2 = 1, ...)`

**Arguments**

- `tmatch`: initial results from `trimatch` that contains all possible matches within the specified caliper.
- `M1`: a scaler indicating the number of unique subjects in group one to retain. This applies only to the first group in the matching order.
- `M2`: a scaler indicating the number of unique matches to retain. This applies to the first two groups in the matching order.
- `...`: currently unused.

---

**parallel.plot**

Parallel coordinate plot for the three groups and dependent variable.

**Description**

Creates a ggplot2 figure of a parallel coordinate plot.

**Usage**

`parallel.plot(tmatch, outcome)`
**perpPt**

**Arguments**

- `tmatch` results from `trimatch`
- `outcome` vector of the outcome

**Description**

Internal method for plotting. Finds a point d distance from x, y

**Usage**

```
perpPt(x, y, d = 0.05)
```

**Arguments**

- `x` x coordinate
- `y` y coordinate
- `d` the distance

---

**plot.balance.plots**

*Prints a grid of balance plots.*

**Description**

Prints a grid of balance plots.

**Usage**

```
## S3 method for class 'balance.plots'
plot(x, rows, cols, byrow = TRUE,
     plot.sequence = seq_along(bplots), ...)
```

**Arguments**

- `x` the results of `balance.plot` when a data frame is specified.
- `rows` if `covar` is a data frame of covariates, the number of rows in the grid of figures.
- `cols` if `covar` is a data frame of covariates, the number of columns in the grid of figures.
- `byrow` if TRUE (default), plots will be drawn by rows, otherwise by columns.
- `plot.sequence` the sequence (or subset) of plots to draw.
- `...` currently unused.
plot.triangle.matches  Triangle plot drawing matched triplets.

Description

This plot function adds a layer to plot.triangle.psa drawing matched triplets. If p is supplied, this function will simply draw on top of the pre-existing plot, otherwise plot.triangle.psa will be called first.

Usage

```r
## S3 method for class 'triangle.matches'
plot(x, sample = 0.05,
     rows = sample(nrow(tmatch), nrow(tmatch) * sample), line.color = "black",
     line.alpha = 0.5, point.color = "black", point.size = 3, p, ...)
```

Arguments

- `x`: matched triplets from link(triangle.match).
- `sample`: an number between 0 and 1 representing the percentage of matched triplets to draw.
- `rows`: an integer vector corresponding to the rows in tmatch to draw.
- `line.color`: the line color.
- `line.alpha`: the alpha for the lines.
- `point.color`: color of matched triplet points.
- `point.size`: point size for matched triplets.
- `p`: a ggplot to add the match lines. If NULL, then plot.triangle.psa.
- `...`: other parameters passed to plot.triangle.psa.

Details

If this function calls plot.triangle.psa, it will only draw line segments and points for those data rows that were used in the matching procedure. That is, data elements not matched will be excluded from the figure. To plot all segments and points regardless if used in matching, set p = plot(tpsa).

Value

- a ggplot2 graphic.

See Also

- plot.triangle.psa
- triangle.match
Description

Triangle plot showing the fitted values (propensity scores) for three different models.

Usage

```r
## S3 method for class 'triangle.psa'
plot(x, point.alpha = 0.3, point.size = 5,
     legend.title = "Treatment", text.size = 4, draw.edges = FALSE,
     draw.segments = TRUE, edge.alpha = 0.2, edge.color = "grey",
     edge.labels = c("Model 1", "Model 2", "Model 3"), sample = c(1), ...)
```

Arguments

- `x` : the results from `trips`.
- `point.alpha` : alpha level for points.
- `point.size` : point size.
- `legend.title` : title for the legend.
- `text.size` : text size.
- `draw.edges` : draw edges of the triangle.
- `draw.segments` : draw segments connecting points across two models.
- `edge.alpha` : alpha level for edges if drawn.
- `edge.color` : the color for edges if drawn.
- `edge.labels` : the labels to use for each edge of the triangle.
- `sample` : a vector of length 1 or 3 representing the sample of points to plot. The position of each element corresponds to the groups as returned by `attr(tpsa, 'groups')`. If equal to one, all points will be plotted. Values less than one will plot a percentage of points. Values greater than one exactly that number of points will be plotted.
- `...` : currently unused.

Value

- ggplot2 figure

See Also

- triangle.psa
print.balance.plots  
*Print the results of balance.plot for a data frame of covariates.*

**Description**

Print the results of `balance.plot` for a data frame of covariates.

**Usage**

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

**Arguments**

- `x`  
  the results of `balance.plot` when a data frame is specified.
- `...`  
  parameters passed to `plot.balance.plots` and `summary.balance.plots`.

print.triangle.plot  
*Print method for plot.triangle.psa. The primary purpose is to suppress the "Removed n rows containing missing values" warning printed by ggplot2.*

**Description**

Print method for `plot.triangle.psa`. The primary purpose is to suppress the "Removed n rows containing missing values" warning printed by ggplot2.

**Usage**

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

**Arguments**

- `x`  
  a plot from `plot.triangle.psa`.
- `...`  
  other parameters passed to ggplot2.
print.trimatch.summary

Prints the results of summary.triangle.matches.

Description

This is an S3 generic function to print the results of summary.triangle.matches.

Usage

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

Arguments

- `x`: results of summary.triangle.matches.
- `...`: multiple results of summary.triangle.matches. These must be named. For example, `Method 1 = summary(tmath, outcome)`.

---

segment1

Internal method for plotting. Position along the left side segment.

Description

Internal method for plotting. Position along the left side segment

Usage

```r
segment1(d)
```

Arguments

- `d`: the distance
segment2

Internal method for plotting. Position along the right side segment

Description

Internal method for plotting. Position along the right side segment

Usage

segment2(d)

Arguments

d the distance

star

Returns significance level.

Description

Returns the significance level as stars, or NA if a non-numeric value is passed in.

Usage

star(x)

Arguments

x p-value.

summary.balance.plots

Prints a summary table of the test statistics of each balance plot.

Description

The balance.plot function will create a grid of balance plots if a data frame is provided. The returned object is a list of ggplot2 figures with the statistical tests (i.e. Friedman Rank Sum tests and if a continuous variable, repeated measures ANOVA as well) saved as attributes. This function will return a data frame combining all of those results.

Usage

## S3 method for class 'balance.plots'
summary(object, ...)

Arguments

object: the results of `balance.plot` when a data frame is specified.

Value

a data frame

Description

If an outcome measure is provided this function will perform a Freidman Rank Sum Test and repeated measures ANOVA. If either test has a statistically significant difference (as determined by the value of the `p` parameter), a Pairwise Wilcoxon Rank Sum Test will also be provided.

Usage

```r
## S3 method for class 'triangle.matches'
summary(object, outcome, p = 0.05, ordering = attr(object, "match.order"), ...)
```

Arguments

- **object**: result of `trimatch`
- **outcome**: vector representing the outcome measure.
- **p**: threshold of the `p` value to perform a
- **ordering**: specify the order for doing the paired analysis, that is analysis will be conducted as: `ordering[1] - ordering[2], ordering[1] - ordering[3], and ordering[2] - ordering[3].`

Value

a `trimatch.summary` object.

See Also

`friedman.test, ezANOVA, pairwise.wilcox.test`
summary.triangle.psa  
*Prints the summary results of the logistic regression models.*

**Description**

The `trips` function estimates three separate logistic regression models for each pair of groups. This function will print a combined table of the three summaries.

**Usage**

```r
## S3 method for class 'triangle.psa'
summary(object, ...)
```

**Arguments**

- `object`  
  the results of `trips`.
- `...`  
  currently unused.

---

**summary.unmatched**  
*Provides a summary of unmatched subjects.*

**Description**

Will return as a list and print the percentage of total unmatched rows and percent by treatment.

**Usage**

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

**Arguments**

- `object`  
  results of `unmatched`
- `digits`  
  number of digits to print.
- `...`  
  currently unused.

**Value**

a list of summary results.
trimatch

Creates matched triplets.

Description

Create matched triplets by minimizing the total distance between matched triplets within a specified caliper.

Usage

trimatch(tpsa, caliper = 0.25, nmatch = c(15), match.order, exact, method = maximumtreat, ...)

Arguments

tpsa

the results from trips
caliper

a vector of length one or three indicating the caliper to use for matching within each step. This is expressed in standardized units such that .25 means that matches must be within .25 of one standard deviation to be kept, otherwise the match is dropped.
nmatch

number of closest matches to retain before moving to next edge. This can be Inf in which case all matches within the caliper will be retained through to the next step. For large datasets, evaluating all possible matches within the caliper could be time consuming.
match.order

character vector of length three indicating the order in which the matching algorithm will processes. The default is to use start with the group the middle number of subjects, followed by the smallest, and then the largest.
exact

a vector or data frame of representing covariates for exact matching. That is, matched triplets will first be matched exactly on these covariates before evaluating distances.
method

This is a function that specifies which matched triplets will be retained. If NULL, all matched triplets within the specified caliper will be returned (equivalent to caliper matching in two group matching). The default is maximumtreat that attempts include each treatment at least once. Another option is OneToN which mimicks the one-to-n matching where treatments are matched to multiple control units.
...

other parameters passed to method.

Details

The trips function will estimate the propensity scores for three models. This method will then find the best matched triplets based upon minimizing the summed differences between propensity scores across the three models. That is, the algorithm works as follows:

• The first subject from model 1 is selected.
- The \texttt{nmatch[1]} smallest distances are selected using propensity scores from model 1.
- For each of the matches identified, the subjects propensity score from model 2 is retrieved.
- The \texttt{nmatch[2]} smallest distances are selected using propensity score from model 3.
- For each of those matches identified, the subjects propensity score from model 2 is retrieved.
- The distances is calculated from the first and last subjects propensity scores from model 2.
- The three distances are summed.
- The triplet with the smallest overall distance is selected and returned.

**Examples**

```r
## Not run:
data(turoing)
formu <- ~ Gender + Ethnicity + Military + ESL + EdMother + EdFather + Age + Employment + Income + Transfer + GPA
tpsa <- trips(tutoring, tutoring$treat, formu)
tmatch <- trimatch(tpsa, status=FALSE)
## End(Not run)
```

**trimatch.apply2**

Recursive function to find possible matched triplets using the apply functions.

**Description**

Internal method. This version does not use the exact matching. Instead, this function should be called separately for each grouping.

**Usage**

```r
trimatch.apply2(tpsa, caliper, nmatch, match.order, sd1, sd2, sd3)
```

**Arguments**

- \texttt{tpsa} the results from \texttt{trips}
- \texttt{caliper} a vector of length one or three indicating the caliper to use for matching within each step. This is expressed in standardized units such that .25 means that matches must be within .25 of one standard deviation to be kept, otherwise the match is dropped.
- \texttt{nmatch} number of closest matches to retain before moving to next edge. This can be \texttt{Inf} in which case all matches within the caliper will be retained through to the next step. For large datasets, evaluating all possible matches within the caliper could be time consuming.
- \texttt{match.order} character vector of length three indicating the order in which the matching algorithm will processes. The default is to use start with the group the middle number of subjects, followed by the smallest, and then the largest.
trips

sd1 standard deviation for propensity scores from model 1.
sd2 standard deviation for propensity scores from model 2.
sd3 standard deviation for propensity scores from model 3.

---

trips Estimates propensity scores for three groups

Description

The propensity score is
\[ e(X) = P(W = 1|X) \]

This function will estimate the propensity scores for each pair of groups (e.g. two treatments and one control).

Usage

trips(thedata, treat, formu = ~., groups = unique(treat), nstrata = 5, ...)

Arguments

- thedata: the data frame.
- treat: vector or factor indicating the treatment/control assignment for thedata. Length must be equal to nrow(thedata).
- formu: the logistic regression formula. Note that the dependent variable should not be specified and will be modified.
- groups: a vector of exactly length three corresponding the values in treat for each control/treatment.
- nstrata: the number of strata marks to plot on the edge.
- ... other parameters passed to glm.

Details

\[ PS_1 = e(X_{T_1C}) = Pr(z = 1|X_{T_1C}) \]

\[ PS_2 = e(X_{T_2C}) = Pr(z = 1|X_{T_2C}) \]

\[ PS_3 = e(X_{T_2T_1}) = Pr(z = 1|X_{T_2T_1}) \]
Examples

```r
## Not run:
data(tutoring)
formu <- ~ Gender + Ethnicity + Military + ESL + EdMother + EdFather + Age + Employment + Income + Transfer + GPA
tpsa <- trips(tutoring, tutoring$treat, formu)
head(tpsa)

## End(Not run)
```

### tutoring

Results from a study examining the effects of tutoring services on course grades.

**Description**

- `treat` Treatment indicator.
- `course` The course id the student was enrolled in.
- `grade` The course grade the student earned (4=A, 3=B, 2=C, 1=D, 0=F or W).
- `gender` Gender of the student.
- `ethnicity` Ethnicity of the student, either White, Black, or Other.
- `military` Is the student an active military student.
- `esl` English second language student.
- `edmother` Education level of the mother (1 = did not finish high school; 2 = high school grad; 3 = some college; 4 = earned associate degree; 5 = earned baccalaureate degree; 6 = Earned Master’s degree; 7 = earned doctorate).
- `edfather` Education level of the father (levels same as EdMother).
- `age` Age at the start of the course.
- `employment` Employment level at college enrollment (1 = No; 2 = part-time; 3 = full-time).
- `income` Household income level at college enrollment (1 = <25K; 2 = <35K; 3 = <45K; 4 = <55K; 5 = <70K; 6 = <85K; 7 = <100K; 8 = <120K; 9 = >120K).
- `transfer` Number of transfer credits at the start of the course.
- `gpa` GPA as of the start of the course.
- `gradecode` Letter grade.
- `level` Level of the course, either Lower or Upper.
- `id` Randomly assigned student ID.

**Format**

a data frame with 17 variables.
unmatched

Returns rows from trips that were not matched by trimatch.

Description

This function returns a subset of trips that were not matched by trimatch. All data frame methods work with the returned object but special summary function will provided relevant information.

Usage

unmatched(tmatch)

Arguments

  tmatch the results of trimatch.

Value

  a data frame of unmatched rows.
Index

*Topic analysis
  TriMatch-package, 2
*Topic datasets
  nmes, 11
tutoring, 24
*Topic matching
  TriMatch-package, 2
*Topic propensity
  TriMatch-package, 2
*Topic psa
  TriMatch-package, 2
*Topic score
  TriMatch-package, 2
as.data.frame.list, 3
balance.plot, 4, 13, 16, 18, 19
boxdiff.plot, 5
covariateBalance, 6
cv.bal.psa, 6, 11
data.frame, 3
distance.euclid, 7
distances.plot, 8
ezANOVA, 19
friedman.test, 19
geom_jitter, 9
geom_point, 9
geom_smooth, 9
glm, 23
loess3.plot, 8
maximumTreat, 9, 21
merge.triangle.matches, 10
merge.triangle.psa, 10
multibalance.plot, 11
nmes, 11
OneToN, 12, 21
pairwise.wilcox.test, 19
parallel.plot, 12
perpPt, 13
plot.balance.plots, 5, 13, 16
plot.triangle.matches, 14
plot.triangle.psa, 14, 15, 16
print.balance.plots, 16
print.triangle.plot, 16
print.trimatch.summary, 17
scale_colour_brewer, 9
segment1, 17
segment2, 18
star, 18
stat_smooth, 9
summary.balance.plots, 16, 18
summary.triangle.matches, 17, 19
summary.triangle.psa, 20
summary.unmatched, 20
theme, 5
TriMatch (TriMatch-package), 2
trimatch, 4, 5, 8–10, 12, 13, 19, 21, 25
TriMatch-package, 2
trimatch.apply2, 22
trips, 10, 11, 15, 20–22, 23, 25
tutoring, 24
unmatched, 20, 25