Package ‘CIMTx’

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**Type** Package

**Title** Causal Inference for Multiple Treatments with a Binary Outcome

**Version** 0.1.0

**Description** Different methods to conduct causal inference for multiple treatments with a binary outcome, including regression adjustment, vector matching, Bayesian additive regression trees, targeted maximum likelihood and inverse probability of treatment weighting using different generalized propensity score models such as multinomial logistic regression, generalized boosted models and super learner. For more details, see the paper by Liangyuan Hu (2020) <arXiv:2001.06483> and Jennifer L. Hill (2011) <doi:10.1198/jcgs.2010.08162>.

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**R topics documented:**

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ate_fun

Description

The function estimates OR/RR/RD for ATE. Please use our main function causal_multi_treat.R.

Usage

ate_fun(wt1, wt2, wt3, y, trt_ind)

Arguments

wt1 weight for treatment group 1 in ATE
wt2 weight for treatment group 2 in ATE
wt3 weight for treatment group 3 in ATE
y numeric vector for the binary outcome
trt_ind numeric vector for the treatment indicator

Value

list with 3 elements for ATE effect. It contains

ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

```r
library(CIMTx)
ate_fun(wt1 = 1:100, wt2 = 1:100, wt3 = 1:100, y = 1:100, trt_ind = rep(1:3, c(32,32,36)))
```

Description

The function estimates OR/RR/RD for ATT. Please use our main function causal_multi_treat.R.

Usage

```r
att_fun(wt12, wt13, y, trt_ind)
```

Arguments

- `wt12`: weight for treatment group 2 in ATT
- `wt13`: weight for treatment group 3 in ATT
- `y`: numeric vector for the binary outcome
- `trt_ind`: numeric vector for the treatment indicator

Value

List with 2 elements for ATT effect. It contains

- `ATT12`: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- `ATT13`: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples

```r
library(CIMTx)
att_fun(wt12 = 1:100, wt13 = 1:100, y = 1:100, trt_ind = rep(1:3, c(32,32,36)))
```
**bart_multiTrt**

*Bayesian Additive Regression Trees (BART)*

**Description**

This function implements the BART method. Please use our main function causal_multi_treat.R.

**Usage**

```r
bart_multiTrt(y, x, trt, discard = FALSE, estimand = "ATE", k = 2, ntree = 100, ndpost = 1000, nskip = 1000)
```

**Arguments**

- `y`: numeric vector for the binary outcome
- `x`: dataframe including the treatment indicator and the covariates
- `trt`: numeric vector for the treatment indicator
- `discard`: discarding rules for BART method, inherited from causal_multi_treat.R
- `estimand`: causal estimands. Please select "ATT" or "ATE"
- `k`: For binary y, k is the number of prior standard deviations f(x) is away from +/-3. The bigger k is, the more conservative the fitting will be.
- `ntree`: The number of trees in the sum
- `ndpost`: The number of posterior draws returned
- `nskip`: Number of MCMC iterations to be treated as burn in

**Value**

list with 2 elements for ATT effect. It contains

- **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

- **ATE12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE23**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
**Examples**

```r
library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 3, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs
bart_multiTrt(y=y,x = idata$trtdat, trt = trt_ind, estimand="ATT")
```

---

**bart_multiTrt_ate Bayesian Additive Regression Trees (BART) for ATE estimation**

**Description**

This function implements the BART method when estimand is ATE. Please use our main function causal_multi_treat.R.

**Usage**

```r
bart_multiTrt_ate(y, x, trt, k = 2, discard = "No", ntree = 100,
ndpost = 1000, nskip = 1000)
```

**Arguments**

- `y`: numeric vector for the binary outcome
- `x`: dataframe including the treatment indicator and the covariates
- `trt`: numeric vector for the treatment indicator
- `k`: For binary y, k is the number of prior standard deviations f(x) is away from +/-3. The bigger k is, the more conservative the fitting will be.
- `discard`: discarding rules for BART method, inherited from causal_multi_treat.R
- `ntree`: The number of trees in the sum
- `ndpost`: The number of posterior draws returned
- `nskip`: Number of MCMC iterations to be treated as burn in

**Value**

list with 2 elements for ATT effect. It contains

- **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains
ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples

library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 3, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs

---

**bart_multiTrt_att**  
*Bayesian Additive Regression Trees (BART) for ATE estimation*

---

**Description**

This function implements the BART method when estimand is ATT. Please use our main function causal_multi_treat.R.

**Usage**

```r
bart_multiTrt_att(y, x, trt, k = 2, discard = "No", ntree = 100, ndpost = 1000, nskip = 1000)
```

**Arguments**

- `y`: numeric vector for the binary outcome
- `x`: dataframe including the treatment indicator and the covariates
- `trt`: numeric vector for the treatment indicator
- `k`: For binary y, k is the number of prior standard deviations f(x) is away from +/-3. The bigger k is, the more conservative the fitting will be.
- `discard`: discarding rules for BART method, inherited from causal_multi_treat.R
- `ntree`: The number of trees in the sum
- `ndpost`: The number of posterior draws returned
- `nskip`: Number of MCMC iterations to be treated as burn in
causal_multi_treat

Value

list with 2 elements for ATT effect. It contains

ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples

library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 5, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs
bart_multiTrt_att(y=y, x = idata$trtdat, trt = trt_ind)

causal_multi_treat Estimation of causal effects of multiple treatments

Description

This function estimates the causal effects of multiple treatments with a binary outcome.

Usage

causal_multi_treat(y, x, trt, method, discard = "No", estimand,
trim_alpha = 0.05, SL.library = c("SL.glm", "SL.gam", "SL.knn"))

Arguments

y numeric vector for the binary outcome
x dataframe including the treatment indicator and the covariates
trt numeric vector for the treatment indicator
method methods for causal inference with multiple treatments. Please select one of the following methods:
1. Regression Adjustment: Logistics regression to impute missing outcomes
2. VM Matching: vector matching
3. BART: Bayesian Additive Regression Trees
4. TMLE: Targeted maximum likelihood
5. IPTW-Logistics: Inverse probability of treatment weighting (IPTW) with weights from logistics regression
6. IPTW-Logistics-Trim: IPTW with trimmed weights from logistics regression
7. IPTW-GBM: IPTW with weights from generalized boosted method
8. IPTW-GBM-Trim: IPTW with trimmed weights from generalized boosted method
9. IPTW-Superlearner: IPTW with weights from superlearner
10. IPTW-Superlearner-Trim: IPTW with trimmed weights from superlearner

discard discarding rules for BART method. Please select "No", "Lenient" or "Stringent". The default is "No".
estimand causal estimands. Please select "ATT" or "ATE"
trim_alpha alpha values for IPTW weight trimming. The default is 0.05, which means we truncate upper 95% and lower 5% of the weights for further IPTW estimation. The default is a combination of SL.glm, SL.gam and SL.knn.

Value

list with 2 elements for ATT effect. It contains

ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples

library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 12, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs
# Regression Adjustment
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "Regression Adjustment", estimand = "ATE")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "Regression Adjustment", estimand = "ATT")

# BART with and without discarding
## Not run:
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATE", discard = "No")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATE", discard = "No")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATT", discard = "Stringent")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATT", discard = "Stringent")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATT", discard = "Lenient")
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "BART", estimand = "ATT", discard = "Lenient")

# VM Matching
causal_multi_treat(y = y, x = idata$trtdat, trt = trt_ind, method = "VM Matching", estimand = "ATT")

# IPTW-related methods
causal_multi_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Logistics", estimand = "ATT")
causal_multi_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Logistics", estimand = "ATE")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-GBM", estimand = "ATE")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-GBM-Trim", estimand = "ATE")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Superlearner", estimand = "ATE")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Superlearner-Trim", estimand = "ATE")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Superlearner", estimand = "ATT")
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "IPTW-Superlearner-Trim", estimand = "ATT")

# TMLE
causal_multiple_treatment(y = y, x = idata$trtdat, trt = trt_ind, method = "TMLE", estimand = "ATE")

## End(Not run)
Description

This function generates data to test different causal inference methods.

Usage

data_gen(n, scenario, ratio, overlap, all_confounder)

Arguments

- **n**: total number of units for simulation
- **scenario**: simulation scenario 1 or scenario 2
- **ratio**: ratio of units in the treatment groups
- **overlap**: levels of covariate overlap: Please select: weak, strong, moderate
- **all_confounder**: TRUE or FALSE. overlap is lacking for a variable that is not predictive of the outcome (all_confounder equals to TRUE) or situations when it is lacking for a true confounder (all_confounder equals to FALSE)

Value

list with the 5 elements. Nested within each list, it contains

- **n**: Number of units for simulation
- **trt_ind**: A data frame with number of rows equals to n and 11 columns
- **Y**: Observed binary outcome for 3 treatments
- **Yobs**: Observed binary outcome
- **Est**: True ATE/ATT for RD/RR/OR

Examples

library(CIMTx)
set.seed(3242019)
tdata = data_gen(n = 120, ratio = 1, scenario = 1)
**data_gen_p1**  

*Data generation function for scenario 1*

---

**Description**

This function generates data to test different causal inference methods for scenario 1. Please use our main function `data_gen.R`.

**Usage**

```r
data_gen_p1(n = 11600, ratio = 3, all_confounder = FALSE)
```

**Arguments**

- `n`: total number of units for simulation
- `ratio`: ratio of units in the treatment groups
- `all_confounder`: TRUE or FALSE. overlap is lacking for a variable that is not predictive of the outcome (all_confounder equals to TRUE) or situations when it is lacking for a true confounder (all_confounder equals to FALSE)

**Value**

list with the 5 elements. Nested within each list, it contains

- `n`: Number of units for simulation
- `trt_ind`: A data frame with number of rows equals to n and 11 columns
- `Y`: Observed binary outcome for 3 treatments
- `Yobs`: Observed binary outcome
- `Est`: True ATE/ATT for RD/RR/OR

**Examples**

```r
library(CIMTx)
set.seed(3242019)
data_gen_p1(n = 116, ratio = 3, all_confounder=FALSE)
```
Data generation function for scenario 2 This function generates data to test different causal inference methods for scenario 2. Please use our main function data_gen.R

Usage

data_gen_p2(n = 11600, p = 10, overlap = "weak", all_confounder = TRUE)

Arguments

n total number of units for simulation
p number of predictors
overlap levels of covariate overlap: Please select: weak, strong, moderate
all_confounder TRUE or FALSE. overlap is lacking for a variable that is not predictive of the outcome (all_confounder equals to TRUE) or situations when it is lacking for a true confounder (all_confounder equals to FALSE)

Value

list with the 5 elements. Nested within each list, it contains

n: Number of units for simulation
trt_ind: A data frame with number of rows equals to n and 11 columns
Y: Observed binary outcome for 3 treatments
Yobs: Observed binary outcome
Est: True ATE/ATT for RD/RR/OR

Examples

library(CIMTx)
set.seed(3242019)
data_gen_p2(n = 116, p =10, overlap = "weak", all_confounder = TRUE)
expit

**Description**

This function inverse the logit function.

**Usage**

expit(x)

**Arguments**

- **x**
  - a vector

**Value**

- a vector

**Examples**

```r
library(CIMTx)
expit(1:5)
```

iptw_multiTrt

**Inverse probability of treatment weighting (IPTW)**

**Description**

This function implements the IPTW method. Please use our main function causal_multi_treat.R.

**Usage**

iptw_multiTrt(y, trt, psdat, estimand = "ATE", method, wt1, wt2, wt3, wt12, wt13, trim_alpha, SL.library)

**Arguments**

- **y**
  - numeric vector for the binary outcome
- **trt**
  - numeric vector for the treatment indicator
- **psdat**
  - data frame containing the treatment indicator and covariates
- **estimand**
  - causal estimands, "ATT" or "ATE"
- **method**
  - methods for causal inference with multiple treatments, inherited from causal_multi_treat.R
- **wt1**
  - weight for treatment group 1 in ATE
iptw_multiTrt_ate

wt2 weight for treatment group 2 in ATE
wt3 weight for treatment group 3 in ATE
wt12 weight for treatment group 2 in ATT
wt13 weight for treatment group 3 in ATT
trim_alpha alpha values for IPTW weight trimming, inherited from causal_multi_treat.R
SL.library methods specified with SL.library in Superlearner package, inherited from causal_multi_treat.R

Value
list with 2 elements for ATT effect. It contains
ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
list with 3 elements for ATE effect. It contains
ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples
library(CIMTx)
set.seed(1)
idata = data_gen(n = 50, ratio =1, scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs
iptw_multiTrt(y = y, trt = trt_ind, SL.library = c("SL.glm"),
trim_alpha = 0.05, method = "IPTW-GBM", estimand = "ATT")

iptw_multiTrt_ate Inverse probability of treatment weighting for ATE estimation (IPTW)

Description
This function implements the IPTW method when estimand is ATE. Please use our main function causal_multi_treat.R.

Usage
iptw_multiTrt_ate(y, trt_ind, psdat, wt1, wt2, wt3, method, trim_alpha, SL.library)
iptw_multiTrt_ate

Arguments

y         numeric vector for the binary outcome
trt_ind   numeric vector for the treatment indicator
psdat     data frame containing the treatment indicator and covariates
wt1       weight for treatment group 1 in ATE
wt2       weight for treatment group 2 in ATE
wt3       weight for treatment group 3 in ATE
method    methods for causal inference with multiple treatments, inherited from causal_multi_treat.R
trim_alpha alpha values for IPTW weight trimming, inherited from causal_multi_treat.R
SL.library methods specified with SL.library in Superlearner package, inherited from causal_multi_treat.R

Value

list with 2 elements for ATT effect. It contains

ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples

library(CIMTx)
set.seed(1)
idata = data_gen(n = 50, ratio =1, scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] #exclude treatment indicator
y <- idata$Yobs
iptw_multiTrt_ate(y=y, trt = trt_ind,SL.library = c("SL.glm"),
trim_alpha = 0.05, method = "IPTW-GBM")
iptw_multiTrt_att

Description
This function implements the IPTW method when estimand is ATT. Please use our main function causal_multi_treat.R.

Usage
iptw_multiTrt_att(y, trt, psdat, wt12, wt13, method, trim_alpha, SL.library)

Arguments
- `y`: numeric vector for the binary outcome
- `trt`: numeric vector for the treatment indicator
- `psdat`: data frame containing the treatment indicator and covariates
- `wt12`: weight for treatment group 2 in ATT
- `wt13`: weight for treatment group 3 in ATT
- `method`: methods for causal inference with multiple treatments, inherited from causal_multi_treat.R
- `trim_alpha`: alpha values for IPTW weight trimming, inherited from causal_multi_treat.R
- `SL.library`: methods specified with SL.library in Superlearner package, inherited from causal_multi_treat.R

Value
list with 2 elements for ATT effect. It contains
- **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains
- **ATE12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE23**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

```r
library(CIMTx)
set.seed(1)
idata = data_gen(n = 50, ratio = 1, scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] # exclude treatment indicator
y <- idata$Yobs
iptw_multiTrt_att(y = y, trt = trt_ind, SL.library = c("SL.glm"),
trim_alpha = 0.05, method = "IPTW-GBM")
```

postSumm  
Summarize posterior samples

Description

This function summarize posterior samples of RD, RR and OR. Please use our main function causal_multi_treat.R.

Usage

```r
postSumm(RD_est, RR_est, OR_est)
```

Arguments

- RD_est: vector of estimation for RD
- RR_est: vector of estimation for RR
- OR_est: vector of estimation for OR

Value

list with 2 elements for ATT effect. It contains

- **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

- **ATE12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE23**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

```r
library(CIMTx)
postSumm(RD_est = 1:10, RR_est = 11:20, OR_est = 1:10)
```

Description

This function implements the regression adjustment method. Please use our main function causal_multi_treat.R.

Usage

```r
regadj_multiTrt(y, x, trt, estimand = "ATE", ndpost = 1000)
```

Arguments

- **y**: numeric vector for the binary outcome
- **x**: dataframe including the treatment indicator and the covariates
- **trt**: numeric vector for the treatment indicator
- **estimand**: causal estimands. Please select "ATT" or "ATE"
- **ndpost**: number of independent simulation draws to create

Value

- list with 2 elements for ATT effect. It contains
  - **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
  - **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

- list with 3 elements for ATE effect. It contains
  - **ATE12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
  - **ATE13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
  - **ATE23**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 12, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1]
y <- idata$Yobs
regadj_multiTrt(y = y, x = idata$trtdat,trt = trt_ind, estimand="ATE")

regadj_multiTrt_ate  Regression Adjustment when estimand is ATE

Description

Regression Adjustment when estimand is ATE

Usage

regadj_multiTrt_ate(y, x, trt, ndpost = 1000)

Arguments

y numeric vector for the binary outcome
x dataframe including the treatment indicator and the covariates
trt numeric vector for the treatment indicator
ndpost number of independent simulation draws to create

Value

list with 2 elements for ATT effect. It contains
ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains
ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

```r
library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 12, ratio =1,scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1]
y <- idata$Yobs
regadj_multiTrt_ate(y = y, x = idata$trtdat, trt = trt_ind)
```

**regadj_multiTrt_att**  Regression Adjustment when estimand is ATT

Description

This function implements the regression adjustment method when estimand is ATT. Please use our main function causal_multi_treat.R.

Usage

```r
regadj_multiTrt_att(y, x, trt, ndpost = 1000)
```

Arguments

- `y`: numeric vector for the binary outcome
- `x`: dataframe including the treatment indicator and the covariates
- `trt`: numeric vector for the treatment indicator
- `ndpost`: number of independent simulation draws to create

Value

list with 2 elements for ATT effect. It contains

- **ATT12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATT13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains

- **ATE12**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE13**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
- **ATE23**: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
Examples

```r
library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 12, ratio = 1, scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1]
y <- idata$Yobs
regadj_multiTrt_att(y = y, x = idata$trtdat, trt = trt_ind)
```

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**tmle**

Targeted maximum likelihood (TMLE)

Description

This function implements the TMLE method. Please use our main function causal_multi_treat.R.

Usage

`tmle(y, trt, psdat, ...)`

Arguments

- `y` numeric vector for the binary outcome
- `trt` numeric vector for the treatment indicator
- `psdat` data frame containing the treatment indicator and covariates
- `...` Other arguments

Examples

```r
library(CIMTx)
set.seed(3242019)
idata = data_gen(n = 120, ratio = 1, scenario = 1)
trt_ind <- as.numeric(idata$trtdat$trt_ind)
all_vars <- idata$trtdat[, -1] # exclude treatment indicator
y <- idata$Yobs
psdat = idata$trtdat
tmle(y = y, x = idata$trtdat, trt = trt_ind, psdat = idata$trtdat, SL.library = c("SL.glm"))
```
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<td>This function implements the truncation feature when estimand is ATT. Please use our main function causal_multi_treat.R.</td>
<td>trunc_fun(x, trim_alpha = 0.05)</td>
<td>x vector to be trimmed</td>
<td>vector trimmed</td>
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<td>trim_alpha alpha values for IPTW weight trimming, inherited from causal_multi_treat.R</td>
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<td>vm_multiTrt_att</td>
<td>Vector matching Matching (VM matching)</td>
<td>vm_multiTrt_att(y, x, trt)</td>
<td>y numeric vector for the binary outcome</td>
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<td></td>
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<td>x dataframe including the treatment indicator and the covariates</td>
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<td>trt numeric vector for the treatment indicator</td>
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Value
    list with 2 elements for ATT effect. It contains
    ATT12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
    ATT13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

list with 3 elements for ATE effect. It contains
    ATE12: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
    ATE13: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR
    ATE23: A dataframe containing the estimation, standard error, lower and upper 95% CI for RD/RR/OR

Examples
    library(CIMTx)
    set.seed(1)
    idata = data_gen(n = 1200, ratio = 1, scenario = 1)
    trt_ind <- as.numeric(idata$trtdat$trt_ind)
    all_vars <- idata$trtdat[, -1] # exclude treatment indicator
    y <- idata$Yobs
    vm_multiTrt_att(y = y, x = idata$trtdat, trt = trt_ind)
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