

R package ‘AdjMed’

Title Efficient Adjusted Joint Significance Test and Sobel-Type Confidence Interval for Mediation Effect

Depends R (>= 4.0), MASS, survival

AJS Adjusted Joint Significance Test for Mediation Effect

Description

AJS() is used to perform adjusted joint significance test for mediation effect

Usage

```
AJS(X, M, Y, Z, Delta, Model)
```

Arguments

- X a vector of exposures
- M a matrix of continuous mediators. Rows represent samples, columns represent variables.
- Y a vector of observed outcomes.
- Z a matrix of covariates. Rows represent samples, columns represent variables; Z="null" when the covariates are not available.
- Model the type of outcome. Model= "Linear" for continuous outcome; Model= "Logistic" for binary outcome; Model= "Cox" for time-to-event outcome with Cox model.
- Delta a vector of indicators for Model= "Cox", where 1=uncensored, 0=censored; Delta="null" when Model= "Linear" and Model= "Logistic".

Values

- alpha_est coefficient estimate of exposure (X) → mediator (M)
- alpha_SE the standard error for alpha_est
- beta_est coefficient estimate of mediator (M) → outcome (Y)

beta_SE the standard error for beta_est

P_AJS the p-values of mediation tests

References

Zhang, H. (2023). Efficient adaptive joint significance tests and Sobel-type confidence intervals for mediation effects. arXiv:2302.02288

Examples

```
library(MASS)
library(AdapMed)
p <- 10 # the dimension of mediators
q <- 2
n <- 1000
alpha <- matrix(0,1,p) # the coefficients for X -> M
beta <- matrix(0,1,p) # the coefficients for M -> Y
alpha[1:5] <- 0.2
beta[1:5] <- 0.2
sigma_e <- matrix(0,p,p)
rou <- 0.25 # the correlation of M
for (i in 1:p) {
  for (j in 1:p) {
    sigma_e[i,j]=(rou^(abs(i-j)));
  }
}

X <- matrix(rnorm(n, mean = 0, sd = 1),n,1) # expoure
zeta <- matrix(0.3,p,q) # the coefficients of covariates for X -> M
eta <- matrix(0.5,1,q) # the coefficients of covariates for M -> Y
gamma <- 0.5 # the direct effect
E <- matrix(rnorm(n, mean = 0, sd = 1),n,1)
mu <- matrix(0,p,1)
e <- mvrnorm(n, mu, sigma_e)
Z <- matrix(rnorm(n*q, mean = 0, sd = 1),n,q) # covariates
M <- X%*(alpha) + Z%*t(zeta) + e # the mediators
Y <- X*gamma + M%*t(beta) + Z%*t(eta) + E # the response Y
fit <- AJS(X, M, Y, Z, Delta="null", Model="Linear")
```

Description

ASobel () is used to perform adjusted Sobel-type confidence interval for mediation effect

Usage

ASobel (X, M, Y, Z, Delta, Model,tau)

Arguments

- | | |
|-------|---|
| X | a vector of exposures |
| M | a matrix of continuous mediators. Rows represent samples, columns represent variables. |
| Y | a vector of observed outcomes. |
| Z | a matrix of covariates. Rows represent samples, columns represent variables; Z="null" when the covariates are not available. |
| Model | the type of outcome. Model= "Linear" for continuous outcome; Model= "Logistic" for binary outcome; Model= "Cox" for time-to-event outcome with Cox model. |
| Delta | a vector of indicators for Model= "Cox", where 1=uncensored, 0=censored; Delta="null" when Model= "Linear" and Model= "Logistic". |
| tau | the (1-tau)% confidence level; e.g., tau=0.05 denotes 95% confidence level. |

Values

- | | |
|-----------|---|
| alpha_est | coefficient estimate of exposure (X) \rightarrow mediator (M) |
| alpha_SE | the standard error for alpha_est |
| beta_est | coefficient estimate of mediator (M) \rightarrow outcome (Y) |
| beta_SE | the standard error for beta_est |
| CI_ASobel | the confidence intervals for mediation effects $\alpha*\beta$ |

References

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Examples

```
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p <- 10 # the dimension of mediators
q <- 2
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alpha <- matrix(0,1,p) # the coefficients for X -> M
beta <- matrix(0,1,p) # the coefficients for M -> Y
alpha[1:5] <- 0.2
beta[1:5] <- 0.2
sigma_e <- matrix(0,p,p)
rou <- 0.25 # the correlation of M
for (i in 1:p) {
  for (j in 1:p) {
    sigma_e[i,j]=(rou^(abs(i-j)));
  }
}

X <- matrix(rnorm(n, mean = 0, sd = 1),n,1) # expoure
zeta <- matrix(0.3,p,q) # the coefficients of covariates for X -> M
eta <- matrix(0.5,1,q) # the coefficients of covariates for M -> Y
gamma <- 0.5 # the direct effect
E <- matrix(rnorm(n, mean = 0, sd = 1),n,1)
mu <- matrix(0,p,1)
e <- mvrnorm(n, mu, sigma_e)
Z <- matrix(rnorm(n*q, mean = 0, sd = 1),n,q) # covariates
M <- X%*(alpha) + Z%*t(zeta) + e # the mediators
Y <- X*gamma + M%*t(beta) + Z%*t(eta) + E # the response Y
fit <- ASobel(X, M, Y, Z, Delta="null", Model="Linear",tau=0.05)
```