R package 'AdapMed'

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

Depends R (>= 4.0), MASS, survival

AJS Adaptive Joint Significance Test for Mediation Effect

Description

AJS( ) is used to perform adaptive 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")
```

ASobel Adaptive Sobel-Type Confidence Interval for Mediation Effect

Description

ASobel ( ) is used to perform adaptive 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) → 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
CI_Asobel	the confidence intervals for mediation effects alpha*beta

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 <- ASobel(X, M, Y, Z, Delta="null", Model="Linear",tau=0.05)
```