Package 'caratINT'

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Type Package

Title Interaction Tests with Covariate-Adaptive Randomization

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Description This package implements all of the interaction tests in Zhang and Ma (2024) for interaction testing under covariate-adaptive randomization

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Encoding UTF-8

LazyData true

RoxygenNote 7.3.2

R topics documented:

`modified.test` *The modified interaction test*

Description

Testing the interaction effect based on difference in means interaction effect estimator and modified variance estimator

Usage

```
modified.test(Y, A, S, X, pi, q)
```

Arguments

Y	a numeric vector of observed outcomes. Its length should be the same as the number of subjects.
A	a numeric vector of treatment assignments. Its length should be the same as the number of subjects.
S	a categorical vector of stratum labels. Its length should be the same as the number of subjects.
X	a categorical vector of covariate levels, whose treatment-covariate interaction is of interest.
pi	a numeric value for the target treatment proportion in each stratum.
q	a numeric value indicating the balance level of covariate-adaptive randomizations. Detailed information can be found in Section 2, Ma et al. (2022) and Zhang and Ma (2024).

Details

Testing the interaction effect based on difference in means. It implements the methods as described in Sections 3.1 and 4.1, Zhang and Ma (2024).

Value

The p-value for the test.

References

Ma, W., Tu, F., & Liu, H. (2022). Regression analysis for covariate-adaptive randomization: a robust and efficient inference perspective. *Statistics in Medicine*, 41(29), 5645–5661.

Zhang, L. & Ma, W. (2024). Interaction tests with covariate-adaptive randomization. arXiv preprint arXiv:2311.17445.

Examples

```
#The code replicates the simulation setting of Model 2 in Section 5, Zhang and Ma (2024).
N <- 800
pi <- 0.5
q <- pi*(1-pi)
X_star = runif(N, -1, 1)
X_d = ifelse(X_star > 0, 1, 0)
W = rnorm(N,0,2)
W_d = ifelse(W > 0, 1, 0)
error1 = exp(0.5*X_star)*rnorm(N)
error0 = 0.5*exp(0.5*X_star)*rnorm(N)
S <- stratify(X_d, W_d)
X <- X_d
A <- sample(c(0,1),N,replace=TRUE,prob=c(1-pi,pi))
alphavec <- c(5, 4, 0.5, 1.2, 2, 6)
Y0 <- alphavec[2] +  exp(alphavec[3]*X_star) + alphavec[5]*W + error0
Y1 <- alphavec[1] + exp((alphavec[3] + alphavec[4])*X_star) + alphavec[5]*W+ alphavec[6] * W *X_star + error1
Y <- Y0*(1-A)+Y1*A
modified.test(Y, A, S, X, pi, q)
```

stratified.adjusted.test

The stratified-adjusted interaction test

Description

Testing the interaction effect based on stratified-adjusted difference in means interaction effect estimator and stratified-adjusted variance estimator

Usage

```
stratified.adjusted.test(Y, A, S, X, pi)
```

Arguments

Y	a numeric vector of observed outcomes. Its length should be the same as the number of subjects.
A	a numeric vector of treatment assignments. Its length should be the same as the number of subjects.
S	a categorical vector of stratum labels. Its length should be the same as the number of subjects.
X	a categorical vector of covariate levels, whose treatment-covariate interaction is of interest.
pi	a numeric value for the target treatment proportion in each stratum.

Details

Testing the interaction effect based on stratified-adjusted difference in means. It implements the methods as described in Sections 3.2 and 4.2, Zhang and Ma (2024).

Value

The p-value for the test.

References

Zhang, L. & Ma, W. (2024). Interaction tests with covariate-adaptive randomization. arXiv preprint arXiv:2311.17445.

Examples

```
#The code replicates the simulation setting of Model 2 in Section 5, Zhang and Ma (2024).
N <- 800
pi <- 0.5
X_star = runif(N, -1, 1)
X_d = ifelse(X_star > 0, 1, 0)
W = rnorm(N,0,2)
W_d = ifelse(W > 0, 1, 0)
error1 = exp(0.5*X_star)*rnorm(N)
error0 = 0.5*exp(0.5*X_star)*rnorm(N)
S <- stratify(X_d, W_d)
```

```
X <- X_d
A <- sample(c(0,1),N,replace=TRUE,prob=c(1-pi,pi))
alphavec <- c(5, 4, 0.5, 1.2, 2, 6)
Y0 <- alphavec[2] +  exp(alphavec[3]*X_star) + alphavec[5]*W + error0
Y1 <- alphavec[1] + exp((alphavec[3] + alphavec[4])*X_star) + alphavec[5]*W+ alphavec[6] * W *X_star + error1
Y <- Y0*(1-A)+Y1*A
stratified.adjusted.test(Y, A, S, X, pi)
```

`stratify` *Stratification based on one or more categorical variables*

Description

Generate strata by considering all combinations of covariates' levels

Usage

```
stratify(...)
```

Details

Testing the interaction effect based on difference in means. It implements the methods as described in Sections 3.1 and 4.1, Zhang and Ma (2024).

Value

All level combinations derived from the provided categorical covariates.

Examples

```
#The code shows how to generate strata based on one or more categorical covariates
N <- 800
X_star = runif(N, -1, 1)
X_d = ifelse(X_star > 0, 1, 0)
W = rnorm(N,0,2)
W_d = ifelse(W > 0, 1, 0)
stratify(X_d, W_d)
```

`usual.test` *The usual interaction test*

Description

Testing the interaction effect based on difference in means interaction effect estimator and heteroscedasticity-robust variance estimator (Huber–White)

Usage

```
usual.test(Y, A, S, X, pi)
```

Arguments

Y	a numeric vector of observed outcomes. Its length should be the same as the number of subjects.
A	a numeric vector of treatment assignments. Its length should be the same as the number of subjects.
S	a categorical vector of stratum labels. Its length should be the same as the number of subjects.
X	a categorical vector of covariate levels, whose treatment-covariate interaction is of interest.
pi	a numeric value for the target treatment proportion in each stratum.

Details

Testing the interaction effect based on difference in means. It implements the methods as described in Sections 3.1 and 4.1, Zhang and Ma (2024).

Value

The p-value for the test.

References

Zhang, L. & Ma, W. (2024). Interaction tests with covariate-adaptive randomization. arXiv preprint arXiv:2311.17445.

Examples

```
#The code replicates the simulation setting of Model 2 in Section 5, Zhang and Ma (2024).
N <- 800
pi <- 0.5
X_star = runif(N, -1, 1)
X_d = ifelse(X_star > 0, 1, 0)
W = rnorm(N,0,2)
W_d = ifelse(W > 0, 1, 0)
error1 = exp(0.5*X_star)*rnorm(N)
error0 = 0.5*exp(0.5*X_star)*rnorm(N)
S <- stratify(X_d, W_d)
X <- X_d
A <- sample(c(0,1),N,replace=TRUE,prob=c(1-pi,pi))
alphavec <- c(5, 4, 0.5, 1.2, 2, 6)
Y0 <- alphavec[2] +  exp(alphavec[3]*X_star) + alphavec[5]*W + error0
Y1 <- alphavec[1] + exp((alphavec[3] + alphavec[4])*X_star) + alphavec[5]*W+ alphavec[6] * W *X_star + error1
Y <- Y0*(1-A)+Y1*A
usual.test(Y, A, S, X, pi)
```

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