Package 'STAREG'

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Type Package

Title An Empirical Bayes Approach for Replicability Analysis Across Two Studies

Version 1.0.4

Description A robust and powerful empirical Bayesian approach is developed for replicability analysis of two large-scale experimental studies. The method controls the false discovery rate by using the joint local false discovery rate based on the replicability null as the test statistic. An EM algorithm combined with a shape constraint nonparametric method is used to estimate unknown parameters and functions. [Li, Y. et al., (2024), <doi:10.1371/journal.pgen.1011423>].

License GPL-3

Encoding UTF-8

Depends Rcpp (>= 1.0.9), qvalue

LinkingTo Rcpp, RcppArmadillo

RoxygenNote 7.2.3

NeedsCompilation yes

Author Yan Li [aut, cre, cph],
Xiang Zhou [aut],
Rui Chen [aut],
Xianyang Zhang [aut],
Hongyuan Cao [aut, ctb]

Maintainer Yan Li <yanli_@jlu.edu.cn>

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em_lfdr *EM algorithm to estimate local false discovery rate*

Description

Estimate the local false discovery rate across two studies and apply a step-up procedure to control the FDR of replicability null.

Usage

```
em_lfdr(pa_in, pb_in, pi0a_in, pi0b_in)
```

Arguments

pa_in	A numeric vector of p-values from study 1.
pb_in	A numeric vector of p-values from study 2.
pi0a_in	An initial estimate of the null probability in study 1.
pi0b_in	An initial estimate of the null probability in study 2.

Value

Lfdr	The estimated local false discovery rate for replicability null.
fdr	The adjusted values based on local false discovery rate for FDR control.
xi00	An estimate of the prior probability for joint state (0, 0).
xi01	An estimate of the prior probability for joint state (0, 1).
xi10	An estimate of the prior probability for joint state (1, 0).
xi11	An estimate of the prior probability for joint state (1, 1).
f1	A non-parametric estimate for the non-null probability density function in study 1.
f2	A non-parametric estimate for the non-null probability density function in study 2.

stareg *An empirical Bayes approach for replicability analysis across two studies*

Description

An empirical Bayes approach for replicability analysis across two studies

Usage

```
stareg(pa, pb, init.pi0 = TRUE)
```

Arguments

pa	A numeric vector of p-values from study 1.
pb	A numeric vector of p-values from study 2.
init.pi0	A logistic value for deciding whether to initialize the prior probabilities based on the estimates of pi0's. If true, estimate the marginal pi0's in two studies using qvalue; otherwise, specify pi0_pa = pi_pb = 0.9.

Value

A list:

Lfdr	The estimated local false discovery rate for replicability null.
fdr	The adjusted Lfdr values based on the step-up procedure for FDR control.
xi00	An estimate of the prior probability for joint state (0, 0) in two studies.
xi01	An estimate of the prior probability for joint state (0, 1) in two studies.
xi10	An estimate of the prior probability for joint state (1, 0) in two studies.
xi11	An estimate of the prior probability for joint state (1, 1) in two studies.
f1	A non-parametric estimate for the non-null probability density function in study 1.
f2	A non-parametric estimate for the non-null probability density function in study 2.

Examples

```
# Simulate p-values in two studies
m = 10000
h = sample(0:3, m, replace = TRUE, prob = c(0.9, 0.025, 0.025, 0.05))
states1 = rep(0, m); states2 = rep(0, m)
states1[which(h==2|h==3)] = 1; states2[which(h==1|h==3)] = 1
z1 = rnorm(m, states1*2, 1)
z2 = rnorm(m, states2*3, 1)
p1 = 1 - pnorm(z1); p2 = 1 - pnorm(z2)
# Run STAREG to identify replicable signals
res.stareg = stareg(p1, p2)
sig.idx = which(res.stareg$fdr <= 0.05)
```

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