

# Package ‘swfdr’

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**Title** Science-wise false discovery rate and proportion of true null hypotheses estimation

**Version** 1.6.0

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**Description** This package allows users to estimate the science-wise false discovery rate from Jager and Leek, "Empirical estimates suggest most published medical research is true," 2013, *Biostatistics*, using an EM approach due to the presence of rounding and censoring. It also allows users to estimate the proportion of true null hypotheses in the presence of covariates, using a regression framework, as per Boca and Leek, "A regression framework for the proportion of true null hypotheses," 2015, bioRxiv preprint.

**Depends** R (>= 3.4)

**Imports** stats4, ggplot2, reshape2, stats, dplyr

**License** GPL (>= 3)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.0.1

**Suggests** BiocStyle, knitr, rmarkdown

**VignetteBuilder** knitr

**biocViews** MultipleComparison, StatisticalMethod, Software

**git\_url** <https://git.bioconductor.org/packages/swfdr>

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BMI\_GIANT\_GWAS\_sample *Subset of SNPs from meta-analysis of BMI GWAS study.*

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### Description

A dataset containing 50,000 SNPs and results for their associations with BMI.

### Usage

```
data(BMI_GIANT_GWAS_sample)
```

### Format

A data frame with 50,000 rows and 9 variables:

**SNP** ID for SNP (single nucleotide polymorphism)

**A1** Allele 1 for SNP

**A2** Allele 2 for SNP

**Freq\_MAF\_Hapmap** Frequency of minor allele (MAF) in Hapmap project

**b** Estimated beta for association between SNP and BMI

**se** Estimated standard error (se) for association between SNP and BMI

**p** P-value for association between SNP and BMI

**N** Total sample size considered for association of SNP and BMI

**Freq\_MAF\_Int\_Hapmap** Three approximately equal intervals for the Hapmap MAFs

### Value

Object of class tbl\_df, tbl, data.frame.

### Source

[https://www.broadinstitute.org/collaboration/giant/index.php/GIANT\\_consortium\\_data\\_files#GWAS\\_Anthropometric\\_2015\\_BMI](https://www.broadinstitute.org/collaboration/giant/index.php/GIANT_consortium_data_files#GWAS_Anthropometric_2015_BMI)

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calculateSwfdr	<i>Calculate the science-wise FDR (swfdr)</i>
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**Description**

Calculate the science-wise FDR (swfdr)

**Usage**

```
calculateSwfdr(pValues, truncated, rounded, pi0 = 0.5, alpha = 1,
  beta = 50, numEmIterations = 100)
```

**Arguments**

pValues	Numerical vector of p-values
truncated	Vector of 0s and 1s with indices corresponding to those in pValues; 1 indicates that the p-values is truncated, 0 that it is not truncated
rounded	Vector of 0s and 1s with indices corresponding to those in pValues; 1 indicates that the p-values is rounded, 0 that it is not rounded
pi0	Initial prior probability that a hypothesis is null (default is 0.5)
alpha	Initial value of parameter alpha from Beta(alpha, beta) true positive distribution (default is 1)
beta	Initial value of parameter beta from Beta(alpha, beta) true positive distribution (default is 50)
numEmIterations	The number of EM iterations (default is 100)

**Value**

pi0 Final value of prior probability - estimated from EM - that a hypothesis is null, i.e. estimated swfdr

alpha Final value of parameter alpha - estimated from EM - from Beta(alpha, beta) true positive distribution

beta Final value of parameter beta - estimated from EM - from Beta(alpha, beta) true positive distribution

z Vector of expected values of the indicator of whether the p-value is null or not - estimated from EM - for the non-rounded p-values (values of NA represent the rounded p-values)

n0 Expected number of rounded null p-values - estimated from EM - between certain cutpoints (0.005, 0.015, 0.025, 0.035, 0.045, 0.05)

n Number of rounded p-values between certain cutpoints (0.005, 0.015, 0.025, 0.035, 0.045, 0.05)

**Examples**

```
pVals <- runif(100)
tt <- rr <- rep(0, 100)
resSwfdr <- calculateSwfdr(pValues = pVals, truncated = tt, rounded = rr, numEmIterations=100)
```

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journals_pVals	<i>P-values from abstracts from articles in 5 biomedical journals (American Journal of Epidemiology, BMJ, JAMA, Lancet, New England Journal of Medicine), over 11 years (2000-2010).</i>
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### Description

A dataset containing 15,653 p-values.

### Usage

```
journals_pVals
```

### Format

A tbl data frame with 15,653 rows and 5 variables:

**pvalue** P-value

**pvalueTruncated** Equals to 1 if the p-value is truncated, 0 otherwise

**pubmedID** Pubmed ID of the article

**year** Year of publication

**journal** Journal

### Value

Object of class tbl\_df, tbl, data.frame.

### Source

Code for extracting p-values at: [inst/script/getPvalues.R](#)

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lm_pi0	<i>Estimate pi0(x)</i>
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### Description

Estimate pi0(x)

### Usage

```
lm_pi0(pValues, lambda = seq(0.05, 0.95, 0.05), X, type = "logistic",
       smooth.df = 3, threshold = TRUE)
```

**Arguments**

pValues	Numerical vector of p-values
lambda	Numerical vector of thresholds. Must be in [0,1).
X	Design matrix (one test per row, one variable per column). Do not include the intercept.
type	Type of regression, "logistic" or "linear." Default is logistic.
smooth.df	Number of degrees of freedom when estimating $\pi_0(x)$ with a smoother.
threshold	If TRUE (default), all estimates are thresholded at 0 and 1, if FALSE, none of them are.

**Value**

pi0 Numerical vector of smoothed estimate of  $\pi_0(x)$ . The length is the number of rows in X.

pi0.lambda Numerical matrix of estimated  $\pi_0(x)$  for each value of lambda. The number of columns is the number of tests, the number of rows is the length of lambda.

lambda Vector of the values of lambda used in calculating pi0.lambda

pi0.smooth Matrix of fitted values from the smoother fit to the  $\pi_0(x)$  estimates at each value of lambda (same number of rows and columns as pi0.lambda)

**Examples**

```
X <- seq(-1,2,length=1000) ##covariate
pi0 <- 1/4*X + 1/2 ##probability of being null
nullI <- rbinom(1000,prob=pi0,size=1)> 0 ##generate null/alternative p-values
pValues <- rep(NA,1000) ##vector of p-values
pValues[nullI] <- runif(sum(nullI)) ##null from U(0,1)
pValues[!nullI] <- rbeta(sum(!nullI),1,2) ##alternative from Beta
pi0x <- lm_pi0(pValues=pValues, X=X, smooth.df=3)
```

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