Package ‘Wrench’

May 3, 2024

**Depends** R (>= 3.5.0)

**Type** Package

**Title** Wrench normalization for sparse count data

**Version** 1.22.0

**Description** Wrench is a package for normalization sparse genomic count data, like that arising from 16s metagenomic surveys.

**Imports** limma, matrixStats, locfit, stats, graphics

**License** Artistic-2.0

**LazyData** TRUE

**RoxygenNote** 6.1.0

**Suggests** knitr, rmarkdown, metagenomeSeq, DESeq2, edgeR

**VignetteBuilder** knitr

**biocViews** Normalization, Sequencing, Software

**URL** https://github.com/HCBravoLab/Wrench

**BugReports** https://github.com/HCBravoLab/Wrench/issues

**git_url** https://git.bioconductor.org/packages/Wrench

**git_branch** RELEASE_3_19

**git_last_commit** 4abb0da

**git_last_commit_date** 2024-04-30

**Repository** Bioconductor 3.19

**Date/Publication** 2024-05-02

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Contents

.estimSummary .................................................. 2
.getCondLogWeights ................................................. 3
.getCondWeights .................................................. 3
.getHurdle ....................................................... 4
.getMargWeights .................................................. 4
.getReference ................................................... 5
.gets2 ............................................................ 5
.getWeightedMean .................................................. 6
.getWeightedMedian ............................................... 7
.wrench ........................................................... 7

Index 10

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.estimSummary  Obtain robust means.

Description

Obtain robust means.

Usage

.estimSummary(res, estim.type = "s2.w.mean", ...)

Arguments

res  result structure of wrench
estim.type  estimator type
...  other parameters

Value

a chosen summary statistic
.getCondLogWeights

Log Positive-conditional weight computations for wrench estimators.

Description

Log Positive-conditional weight computations for wrench estimators.

Usage

.getCondLogWeights(res)

Arguments

res result structure of wrench

Value

inverse variance weights when using positive conditional models.

.getCondWeights

Positive-conditional weight computations for wrench estimators.

Description

Positive-conditional weight computations for wrench estimators.

Usage

.getCondWeights(res)

Arguments

res result structure of wrench

Value

positive conditional weights for each sample
.getHurdle

Obtains logistic fits for presence/absence and fitted probabilities of a zero occurring.

Description

This function is used to derive weights for feature-wise compositional estimates. Our (default) intention is to derive these based on average occurrences across the dataset, as just a function of sample depth, and not with particular relevance to groups.

Usage

```
.getHurdle(mat, hdesign = model.matrix(~-1 + log(colSums(mat))),
        pres.abs.mod = TRUE, thresh = FALSE, thresh.val = 1e-08, ...)
```

Arguments

- **mat**: count matrix
- **hdesign**: design matrix for the logistic; the default is usually sufficient.
- **pres.abs.mod**: TRUE if glm regression is for presence or absence. FALSE if glm regression is for counts.
- **thresh**: TRUE if numerically one/zero probability occurrences must be thresholded
- **thresh.val**: if thresh is true, the numerically one/zero probability occurrences is thresholded to this value
- **...**: other parameters

Value

A list with components:

- pi0.fit - list with feature-wise glm.fit objects
- pi0 - matrix with fitted probabilities

.getMargWeights

Marginal weight computations for wrench estimators.

Description

Marginal weight computations for wrench estimators.

Usage

```
.getMargWeights(res, z.adj, ...)
```
**Arguments**

- `res` result structure of `wrench`
- `z.adj` TRUE if the result structure was generated with `wrench` with `z.adj` set to TRUE.
- `...` other parameters

**Value**

inverse marginal variances for robust mean computing

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**Description**

This function generates the reference.

**Usage**

```
.getReference(mat, ref.est = "sw.means", ...)
```

**Arguments**

- `mat` count matrix; rows are features and columns are samples
- `ref.est` reference estimate method
- `...` other parameters

**Value**

the reference to be used for normalization

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**.gets2** Obtain variances of logged counts.

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**Description**

Obtain variances of logged counts.

**Usage**

```
.gets2(mat, design = model.matrix(mat[, ] ~ 1), plot = FALSE,
       ebs2 = TRUE, smoothed = FALSE, ...)
```
.getWeightedMean

Arguments

mat        count matrix; rows are features and columns are samples.
design     model matrix for the count matrix
plot       if the mean-variance trend function (the same as that of voom) needs to be plot.
ebs2       if regularization of variances needs to be performed.
smoothed   TRUE if all the variance estimates must be based on the mean-variance trend function.
...        other parameters

Value

a vector with variance estimates for logged feature-wise counts.

Description

Get weighted means for matrix

Usage

.getWeightedMean(mat, w = rep(1, nrow(mat)))

Arguments

mat        input matrix
w          weights

Value

column-wise weighted means.
### `.getWeightedMedian`

*Get weighted median for matrix*

**Description**

Get weighted median for matrix

**Usage**

```r
.getWeightedMedian(mat, w = rep(1, nrow(mat)))
```

**Arguments**

- `mat`: input matrix
- `w`: weights

**Value**

column-wise weighted means.

### `wrench`

*Normalization for sparse, under-sampled count data.*

**Description**

Obtain normalization factors for sparse, under-sampled count data that often arise with metagenomic count data.

**Usage**

```r
wrench(mat, condition, etype = "w.marg.mean", ebcf = TRUE,
        z.adj = FALSE, phi.adj = TRUE, detrend = FALSE, ...)
```

**Arguments**

- `mat`: count matrix; rows are features and columns are samples
- `condition`: a vector with group information on the samples
- `etype`: weighting strategy with the following options:
  - hurdle.w.mean, the W1 estimator in manuscript.
  - w.marg.mean, the W2 estimator in manuscript. These are appropriately computed depending on whether `z.adj=TRUE` (see below)
  - s2.w.mean, weight by inverse of feature-variances of logged count data.
- `ebcf`: TRUE if empirical bayes regularization of ratios needs to be performed. Default recommended.
z.adj  TRUE if the feature-wise ratios need to be adjusted by hurdle probabilities (arises when taking marginal expectation). Default recommended.

phi.adj TRUE if estimates need to be adjusted for variance terms (arises when considering positive-part expectations). Default recommended.

detrend FALSE if any linear dependence between sample-depth and compositional factors needs to be removed. (setting this to TRUE reduces variation in compositional factors and can improve accuracy, but requires an extra assumption that no linear dependence between compositional factors and sample depth is present in samples).

other parameters

Value

a list with components:

- nf, normalization factors for samples passed. Samples with zero total counts are removed from output.
- ccf, compositional correction factors. Samples with zero total counts are removed from output.
- others, a list with results from intermediate computations.
  - qref, reference chosen.
  - design, design matrix used for computation of positive-part parameters.
  - s2, feature-wise variances of logged count data.
  - r, (regularized) ratios of feature-wise proportions.
  - radj, adjustments made to the regularized ratios based on z.adj and phi.adj settings.

Author(s)

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Examples

#Obtain counts matrix and some group information
require(metagenomeSeq)
data(mouseData)
cntsMatrix <- MRcounts(mouseData)
group <- pData(mouseData)$diet
#Running wrench with defaults
W <- wrench( cntsMatrix, condition=group )
compositionalFactors <- W$ccf
normalizationFactors <- W$nf

#Introducing the above normalization factors for the most
# commonly used tools is shown below.

#If using metagenomeSeq
normalizedObject <- mouseData
normFactors(normalizedObject) <- normalizationFactors
# If using edgeR, we must pass in the compositional factors
require(edgeR)
edgerobj <- DGEList( counts=cntsMatrix,
                 group = as.matrix(group),
                 norm.factors=compositionalFactors )

# If using DESeq/DESeq2
require(DESeq2)
deseq.obj <- DESeqDataSetFromMatrix(countData = cntsMatrix,
                                DataFrame(group),
                                ~ group )
DESeq2::sizeFactors(deseq.obj) <- normalizationFactors
Index

.estimSummary, 2
.getCondLogWeights, 3
.getCondWeights, 3
.getHurdle, 4
.getMargWeights, 4
.getReference, 5
.getWeightedMean, 6
.getWeightedMedian, 7
.gets2, 5

wrench, 7