

# Package ‘MetaNeighbor’

October 16, 2019

**Type** Package

**Title** Single cell replicability analysis

**Version** 1.4.0

**Description** MetaNeighbor allows users to quantify cell type replicability across datasets using neighbor voting.

**biocViews** ImmunoOncology, GeneExpression, GO, MultipleComparison, SingleCell, Transcriptomics

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**Depends** R(>= 3.5)

**Imports** beanplot (>= 1.2), GenomicRanges (>= 1.34.0), gplots (>= 3.0.1), Matrix (>= 1.2), matrixStats (>= 0.54), Rcpp, RColorBrewer (>= 1.1), stats (>= 3.4), SummarizedExperiment (>= 1.12), utils (>= 3.4)

**LinkingTo** Rcpp

**Suggests** knitr (>= 1.17), rmarkdown (>= 1.6), testthat (>= 1.0.2)

**LazyData** true

**RoxygenNote** 6.1.1

**VignetteBuilder** knitr

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

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GOhuman	<i>GOhuman</i>
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### Description

List containing gene symbols for 71 GO function

### Usage

GOhuman

### Format

**genesets** List containing gene symbols for 71 GO function (GO slim terms containing between 50 and 1,000 genes) downloaded from the Gene Ontology Consortium August 2015 <http://www.geneontology.org/page/download-annotations>

### Source

Dataset: <https://github.com/mm-shah/MetaNeighbor/tree/master/data> | Paper: <https://www.biorxiv.org/content/early/2017/06/16/150524>

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GOMouse	<i>GOMouse</i>
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### Description

List containing gene symbols for 10 GO function

### Usage

GOMouse

### Format

**genesets** List containing gene symbols for 10 GO function (GO:0016853, GO:0005615, GO:0005768, GO:0007067, GO:0065003, GO:0042592, GO:0005929, GO:0008565, GO:0016829, GO:0022857) downloaded from the Gene Ontology Consortium August 2015 <http://www.geneontology.org/page/download-annotations>

**Source**

Dataset: <https://github.com/mm-shah/MetaNeighbor/tree/master/data> | Paper: <https://www.biorxiv.org/content/early/2017/06/16/150524>

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MetaNeighbor

*Runs MetaNeighbor*

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**Description**

For each gene set of interest, the function builds a network of rank correlations between all cells. Next, it builds a network of rank correlations between all cells for a gene set. Next, the neighbor voting predictor produces a weighted matrix of predicted labels by performing matrix multiplication between the network and the binary vector indicating cell type membership, then dividing each element by the null predictor (i.e., node degree). That is, each cell is given a score equal to the fraction of its neighbors (including itself), which are part of a given cell type. For cross-validation, we permute through all possible combinations of leave-one-dataset-out cross-validation, and we report how well we can recover cells of the same type as area under the receiver operator characteristic curve (AUROC). This is repeated for all folds of cross-validation, and the mean AUROC across folds is reported. Calls `neighborVoting`.

**Usage**

```
MetaNeighbor(dat, i = 1, experiment_labels, celltype_labels, genesets,
             bplot = TRUE, fast_version = FALSE)
```

**Arguments**

<code>dat</code>	A SummarizedExperiment object containing gene-by-sample expression matrix.
<code>i</code>	default value 1; non-zero index value of assay containing the matrix data
<code>experiment_labels</code>	A numerical vector that indicates the source of each sample.
<code>celltype_labels</code>	A matrix that indicates the cell type of each sample.
<code>genesets</code>	Gene sets of interest provided as a list of vectors.
<code>bplot</code>	default true, beanplot is generated
<code>fast_version</code>	default value FALSE; a boolean flag indicating whether to use the fast and low memory version of MetaNeighbor

**Value**

A matrix of AUROC scores representing the mean for each gene set tested for each celltype is returned directly (see `neighborVoting`).

**See Also**

[neighborVoting](#)



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mn_data	<i>mn_data</i>
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### Description

A SummarizedExperiment object containing: a gene matrix, cell type labels, experiment labels, sets of genes, sample ID, study id and cell types.

### Usage

```
mn_data
```

### Format

**Gene matrix** A gene-by-sample expression matrix consisting of 3157 rows (genes) and 1051 columns (cell types)

**cell\_labels** 1051x1 binary matrix that indicates whether a cell belongs to the SstNos cell type (1=yes, 0 = no)

**sample\_id** A character vector of length 1051 that indicates the sample\_id of each sample

**study\_id** A character vector of length 1051 that indicates the study\_id of each sample ("GSE60361" = Zeisel et al, "GSE71585" = Tasic et al)

**cell\_type** A character vector of length 1051 that indicates the cell-type of each sample

### Source

Dataset:<https://github.com/mm-shah/Neighbor/tree/master/data> 1. Zeisel et al. <http://science.sciencemag.org/content/347/6226/1138> 2. Tasic et al. <http://www.nature.com/neuro/journal/v19/n2/full/nn.4216.html>

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neighborVoting	<i>Runs the neighbor voting algorithm.</i>
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### Description

The function performs cell type identity prediction based on 'guilt by association' using cross validation. Performance is evaluated by calculating the AUROC for each cell type.

### Usage

```
neighborVoting(exp_labels, cell_labels, network, means = TRUE)
```

### Arguments

exp_labels	numerical vector that indicates the dataset source of each sample
cell_labels	sample by cell type matrix that indicates the cell type of each sample (0-absent; 1-present)
network	sample by sample adjacency matrix, ranked and standardized between 0-1
means	default TRUE, determines output formatting

**Value**

If means = TRUE (default) a vector containing the mean of AUROC values across cross-validation folds will be returned. If FALSE a list is returned containing a cell type by dataset matrix of AUROC scores, for each fold of cross-validation. Default is over-ridden when more than one cell type is assessed.

**See Also**

[MetaNeighbor](#)

**Examples**

```
data("mn_data")
data("G0mouse")
library(SummarizedExperiment)
AUROC_scores = MetaNeighbor(dat = mn_data,
                             experiment_labels = as.numeric(factor(mn_data$study_id)),
                             celltype_labels = metadata(colData(mn_data))["cell_labels"],
                             genesets = G0mouse,
                             bplot = TRUE)

AUROC_scores
```

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topHits

*Find reciprocal top hits*


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**Description**

Identifies reciprocal top hits and high scoring cell type pairs

**Usage**

```
topHits(cell_NV, dat, i = 1, study_id, cell_type, threshold = 0.95)
```

**Arguments**

cell_NV	matrix of celltype-to-celltype AUROC scores (output from <a href="#">MetaNeighborUS</a> )
dat	a SummarizedExperiment object containing gene-by-sample expression matrix.
i	default value 1; non-zero index value of assay containing the matrix data
study_id	a vector that lists the Study (dataset) ID for each sample
cell_type	a vector that lists the cell type of each sample
threshold	default value 0.95. Must be between [0,1]

**Value**

Function returns a dataframe with cell types that are either reciprocal best matches, and/or those with AUROC values greater than or equal to threshold value

**Examples**

```

data(mn_data)
var_genes = variableGenes(dat = mn_data, exp_labels = mn_data$study_id)
celltype_NV = MetaNeighborUS(var_genes = var_genes,
                             dat = mn_data,
                             study_id = mn_data$study_id,
                             cell_type = mn_data$cell_type)
top_hits = topHits(cell_NV = celltype_NV,
                  dat = mn_data,
                  study_id = mn_data$study_id,
                  cell_type = mn_data$cell_type,
                  threshold = 0.9)

top_hits

```

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variableGenes

*Identify a highly variable gene set*


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**Description**

Identifies genes with high variance compared to their median expression (top quartile) within each experiment. Certain function

**Usage**

```
variableGenes(dat, i = 1, exp_labels)
```

**Arguments**

dat	SummarizedExperiment object containing gene-by-sample expression matrix.
i	default value 1; non-zero index value of assay containing the matrix data
exp_labels	character vector that denotes the source (Study ID) of each sample.

**Value**

The output is a vector of gene names that are highly variable in every experiment (intersect)

**Examples**

```

data(mn_data)
var_genes = variableGenes(dat = mn_data, exp_labels = mn_data$study_id)
var_genes

```

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