

# bioDist

October 25, 2011

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KLD.matrix

*Continuous version of Kullback-Leibler Distance (KLD)*

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## Description

Calculate KLD by estimating by smoothing  $\log(f(x)/g(x)) * f(x)$  and then integrating.

## Usage

```
KLD.matrix(x, ...)
```

## Arguments

- `x` n by p matrix or list or an object of a class that extends eSet; if x is an an object of a class that extends eSet (eg ExpressionSet), then the function works against its 'exprs' slot.
- `...` arguments passed to `KLD.matrix`:
- `method` `locfit` or `density` to estimate integrand; default is `c("locfit", "density")`(i.e. both methods).
  - `suppupper` and lower limits of the integral; default is `NULL` in which case the limits of the integral are calculated from the range of the data.
  - `subdivisions` subdivisions for the integration; default is 1000.
  - `diagif` `TRUE`, then the diagonal of the distance matrix will be displayed; default is `FALSE`.
  - `upperif` `TRUE`, then the upper triangle of the distance matrix will be displayed; default is `FALSE`.
  - `samplefor` ExpressionSet methods: if `TRUE`, then distances are computed between samples, otherwise, they are computed between genes.

## Details

The distance is computed between rows of the input matrix (except if the input is an object of a class that extends eSet and `sample` is `TRUE`).

The presumption is that all samples have the same number of observations. The list method is meant for use when samples sizes are unequal.

**Value**

An object of class `dist` with the pairwise, between rows, Kullback-Leibler distances.

**Author(s)**

Beiyong Ding, Vincent Carey

**See Also**

[cor.dist](#), [spearman.dist](#), [tau.dist](#), [dist](#), [KLdist.matrix](#), [mutualInfo](#)

**Examples**

```
x <- matrix(rnorm(100), nrow = 5)
KLD.matrix(x, method = "locfit", supp = range(x))
```

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KLdist.matrix

*Discrete version of Kullback-Leibler Distance (KLD)*

---

**Description**

Calculate the KLD by binning continuous data.

KL distance is calculated using the formula

$$KLD(f_1(x), f_2(x)) = \sum_{i=1}^N f_1(x_i) * \log \frac{f_1(x_i)}{f_2(x_i)}$$

**Usage**

```
KLdist.matrix(x, ...)
```

**Arguments**

- `x` n by p matrix or a list or an object of a class that extends `eSet`. If `x` is an object of a class derived from `eSet` (`ExpressionSet`, `SnpSet` etc), then the values returned by the `exprs` function are used.
- `...` arguments passed to `KLdist.matrix`:
  - `gridsize` the number of grid points used to select the optimal bin width of the histogram used to estimate density. If no value is supplied, the grid size is calculated internally; default is `NULL`.
  - `symmetrize` if `TRUE`, then `symmetrize`; the default is `FALSE`.
  - `diag` if `TRUE`, then the diagonal of the distance matrix will be displayed; the default is `FALSE`.
  - `upper` if `TRUE`, then the upper triangle of the distance matrix will be displayed; default is `FALSE`.
  - `sample` for `eSet` methods: if `TRUE`, then the distances are computed between samples, otherwise, between features; the default is `TRUE`.

**Details**

The data are binned, and then the KL distance between the two discrete distributions is computed and used. The distance is computed between rows of the input matrix (except if the input is an object of a class that extends `eSet` and `sample` is `TRUE`).

The presumption is that all samples have the same number of observations. The `list` method is meant for use when samples sizes are unequal.

**Value**

An object of class `dist` is returned.

**Author(s)**

Beiyong Ding

**See Also**

[cor.dist](#), [spearman.dist](#), [tau.dist](#), [euc](#), [man](#), [KLD.matrix](#), [mutualInfo](#)

**Examples**

```
x <- matrix(rnorm(100), nrow = 5)
KLDist.matrix(x, symmetrize = TRUE)
```

---

`closest.top`      *Find the closest genes.*

---

**Description**

Find the closest genes to the supplied target gene based on the supplied distances.

**Usage**

```
closest.top(x, dist.mat, top)
```

**Arguments**

<code>x</code>	the name of the gene (feature) to use.
<code>dist.mat</code>	either a <code>dist</code> object or a matrix of distances.
<code>top</code>	the number of closest genes desired.

**Details**

The feature named `x` must be in the supplied distances. If so, then the `top` closest other features are returned.

**Value**

A vector of names of the `top` closest features.

**Author(s)**

Beiyong Ding

**See Also**

`cor.dist`, `spearman.dist`, `tau.dist`, `euc`, `man`, `KLdist.matrix`, `KLD.matrix`, `mutualInfo`

**Examples**

```
data(sample.ExpressionSet)
sE <- sample.ExpressionSet[1:100,]
d1 <- KLdist.matrix(sE, sample = FALSE)
closest.top(featureNames(sE)[1], d1, 5)
```

---

`cor.dist`

*Pearson correlational distance*

---

**Description**

Calculate pairwise Pearson correlational distances, i.e. 1-COR or 1-|COR|, and saves as a 'dist' object

**Usage**

```
cor.dist(x, ...)
```

**Arguments**

- |                  |  |
|------------------|--|
| <code>x</code>   | <code>n</code> by <code>p</code> matrix or <code>ExpressionSet</code> ; if <code>x</code> is an <code>ExpressionSet</code> , then the function uses its 'exprs' slot.  |
| <code>...</code> | arguments passed to <code>cor.dist</code> : <ul style="list-style-type: none"> <li>• <code>absif</code> TRUE, then 1- COR  else 1-COR, default is TRUE.</li> <li>• <code>diagif</code> TRUE, then the diagonal of the distance matrix will be displayed, default is FALSE.</li> <li>• <code>upperif</code> TRUE, then the upper triangle of the distance matrix will be displayed, default is FALSE.</li> <li>• <code>samplefor</code> objects of classes that extend <code>eSet</code>: if TRUE, then distances are computed between samples(columns) , otherwise, they are computed between features(rows).</li> </ul> |

**Details**

The `cor` function is used to compute the pairwise distances between rows of an input matrix, except if the input is an object of a class that extends `eSet` and `sample` is TRUE.

**Value**

Pairwise Pearson correlational distance object

**Author(s)**

Beiyong Ding

**See Also**

[spearman.dist](#), [tau.dist](#), [euc](#), [man](#), [KLdist.matrix](#), [KLD.matrix](#), [mutualInfo](#)

**Examples**

```
x <- matrix(rnorm(200), nrow = 5)
cor.dist(x)
```

---

euc

*Euclidean distance*


---

**Description**

Calculate pairwise Euclidean distances and saves the result as a 'dist' object

**Usage**

```
euc(x, ...)
```

**Arguments**

`x` n by p matrix or an object of a class that extends eSet; if x is a matrix, pairwise distances are calculated between the rows of a matrix. If x is an object of a class that extends eSet, the method makes use of the 'exprs' method and pairwise distances are calculated between samples(columns) if `sample` is TRUE

`...` arguments passed to `euc`:

- `diagif TRUE`, then the diagonal of the distance matrix will be displayed; default is FALSE.
- `upperif TRUE`, then the upper triangle of the distance matrix will be displayed; default is FALSE.
- `sample` For objects of classes that extends eSet, pairwise distances are calculated between samples(columns) if `sample` is TRUE ; default value is TRUE

**Details**

The method calculates pairwise euclidean distances, assuming that all samples have the same number of observations

**Value**

An object of class `dist` with the pairwise Euclidean distance between rows except in case of objects of class that extend eSet when `sample` is TRUE

**Author(s)**

Beiyong Ding

**See Also**

[spearman.dist](#), [tau.dist](#), [man](#), [KLdist.matrix](#), [KLD.matrix](#), [mutualInfo](#)

## Examples

```
x <- matrix(rnorm(200), nrow = 5)
euc(x)
```

---

man

*Manhattan distance*

---

## Description

Calculate pairwise Manhattan distances and saves as a `dist` object.

## Usage

```
man(x, ...)
```

## Arguments

`x` n by p matrix or an object of class that extends `eSet`. If `x` is an object of class that extends `eSet`, (eg `ExpressionSet`) then the function uses its `'exprs'` slot.

`...` arguments passed to `man`:

- `diagif TRUE`, then the diagonal of the distance matrix will be displayed; default is `FALSE`.
- `upperif TRUE`, then the upper triangle of the distance matrix will be displayed; default is `FALSE`.

## Details

This is just an interface to `dist` with the right parameters set.

## Value

An instance of the `dist` class with the pairwise Manhattan distances between the rows of `x` in case of a matrix or between the features (rows) in case of a class that extends `eSet`.

## Author(s)

Beiyong Ding

## See Also

[cor.dist](#), [spearman.dist](#), [tau.dist](#), [euc](#), [KLdist.matrix](#), [KLD.matrix](#), [mutualInfo](#)

## Examples

```
x <- matrix(rnorm(200), nrow = 5)
man(x)
```

---

mutualInfo                      *Mutual Information*

---

## Description

Calculate mutual information via binning

## Usage

```
mutualInfo(x, ...)  
MIdist(x, ...)
```

## Arguments

`x`                      an  $n$  by  $p$  matrix or ExpressionSet; if `x` is an ExpressionSet, then the function uses its 'exprs' slot.

`...`                    arguments passed to `mutualInfo` and `MIdist`:

- `nbin` number of bins to calculate discrete probabilities; default is 10.
- `diagif` TRUE, then the diagonal of the distance matrix will be displayed; default is FALSE.
- `upperif` TRUE, then the upper triangle of the distance matrix will be displayed; default is FALSE.
- `samplefor` ExpressionSet methods, if TRUE, then distances are computed between samples, otherwise, between genes.

## Details

For `mutualInfo` each row of `x` is divided into `nbin` groups and then the mutual information is computed, treating the data as if they were discrete.

For `MIdist` we use the transformation proposed by Joe (1989),  $\delta^* = (1 - \exp(-2\delta))^{1/2}$  where  $\delta$  is the mutual information. The `MIdist` is then  $1 = \delta^*$ . Joe argues that this measure is then similar to Kendall's tau, [tau.dist](#).

## Value

An object of class `dist` which contains the pairwise distances.

## Author(s)

Robert Gentleman

## References

H. Joe, Relative Entropy Measures of Multivariate Dependence, JASA, 1989, 157-164.

## See Also

[dist](#), [KLdist.matrix](#), [cor.dist](#), [KLD.matrix](#)

**Examples**

```
x <- matrix(rnorm(100), nrow = 5)
mutualInfo(x, nbin = 3)
```

---

spearman.dist	<i>Spearman correlational distance</i>
---------------	--

---

**Description**

Calculate pairwise Spearman correlational distances, i.e. 1-SPEAR or 1-|SPEAR|, for all rows of a matrix and return a `dist` object.

**Usage**

```
spearman.dist(x, ...)
```

**Arguments**

<code>x</code>	n by p matrix or ExpressionSet; if x is an ExpressionSet, then the function uses its 'exprs' slot.
<code>...</code>	arguments passed to <code>spearman.dist</code> : <ul style="list-style-type: none"> <li>• <code>absif</code> TRUE, then 1- SPEAR  else 1-SPEAR; default is TRUE.</li> <li>• <code>diagif</code> TRUE, then the diagonal of the distance matrix will be displayed; default is FALSE.</li> <li>• <code>upperif</code> TRUE, then the upper triangle of the distance matrix will be displayed; default is FALSE.</li> <li>• <code>samplefor</code> the ExpressionSet method: if TRUE (the default), then distances are computed between samples.</li> </ul>

**Details**

We call `cor` with the appropriate arguments to compute the row-wise correlations.

**Value**

One minus the Spearman correlation, between rows of `x`, are returned, as an instance of the `dist` class.

**Author(s)**

Beiyong Ding

**See Also**

[cor.dist](#), [tau.dist](#), [euc](#), [man](#), [KLdist.matrix](#), [KLD.matrix](#), [mutualInfo](#), [dist](#)

**Examples**

```
x <- matrix(rnorm(200), nrow = 5)
spearman.dist(x)
```



---

tau.dist	<i>Kendall's tau correlational distance</i>
----------	---

---

### Description

Calculate pairwise Kendall's tau correlational distances, i.e. 1-TAU or 1-|TAU|, for all rows of the input matrix and return an instance of the `dist` class.

### Usage

```
tau.dist(x)
```

### Usage

```
tau.dist(x, ...)
```

### Arguments

<code>x</code>	n by p matrix or ExpressionSet; if x is an ExpressionSet, then the function uses its 'exprs' slot.
<code>...</code>	arguments passed to <code>tau.dist</code> : <ul style="list-style-type: none"><li>• <code>absif</code> TRUE, then 1- TAU  else 1-TAU; default is TRUE.</li><li>• <code>diagif</code> TRUE, then the diagonal of the distance matrix will be displayed; default is FALSE.</li><li>• <code>upperif</code> TRUE, then the upper triangle of the distance matrix will be displayed; default is FALSE.</li><li>• <code>samplefor</code> the ExpressionSet method: if TRUE (the default), then distances are computed between samples.</li></ul>

### Details

Row-wise correlations are computed by calling the `cor` function with the appropriate arguments.

### Value

One minus the row-wise Kendall's tau correlations are returned as an instance of the `dist` class. Note that this can be extremely slow for large data sets.

### Author(s)

Beiyong Ding

### See Also

[cor.dist](#), [spearman.dist](#), [euc](#), [man](#), [KlDist.matrix](#), [KLD.matrix](#), [mutualInfo](#)

### Examples

```
x <- matrix(rnorm(200), nrow = 5)
tau.dist(x)
```

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