Package ‘kantorovich’

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Type Package
Title Kantorovich Distance Between Probability Measures
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Author Stéphane Laurent
Maintainer Stéphane Laurent <laurent_step@outlook.fr>
Description Computes the Kantorovich distance between two probability measures on a finite set. The Kantorovich distance is also known as the Monge-Kantorovich distance or the first Wasserstein distance.
License GPL-3
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**R topics documented:**

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**Description**

Computes the Kantorovich distance between two probability measures on a finite set.

To learn more, start with the vignettes: browseVignettes(package="kantorovich").

If you encounter a bug, or if you have a suggestion to improve the package, please file an issue on the github repo https://github.com/stla/kantorovich.

**Details**

- Package: kantorovich
- Type: Package
- Version: 2.0.0
- Date: 2016-05-25
- License: GPL-2

**Author(s)**

Stéphane Laurent

**Description**

Compute the distances at the extreme joinings.
Usage

edistances(mu, nu, dist = NULL, ...)

Arguments

mu   (row margins) probability measure in numeric or bigq/character mode
nu   (column margins) probability measure in numeric or bigq/character mode
dist function or matrix, the distance to be minimized on average. If NULL, the 0-1 distance is used.
... arguments passed to dist

Value

A list with two components: the extreme joinings in a list and the distances in a vector.

Note

This function, called by kantorovich, is rather for internal purpose.

Description

Return extreme joinings between mu and nu.

Usage

ejoinings(mu, nu, zeros = FALSE)

Arguments

mu   (row margins) probability measure in numeric or bigq/character mode
nu   (column margins) probability measure in numeric or bigq/character mode
zeros logical; in case when mu and nu have different lengths, set FALSE to remove lines or columns full of zeros

Value

A list containing the extreme joinings (matrices).
Examples

```r
mu <- nu <- c(0.5, 0.5)
ejoinings(mu, nu)
# use exact arithmetic
library(gmp)
mu <- nu <- as.bigq(c(0.5,0.5))
ejoinings(mu, nu)
# different lengths example
mu <- setNames(as.bigq(c(1,2,4), 7), c("a", "b", "c"))
nu <- setNames(as.bigq(c(3,1), 4), c("b", "c"))
ejoinings(mu, nu)
```

---

**kantorovich**

**Kantorovich distance**

Description

Compute the Kantorovich distance between two probability measures on a finite set.

Usage

```r
kantorovich(mu, nu, dist = NULL, details = FALSE, ...)
```

Arguments

- `mu` (row margins) probability measure in numeric or bigq/character mode
- `nu` (column margins) probability measure in numeric or bigq/character mode
- `dist` function or matrix, the distance to be minimized on average; if NULL, the 0-1 distance is used.
- `details` prints the joinings achieving the Kantorovich distance and returns them in the "joinings" attribute of the output
- `...` arguments passed to `dist` (only if it is a function)

Details

The function firstly computes all the extreme joinings of `mu` and `nu`, then evaluates the average distance for each of them, and then returns the minimal one.

Value

The Kantorovich distance between `mu` and `nu`. 
Examples

mu <- c(1/7, 2/7, 4/7)
nu <- c(1/4, 1/4, 1/2)
kantorovich(mu, nu)
library(gmp)
u <- as.bigq(c(1,2,4), 7)
nu <- as.bigq(c(1,1,1), c(4,4,2))
kantorovich(mu, nu)
u <- c("1/7", "2/7", "4/7")
nu <- c("1/4", "1/4", "1/2")
kantorovich(mu, nu, details=TRUE)

kantorovich_CVX  Computes Kantorovich distance with CVX

Description

Kantorovich distance using the CVXR package

Usage

kantorovich_CVX(
  mu,
  nu,
  dist = NULL,
  solution = FALSE,
  stop_if_fail = TRUE,
  solver = "ECOS",
  ...
)

Arguments

mu          (row margins) probability measure in numeric mode
nu          (column margins) probability measure in numeric mode
dist        matrix, the distance to be minimized on average; if NULL, the 0-1 distance is used.
solution    logical; if TRUE the solution is returned in the "solution" attributes of the output
stop_if_fail logical; if TRUE, an error is returned in the case when no solution is found; if FALSE, the output of psolve is returned with a warning
solver      the CVX solver, passed to psolve
...         other arguments passed to psolve
Examples

```r
mu <- c(1/7,2/7,4/7)
nu <- c(1/4,1/4,1/2)
kantorovich_CVX(mu, nu)
```

**kantorovich_glpk**  
*Computes Kantorovich distance with GLPK*

Description

Kantorovich distance using the Rglpk package

Usage

```r
kantorovich_glpk(
  mu,
  nu,
  dist = NULL,
  solution = FALSE,
  stop_if_fail = TRUE,
  ...
)
```

Arguments

- **mu** (row margins) probability measure in numeric mode
- **nu** (column margins) probability measure in numeric mode
- **dist** matrix, the distance to be minimized on average; if NULL, the 0-1 distance is used.
- **solution** logical; if TRUE the solution is returned in the "solution" attributes of the output
- **stop_if_fail** logical; if TRUE, an error is returned in the case when no solution is found; if FALSE, the output of `Rglpk_solve_LP` is returned with a warning
- **...** arguments passed to `Rglpk_solve_LP`

Examples

```r
mu <- c(1/7,2/7,4/7)
nu <- c(1/4,1/4,1/2)
kantorovich_glpk(mu, nu)
```
kantorovich_lp

Computes Kantorovich distance with lp_solve

Description

Kantorovich distance using the lpSolve package

Usage

kantorovich_lp(mu, nu, dist = NULL, solution = FALSE, lp.object = FALSE, ...)

Arguments

mu (row margins) probability measure in numeric mode
nu (column margins) probability measure in numeric mode
dist matrix, the distance to be minimized on average; if NULL, the 0-1 distance is used.
solution logical, to use only if lp.object=FALSE; if TRUE the solution is returned in the "solution" attributes of the output
lp.object logical, if FALSE, the output is the Kantorovich distance; if TRUE, the output is a lp.object
...
arguments passed to lp

Examples

mu <- c(1/7,2/7,4/7)
u <- c(1/4,1/4,1/2)
kantorovich_lp(mu, u)

names.bigq

Names for bigq vectors

Description

Names for bigq vectors

Usage

## S3 method for class 'bigq'

names(x)

Arguments

x a bigq vector
Value

the names of x
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