# Package 'kantorovich'

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**Type** Package

**Title** Kantorovich Distance Between Probability Measures

**Version** 2.0.1

**Date** 2020-08-25

**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-2

**LazyData** TRUE

**Suggests** testthat, knitr, rmarkdown

**Imports** rcdd, gmp, methods, lpSolve, Rglpk

**Depends** R (>= 2.5.3)

**SystemRequirements** GMP (https://gmplib.org/)

**RoxygenNote** 7.1.1

**Encoding** UTF-8

**VignetteBuilder** knitr

**URL** https://github.com/stla/kantorovich

**BugReports** https://github.com/stla/kantorovich/issues

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2020-08-26 10:00:03 UTC

# R topics documented:



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`kantorovich-package` *Kantorovich Distance Between Probability Measures*

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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

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`edistances` *Extremal distances*

---

## 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.

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## ejoinings *Extreme joinings*

---

### 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

```
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

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

---

`kantorovich_glpk` *Computes Kantorovich distance with GLPK*

---

## Description

Kantorovich distance using the `Rglpk` package

## Usage

```
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

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

`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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