Package 'nuts'

July 13, 2024

Title Convert European Regional Data

Version 1.1.0

Description Motivated by changing administrative boundaries over time, the 'nuts' package can convert European regional data with NUTS codes between versions (2006, 2010, 2013, 2016 and 2021) and levels (NUTS 1, NUTS 2 and NUTS 3). The package uses spatial interpolation as in Lam (1983) <doi:10.1559/152304083783914958> based on granular (100m x 100m) area, population and land use data provided by the European Commission's Joint Research Center.

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URL https://docs.ropensci.org/nuts/, https://github.com/ropensci/nuts

BugReports https://github.com/ropensci/nuts

Depends R (>= 3.5.0)

Imports cli, dplyr, glue, lifecycle, rlang

Suggests distill, eurostat, formatR, ggalluvial, ggfittext, ggplot2, ggpubr, ggrepel, gridExtra, kableExtra, knitr, raster, RColorBrewer, readr, rmarkdown, sf, stringr, terra, testthat, tidyr, withr

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Author Moritz Hennicke [aut, cre, cph] (<https://orcid.org/0000-0001-6811-1821>), Werner Krause [aut, cph] (<https://orcid.org/0000-0002-5069-7964>), Pueyo-Ros Josep [rev] (Josep reviewed the package for rOpenSci, see https://github.com/ropensci/software-review/issues/623#issuecomment-1951446662), Le Meur Nolwenn [rev] (Nolwenn reviewed the package for rOpenSci, see https://github.com/ropensci/software-review/issues/623#issuecomment-1961501137)

Maintainer Moritz Hennicke <AAoritz@posteo.de>

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Contents

`all_nuts_codes` *List of all NUTS codes and classifications*

Description

The data frame stores all NUTS codes in hierarchical levels 1, 2 and 3 by NUTS classification versions 2006, 2010, 2013, 2016 and 2021.

Usage

```
all_nuts_codes
```

Format

`all_nuts_codes`**:**

A data frame with 8,896 rows and 2 columns:

code NUTS code

version NUTS versions

country Country name

Source

https://urban.jrc.ec.europa.eu/tools/nuts-converter?lng=en#/

cross_walks *Conversion table provided by the Joint Research Center of the European Commission*

Description

The table contains population, area and surface flows between two NUTS regions and different NUTS code classifications. NUTS regions are at 1st, 2nd and 3rd level. NUTS versions are 2006, 2010, 2013, 2016 and 2021.

Usage

```
cross_walks
```

Format

`cross_walks`**:**
A data frame with 47,340 rows and 9 columns:

from_code Departing NUTS code
to_code Desired NUTS code
from_version Departing NUTS version
to_version Desired NUTS version
level NUTS division level
country Country name
areaKm Area size flow
pop18 2018 population flow
pop11 2011 population flow
artif_surf18 2018 artificial surfaces flow
artif_surf12 2012 artificial surfaces flow

Source

https://urban.jrc.ec.europa.eu/tools/nuts-converter?lng=en#/

manure *Manure storage facilities by NUTS 3 regions from Eurostat (aei_fm_ms)*

Description

The data frame contains the number of different manure storage facilities from the Farm Structure Survey in all (former) EU member states, such as Iceland, Norway, Switzerland and Montenegro at the NUTS 3 level. Please see the link indicated below for more information.

Usage

```
manure
```

Format

`manure`:

A data frame with 17,151 rows and 4 columns:

indic_ag 9 indicators: All manure storage facilities, solid dung, liquid manure slurry, slurry: tank, slurry: lagoon; covered facilities with either dung, liquid manure, slurry

geo NUTS 1, 2, 3 or National level

time Years 2000, 2003 and 2010

values Number

Source

https://ec.europa.eu/eurostat/databrowser/view/aei_fm_ms/default/table?lang=en

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nuts_aggregate *Aggregate to higher order NUTS levels*

Description

`nuts_aggregate()` transforms regional NUTS data between NUTS levels.

Usage

```
nuts_aggregate(
  data,
  to_level,
  variables,
  weight = NULL,
  missing_rm = FALSE,
  missing_weights_pct = FALSE,
  multiple_versions = c("error", "most_frequent")
)
```

Arguments

`data`	A nuts.classified object returned by `nuts_classify()`.
`to_level`	Number corresponding to the desired NUTS level to be aggregated to: 1 or 2.
`variables`	Named character specifying variable names and variable type (`'absolute'` or `'relative'`), e.g. `c('var_name' = 'absolute')`.
`weight`	String with name of the weight used for conversion. Can be area size `'areaKm'` (default), population in 2011 `'pop11'` or 2018 `'pop18'`, or artificial surfaces in 2012 `'artif_surf12'` and 2018 `'artif_surf18'`.

`missing_rm` Boolean that is FALSE by default. TRUE removes regional flows that depart from missing NUTS codes.

`missing_weights_pct`
Boolean that is FALSE by default. TRUE computes the percentage of missing weights due to missing departing NUTS regions for each variable.

`multiple_versions`
By default equal to `'error'`, when providing multiple NUTS versions within groups. If set to `'most_frequent'` data is converted using the best-matching NUTS version.

Details

Console messages can be controlled with `rlang::local_options(nuts.verbose = "quiet")` to silence messages and `nuts.verbose = "verbose"` to switch messages back on.

Value

A tibble containing NUTS codes, aggregated variable values, and possibly grouping variables.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Data varies at the NUTS level x indicator x year x country x NUTS code level
head(manure)

# Aggregate from NUTS 3 to 2 by indicator x year
manure %>%
  filter(nchar(geo) == 5) %>%
  nuts_classify(nuts_code = "geo",
                group_vars = c('indic_ag','time')) %>%
  # Group vars are automatically passed on
  nuts_aggregate(to_level = 2,
                 variables = c('values'= 'absolute'),
                 weight = 'pop18')
```

`nuts_classify` *Classify version of NUTS codes*

Description

`nuts_classify()` can identify the NUTS version year and level from a variable containing NUTS codes.

Usage

```
nuts_classify(
  data,
  nuts_code,
  group_vars = NULL,
  ties = c("most_recent", "oldest")
)
```

Arguments

data	A data frame or tibble that contains a variable with NUTS 1, 2 or 3 codes and possibly other variables. NUTS codes must be of the same level and need to be unique, unless additional grouping variables are specified. No duplicate NUTS codes within groups allowed.
nuts_code	Variable name containing NUTS codes
group_vars	Variable name(s) for classification within groups. `nuts_classify()` always computes overlap within country. Hence, country variables should not be specified. `NULL` by default.
ties	Picks `'most_recent'` or `'oldest'` version when overlap is identical across multiple NUTS versions. `'most_recent'` by default.

Details

Console messages can be controlled with `rlang::local_options(nuts.verbose = "quiet")` to silence messages and `nuts.verbose = "verbose"` to switch messages back on.

Value

A list of three tibbles. The first tibble contains the original data with the classified NUTS version, level, and country. The second tibble lists the group-specific overlap with each NUTS version. The third tibble shows missing NUTS codes for each group.

The output can be passed to `nuts_convert_version()` to convert data across NUTS versions and `nuts_aggregate()` to aggregate across NUTS levels.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Data varies at the NUTS level x indicator x year x country x NUTS code level
head(manure)

# Classify version of NUTS 2 codes in Germany
manure %>%
 filter(nchar(geo) == 4) %>%
 filter(indic_ag == 'I07A_EQ_Y') %>%
 filter(grepl('^DE', geo)) %>%
```

```
 filter(time == 2003) %>%
 select(-indic_ag, -time) %>%
 # Data varies at the NUTS code level
 nuts_classify(nuts_code = 'geo')

# Classify version of NUTS 3 codes within country and year
manure %>%
  filter(nchar(geo) == 5) %>%
  filter(indic_ag == 'I07A_EQ_Y') %>%
  select(-indic_ag) %>%
  # Data varies at the year x country x NUTS code level. The country grouping
  # is always used by default.
  nuts_classify(nuts_code = 'geo', group_vars = 'time')
```

`nuts_convert_version` *Convert between NUTS versions*

Description

`nuts_convert_version()` transforms regional NUTS data between NUTS versions.

Usage

```
nuts_convert_version(
  data,
  to_version,
  variables,
  weight = NULL,
  missing_rm = FALSE,
  missing_weights_pct = FALSE,
  multiple_versions = c("error", "most_frequent")
)
```

Arguments

`data`	A nuts.classified object returned by `nuts_classify()`.
`to_version`	String with desired NUTS version the function should convert to. Possible versions: `'2006'`, `'2010'`, `'2013'`, `'2016'` or `'2021'`
`variables`	Named character specifying variable names and variable type (`'absolute'` or `'relative'`) e.g. `c('var_name' = 'absolute')`
`weight`	String with name of the weight used for conversion. Can be area size `'areaKm'` (default), population in 2011 `'pop11'` or 2018 `'pop18'`, or artificial surfaces in 2012 `'artif_surf12'` and 2018 `'artif_surf18'`.
`missing_rm`	Boolean that is FALSE by default. TRUE removes regional flows that depart from missing NUTS codes.

missing_weights_pct
: Boolean that is FALSE by default. TRUE computes the percentage of missing weights due to missing departing NUTS regions for each variable.

multiple_versions
: By default equal to 'error', when providing multiple NUTS versions within groups. If set to 'most_frequent' data is converted using the best-matching NUTS version.

Details

Console messages can be controlled with rlang::local_options(nuts.verbose = "quiet") to silence messages and nuts.verbose = "verbose" to switch messages back on.

Value

A tibble containing NUTS codes, converted variable values, and possibly grouping variables.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Data varies at the NUTS level x indicator x year x country x NUTS code level
head(manure)

# Convert NUTS 2 codes in Germany from 2006 to 2021 version
manure %>%
  filter(nchar(geo) == 4) %>%
  filter(indic_ag == 'I07A_EQ_Y') %>%
  filter(grepl('^DE', geo)) %>%
  filter(time == 2003) %>%
  select(-indic_ag, -time) %>%
  # Data now only varies at the NUTS code level
  nuts_classify(nuts_code = "geo") %>%
  nuts_convert_version(to_version = '2021',
                       weight = 'pop18',
                       variables = c('values' = 'absolute'))


# Convert NUTS 3 codes by country x year, classifying version first
manure %>%
  filter(nchar(geo) == 5) %>%
  filter(indic_ag == 'I07A_EQ_Y') %>%
  select(-indic_ag) %>%
  # Data now varies at the year x NUTS code level
  nuts_classify(nuts_code = 'geo', group_vars = c('time')) %>%
  nuts_convert_version(to_version = '2021',
                       weight = 'pop18',
                       variables = c('values' = 'absolute'))
```

nuts_get_data *Return classified NUTS data*

Description

`nuts_get_data()` returns the classified data after running `nuts_classify()`.

Usage

```
nuts_get_data(data)
```

Arguments

`data`	A nuts.classified object returned by `nuts_classify()`.

Details

Console messages can be controlled with `rlang::local_options(nuts.verbose = "quiet")` to silence messages and `nuts.verbose = "verbose"` to switch messages back on.

Value

A tibble containing the original data with the classified NUTS version, level, and country.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Classify version of NUTS 2 codes in Germany
classified <- manure %>%
   filter(nchar(geo) == 4) %>%
   filter(indic_ag == 'I07A_EQ_Y') %>%
   filter(grepl('^DE', geo)) %>%
   filter(time == 2003) %>%
   select(-indic_ag, -time) %>%
   # Data varies at the NUTS code level
   nuts_classify(nuts_code = 'geo')

nuts_get_data(classified)
```

`nuts_get_missing` *Return missing NUTS codes in classified NUTS data*

Description

`nuts_get_missing()` returns the classified data after running `nuts_classify()`.

Usage

```
nuts_get_missing(data)
```

Arguments

`data`	A nuts.classified object returned by `nuts_classify()`.

Details

Console messages can be controlled with `rlang::local_options(nuts.verbose = "quiet")` to silence messages and `nuts.verbose = "verbose"` to switch messages back on.

Value

A tibble listing missing NUTS codes for each group.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Classify version of NUTS 2 codes in Germany
classified <- manure %>%
   filter(nchar(geo) == 4) %>%
   filter(indic_ag == 'I07A_EQ_Y') %>%
   filter(grepl('^DE', geo)) %>%
   filter(time == 2003) %>%
   select(-indic_ag, -time) %>%
   # Data varies at the NUTS code level
   nuts_classify(nuts_code = 'geo')

nuts_get_missing(classified)
```

nuts_get_version *Return version overlap of classified NUTS data*

Description

`nuts_get_version()` returns the classified data after running `nuts_classify()`.

Usage

```
nuts_get_version(data)
```

Arguments

`data`	A nuts.classified object returned by `nuts_classify()`.

Details

Console messages can be controlled with `rlang::local_options(nuts.verbose = "quiet")` to silence messages and `nuts.verbose = "verbose"` to switch messages back on.

Value

A tibble that lists the group-specific overlap with each NUTS version.

Examples

```
library(dplyr)

# Load EUROSTAT data of manure storage deposits
data(manure)

# Classify version of NUTS 2 codes in Germany
classified <- manure %>%
   filter(nchar(geo) == 4) %>%
   filter(indic_ag == 'I07A_EQ_Y') %>%
   filter(grepl('^DE', geo)) %>%
   filter(time == 2003) %>%
   select(-indic_ag, -time) %>%
   # Data varies at the NUTS code level
   nuts_classify(nuts_code = 'geo')

nuts_get_version(classified)
```

`nuts_test_multiple_versions` *Helper function to test for multiple versions*

Description

`nuts_test_multiple_versions` is called from either `nuts_convert_version` or `nuts_aggregate` to selects the most frequent version within groups or throw an error.

Usage

```
nuts_test_multiple_versions(group_vars, multiple_versions, data_versions, data)
```

Arguments

`group_vars`	Variable name(s) for classification within groups. Always computes overlap within country. `NULL` by default.
`multiple_versions`	By default equal to `'error'`, when providing multiple NUTS versions within groups.
`data_versions`	Data versions
`data`	A nuts.classified object returned by `nuts_classify()`.

Value

A tibble containing NUTS codes, the potential number of rows dropped and a message with the results of the test.

Examples

```
library(dplyr)
df <- manure %>%
  filter(nchar(geo) == 5) %>%
  select(geo, indic_ag, values) %>%
  distinct(geo,  .keep_all = TRUE) %>%
  nuts_classify(nuts_code = "geo",
                group_vars = "indic_ag",
                data = .)

nuts_test_multiple_versions(group_vars = "indic_ag",
                            multiple_versions = "most_frequent",
                            data_versions = df$versions_data,
                            data = df$data)
```

`patents` *Patent applications to the EPO by priority year by NUTS 3 regions (pat_ep_rtot)*

Description

The data frame contains information on patent applications to the European Patent Office by year and NUTS 3 regions.

Usage

```
patents
```

Format

`patents`**:**

A data frame with 104,106 rows and 4 columns:

unit 4 indicators: Number, Nominal GDP in billion euro, Per million habitants, Per million of population in the labor force

geo NUTS 1, 2, 3 or National level

time Years 2008, 2009, 2010, 2011 and 2012

values Values

Source

https://ec.europa.eu/eurostat/databrowser/view/PAT_EP_RTOT/default/table

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