Package ‘remap’

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Type Package
Title Regional Spatial Modeling with Continuous Borders
Version 0.2.1
Description Automatically creates separate regression models for different spatial regions. The prediction surface is smoothed using a regional border smoothing method. If regional models are continuous, the resulting prediction surface is continuous across the spatial dimensions, even at region borders. Methodology is described in Wagstaff (2021) <https://digitalcommons.usu.edu/etd/8065/>.
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**plot.remap**

Plot method for remap object.

**Description**

Plots the regions used for modeling.

**Usage**

```r
## S3 method for class 'remap'
plot(x, ...)
```

**Arguments**

- `x` S3 object output from remap.
- `...` Arguments to pass to regions plot.

**Value**

A list that plots a map of the regions used for modeling.

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**predict.remap**

Make predictions given a set of data and smooths predictions at region borders. If an observation is outside of all regions and smoothing distances, the closest region will be used to predict.

**Description**

Make predictions given a set of data and smooths predictions at region borders. If an observation is outside of all regions and smoothing distances, the closest region will be used to predict.
Usage

```r
## S3 method for class 'remap'
predict(object, data, smooth, distances, cores = 1, progress = FALSE, ...)
```

Arguments

- `object`: S3 object output from remap.
- `data`: An sf dataframe with point geometry.
- `smooth`: The distance in km within a region where a smooth transition to the next region starts. If smooth = 0, no smoothing occurs between regions unless an observation falls on the border of two or more polygons. (Can be a named vector with different values for each unique object$region_id in object$region'.)
- `distances`: An optional matrix of distances between 'data' and 'object$regions' generated by `redist()` function (calculated internally if not provided).
- `cores`: Number of cores for parallel computing. 'cores' above default of 1 will require more memory.
- `progress`: If true, a text progress bar is printed to the console. (Progress bar only appears if 'cores' = 1.)
- `...`: Arguments to pass to individual model prediction functions.

Value

Predictions in the form of a numeric vector.

See Also

- `remap` building a regional model.

Description

Print method for remap object.

Usage

```r
## S3 method for class 'remap'
print(x, ...)
```

Arguments

- `x`: S3 object output from remap.
- `...`: Extra arguments.
Value

No return value, a description of the remap object is printed in the console.

redist

Get distances between data and regions.

Description

Finds distances in km between data provided as sf dataframe with point geometry and regions provided as sf dataframe with polygon or multipolygon geometry.

Usage

redist(data, regions, region_id, max_dist, cores = 1, progress = FALSE)

Arguments

data An sf data frame with point geometry.
regions An sf dataframe with polygon or multipolygon geometry.
region_id Optional name of column in ‘regions’ that contains the id that each region belongs to (no quotes). If null, it will be assumed that each row is its own region.
max_dist a maximum distance that is needed for future calculations. (Set equal to maximum ‘smooth’ when predicting on new observations.)
cores Number of cores for parallel computing. ‘cores’ above default of 1 will require more memory. (Progress bar only appears if ‘cores’ = 1.)
progress If true, a text progress bar is printed to the console. Progress set to FALSE will find distances quicker if max_dist is not specified.

Value

A matrix where each row corresponds one-to-one with each row in provided ‘data’. Matrix columns are either named with regions from ‘region_id’ column of ‘regions’ or the row numbers of ‘regions’ if ‘region_id’ is missing. Values are in kilometers.

See Also

remap - uses redist for regional models.

Examples

library(remap)
library(sf)
data(utsnow)
data(utws)

# Reset CRS in case user has old version of GDAL
remap

sf::st_crs(utsnow) <- 4326
sf::st_crs(utws) <- 4326

# Simplify polygons to run example faster
utws_simp <- sf::st_simplify(utws, dTolerance = 0.01)

# Build a matrix of distances between objects of utsnow and utws
# We will not set max_dist, so all distances will be found
dists <- redist(data = utsnow,
                 regions = utws_simp,
                 region_id = HUC2)

head(dists)

remap

Build separate models for mapping multiple regions.

Description

Separate models are built for each given region and combined into one S3 object that can be used to predict on new data using generic function predict().

Usage

remap(
  data,
  regions,
  region_id,
  model_function,
  buffer,
  min_n = 1,
  distances,
  cores = 1,
  progress = FALSE,
  ...
)

Arguments

data An sf data frame with point geometry.
regions An sf dataframe with polygon or multipolygon geometry.
region_id Optional name of column in 'regions' that contains the id that each region belongs to (no quotes). If null, it will be assumed that each row of 'regions' is its own region.
model_function A function that can take a subset of 'data' and output a model that can be used to predict new values when passed to generic function predict().
buffer

The length of the buffer zone around each region in km where observations are included in the data used to build models for each region. (Can be a named vector with different values for each unique 'region_id' in 'region').

min_n

The minimum number of observations to use when building a model. If there are not enough observations in the region and buffer, then the closest min_n observations are used. min_n must be at least 1.

distances

An optional matrix of distances between 'data' and 'regions' generated by redist() function (calculated internally if not provided). Note that unless you know that you have min_n within a certain distance, no max_dist parameter should be used in redist().

cores

Number of cores for parallel computing. 'cores' above default of 1 will require more memory.

progress

If true, a text progress bar is printed to the console. (Progress bar only appears if 'cores' = 1.)

... Extra arguments to pass to 'model_function' function.

Details

If a model fails for a region, a warning is given but the modeling process will continue.

A description of the methodology can be found in Wagstaff (2021) "Regionalized Models with Spatially Continuous Predictions at the Borders" <https://digitalcommons.usu.edu/etd/8065/>.

Value

A remap S3 object containing:

`models` A list of models containing a model output by `model_function` for each region.

`regions` 'regions' object passed to the function (used for prediction). The first column is 'region_id' or the row number of 'regions' if 'region_id is missing. The second column is the region geometry.

`call` Shows the parameters that were passed to the function.

See Also

predict.remap - used for predicting on new data. redist - used for pre-computing distances.

Examples

```r
library(remap)
library(sf)
data(utsnow)
data(utws)

# Reset CRS in case user has old version of GDAL
sf::st_crs(utsnow) <- 4326
sf::st_crs(utws) <- 4326

# Simplify polygons to run example faster
```
utws_simp <- sf::st_simplify(utws, dTolerance = 0.01)

# Build a remap model with lm that has formula snow_water = elevation
# The buffer to collect data around each region is 30km
# The minimum number of observations per region is 10
remap_model <- remap(data = utsnow,
                      regions = utws_simp,
                      region_id = HUC2,
                      model_function = lm,
                      formula = WESD ~ ELEVATION,
                      buffer = 20,
                      min_n = 10,
                      progress = TRUE)

# Resubstitution predictions
remap_preds <- predict(remap_model, utsnow, smooth = 10)
head(remap_preds)

summary.remap

Summary method for remap object.

Description

Summary method for remap object.

Usage

## S3 method for class 'remap'
summary(object, ...)

Arguments

object S3 object output from remap.
...

Extra arguments to pass to regional models.

Value

No return value, a brief summary of the remap object is printed in the console. This includes the class(es) of the regional models, the CRS of the regions, and the bounding box of the regions.
utsnow

Snowpack at weather stations in Utah on April 1st, 2011.

Description

Water equivalent of snow density (WESD) in mm of water at various locations within and surrounding the state of Utah. WESD are measured at weather stations within the Daily Global Historical Climatology Network. April first measurements are used to estimate snowpack for the state of Utah.

Usage

utsnow

Format

An sf points object with 394 rows and 9 variables:

- **ID** Weather station identification code.
- **STATION_NAME** Weather station name.
- **LATITUDE** Latitude of weather station.
- **LONGITUDE** Longitude of weather station.
- **ELEVATION** Elevation of weather station.
- **HUC2** Largest watershed region containing this weather station (see utws data).
- **WESD** Water equivalent of snow density in mm of water.
- **geometry** sfc points in geographic coordinates.

Source


utws

Watershed polygons within the state of Utah.

Description

Watersheds are defined by the United States Geological Survey. Only the largest defines watersheds are used.

Usage

utws
Format

An sf object with 394 rows and 2 variables:

- **HUC2**  Largest watershed ID’s defined by the USGS.
- **geometry**  sfc multipolygon object in geographic coordinates.

Source

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