Package 'SurfaceTortoise'

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Type Package

Title Find Optimal Sampling Locations Based on Spatial Covariate(s)

Version 0.1.0

Author Kristin Piikki & Mats Soderstrom

Maintainer Kristin Piikki <kristin.piikki@slu.se>

Description Create sampling designs using the surface reconstruction algorithm.
Original method by: Olsson, D. 2002. A method to optimize soil sampling from
ancillary data. Poster presenterad at: NJF seminar no. 336,
Implementation of Precision Farming in Practical Agriculture, 10-12
June 2002, Skara, Sweden.

Depends R (>= 3.4.0)

Imports raster, gstat, rgeos, sp, gtools, rgdal, utils, grDevices

Suggests roxygen2

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Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

NeedsCompilation no

Repository CRAN

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R topics documented:

boundary *Boundary polygon for field 10 at Bjertorp farm in SouthWest Sweden*

Description

Boundary polygon for field 10 at Bjertorp farm in SouthWest Sweden

Usage

```
data(boundary)
```

Format

A SpatialPolygonsDataFrame with the boundary polygon. The polygon has been shrunk (i.e. the field is somewhat larger than the polygon) Projected coordinate system Sweref99TM (epsg: 3006).

References

Piikki, K., Söderström, M., & Stenberg, B. (2013). Sensor data fusion for topsoil clay mapping. Geoderma, 199, 106-116.

prepare *Prepares Data*

Description

Prepares data to be used for sampling

Usage

```
prepare(m, method, mean.filter, buff)
```

Arguments

m	a list of all objects to be used.
method	sampling alogorithm: 'dir' = directed (sr algorithm), 'stratdir' = stratified directed (sr algorithm), 'grid' = regular grid and 'stratrand' = random stratified.
mean.filter	optional. side of the square window (number of raster cells) used for mean filtering of the raster(s). default = 3
buff	buffer zone (m) inside the sample area border, where sampling is prohibited. default = 0.

tortoise *SurfaceTortoise*

Description

Optimizing spatial sampling using the Surface Tortoise algoritm. Grid sampling and random stratified sampling are also available.

Usage

```
tortoise(x1 = NA, x2 = NA, x3 = NA, x4 = NA, x5 = NA, y = NA,
  epsg = 3006, out_folder = NA, out_prefix = "st_", method = "stratdir",
  ncell_meanfilter = 3, p_idw = 2, nmax_idw = 8, edge = 0,
  strat_size = 100, min_dist = 0, stop_n = 100, stop_dens1 = 100,
  stop_dens2 = 100, stop_change = 1e-04, plot_results = T)
```

Arguments

x1	Raster layer. Additionally four raster layers (x2, x3, x4 and x5) can be used. These will be transferred to the same extent and resulution as x1. All rasters will be centered and scaled. The first principal component of the rasters will be used as the surface for wich to optimize the sampling.
x2	Raster layer, see x1.
x3	Raster layer, see x1.
x4	Raster layer, see x1.
x5	Raster layer, see x1.
y	SpatialPolygonsDataframe delineating the area to be sampled. The coordinate system shall be the same as for the rasters. If not completely overlapping, the itersection of x1 and y will be sampled.
epsg	Epsg code (numeric) for the orthognonal spatial reference system onto which x1 and y are projected, see e.g. http://spatialreference.org/ref/epsg/
out_folder	Output folder (path) to which the output files shall be exported.
out_prefix	Prefix (character) for the output filenames.
method	Sampling alogorithm: 'dir' = directed (SurfaceTortoise algorithm), 'stratdir' = stratified directed (SurfaceTortoise algorithm), 'grid' = regular grid and 'stratrand' = random stratified.
ncell_meanfilter	Optional. Side of the square window (number of raster cells) used for mean filtering of the raster(s).
p_idw	Power exponent used for idw-interpolation (SurfaceTortoise algorithm)
nmax_idw	Number of neighbouring samples used for idw-interpolation (SurfaceTortoise algorithm).
edge	Buffer zone (metre) inside the sample area border, where sampling is prohibited.

strat_size	Cell side (metre) of a square staratification grid.
min_dist	Minimum distance allowed between samples. Valid for the 'dir' and the 'stratdir' methods.
stop_n	A stopping criterium. No more samples will be added when this number of samples has been reached. Valid for the 'dir', 'stratdir' and 'stratrand' methods.
stop_dens1	A stopping criterium. No more samples will be added when this number of samples per hectare has been reached. Valid for 'dir', stratdir' and 'stratrand' methods.
stop_dens2	A stopping criterium. No more samples will be added when this number of samples per stratum has been reached. Valid for 'stratdir' and 'stratrand' methods.
stop_change	A stopping criterium. No more samples will be added when the improvement in mean absolute error obtained by the last added sample is less than this percentage of the hitherto improvement since sample no 3. Valid for the 'dir' and the 'stratdir' methods.
plot_results	Logical. shall results be plotted.

Details

The Surface Tortoise algorithm (ST-algorithm) uses a spatial covariate in raster format (or the first principal component of a maximum of five covariates in raster format) to find optimal locations for sampling. The sampling strategy is based on the principle that an interpolation of the samples should results be a similar surface as the covariate. When sample locations are assigned, first the raster cell with the maximum deviation from the covariate raster mean is sampled. Then the raster cell with the maximum deviation from the first sampled raster cell is sampled. From then on, the values of the sampled raster cells are interpolated by inverse distance weighting (idw) and the raster cell with the largest absolute difference to the covariate (error) is sampled. A new idw interpolation is made and a new cell is sampled. This is repeated until any of the specified stopping criteria is reached. The sampling can be stratified, which means that the areas is split by a square grid. When a sample has been located in a stratum, no more samples can be placed in that stratum again until all other strata have been sampled. The likelihood for a clipped stratum, e.g. at the edge of the area to be sampled, is equal to the area of that stratum divided by the area of a full stratum.

Value

A list with 1) a dataframe of sample coordinates 2) a spatialPointsDataFrame with sample locations and 3) a SpatialPolygonsDataFrame with the stratification grid or sampling area.If an output folder is specified, the following files will be exported to the specified output folder: A point shapefile with sample locations; a tab-separated text file with sample coordinates; and a polygon shapefile with the stratification grid.

Author(s)

Kristin Piikki & Mats Söderström , <kristin.piikki@slu.se>

References

Olsson, D. 2002. A method to optimize soil sampling from ancillary data. Poster presenterad at: NJF seminar no. 336, Implementation of Precision Farming in Practical Agriculture, 10-12 June 2002, Skara, Sweden.

Examples

```
data(boundary)
grid.sampling<-tortoise(y=boundary,method='grid',edge=30,strat_size=50,
min_dist=10,plot_results=FALSE)
```

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