Package ‘plotKML’

October 30, 2021

Version 0.8-2
Date 2021-10-06
Title Visualization of Spatial and Spatio-Temporal Objects in Google Earth
Author Tomislav Hengl [cre, aut], Andrea Gilardi [ctb], Pierre Roudier [ctb], Dylan Beaudette [ctb], Edzer Pebesma [ctb], Michael Blaschek [ctb]
Maintainer Tomislav Hengl <tom.hengl@opengeohub.org>
Depends R (>= 3.5.0)
Imports methods, tools, gstat, colorRamps, pixmap, utils, XML, dismo, landmap, sp, raster, rgdal, aqp, spacetime, colorspace, plyr, stringr, scales, zoo, RColorBrewer, classInt, sf, stars
Suggests RSAGA, plotrix, adehabitatLT, maptools, fossil, rjson, animation, spatstat, spatstat.linnet, spatstat.geom, RCurl, rgbif, Hmisc, uuid, intervals, reshape, gdalUtils, snowfall, parallel, testthat
Description Writes sp-class, spacetime-class, raster-class and similar spatial and spatio-temporal objects to KML following some basic cartographic rules.
License GPL
URL https://github.com/Envirometrix/plotKML
LazyLoad yes
NeedsCompilation no
Repository CRAN
Date/Publication 2021-10-30 13:50:06 UTC

R topics documented:

plotKML-package ................................................................. 3
R topics documented:

- aesthetics .......................................................... 4
- baranja .............................................................. 5
- bigfoot ............................................................... 7
- check_projection .................................................. 9
- col2kml ............................................................... 10
- count.GridTopology .............................................. 11
- display_pal ......................................................... 11
- eberg ................................................................. 12
- fmd ................................................................. 15
- geopath .............................................................. 16
- getCRS-methods .................................................. 17
- getWikiMedia.ImageInfo ........................................ 18
- gpxbtour ........................................................... 19
- grid2poly ........................................................... 21
- HRprec08 ........................................................... 22
- HRtemp08 ............................................................ 23
- kml-methods ....................................................... 26
- kml.tiles ............................................................ 28
- kml_compress ...................................................... 29
- kml_description .................................................. 30
- kml_layer-methods ............................................... 31
- kml_layer.Raster .................................................. 33
- kml_layer.RasterBrick .......................................... 34
- kml_layer.SoilProfileCollection ................................ 35
- kml_layer.SpatialLines ......................................... 38
- kml_layer.SpatialPhotoOverlay ................................ 39
- kml_layer.SpatialPixels ........................................ 41
- kml_layer.SpatialPoints ........................................ 43
- kml_layer.SpatialPolygons ..................................... 45
- kml_layer.STIDF .................................................. 46
- kml_layer.STTDF .................................................. 48
- kml_legend.bar .................................................... 50
- kml_legend.whitening .......................................... 51
- kml_metadata-methods ......................................... 52
- kml_open ........................................................... 53
- kml_screen ........................................................ 54
- LST ................................................................. 55
- makeCOLLADA ..................................................... 56
- metadata2SLD-methods ......................................... 58
- metadata2SLD.SpatialPixels .................................... 58
- normalizeFilename .............................................. 59
- northcumbria ...................................................... 60
- plotKML-method ................................................... 61
- plotKML_env ....................................................... 62
- plotKML.GDALobj ................................................ 74
- RasterBrickSimulations-class .................................. 76
- RasterBrickTimeSeries-class ................................... 77
- readGPX ........................................................... 78
plotKML-package

Visualization of spatial and spatio-temporal objects in Google Earth

Description

A suite of functions for converting 2D and 3D spatio-temporal (sp, raster and spacetime package classes) objects into KML or KMZ documents for use in Google Earth.

Details

<table>
<thead>
<tr>
<th>Package:</th>
<th>plotKML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Package</td>
</tr>
<tr>
<td>URL:</td>
<td><a href="http://plotkml.r-forge.r-project.org/">http://plotkml.r-forge.r-project.org/</a></td>
</tr>
<tr>
<td>License:</td>
<td>GPL</td>
</tr>
<tr>
<td>LazyLoad:</td>
<td>yes</td>
</tr>
</tbody>
</table>

Note

This package has been developed as a part of the Global Soil Information Facilities project, which is run jointly by the ISRIC Institute and collaborators. ISRIC is a non-profit organization with a mandate to serve the international community as custodian of global soil information and to increase awareness and understanding of the role of soils in major global issues.
Author(s)

Tomislav Hengl (<tom.hengl@opengeohub.org>), Pierre Roudier (<pierre.roudier@landcare.nz>), Dylan Beaudette (<debeaudette@ucdavis.edu>), Edzer Pebesma (<edzer.pebesma@uni-muenster.de>)

References

- KML documentation (https://developers.google.com/kml/documentation/?csw=1)
- Google Earth Outreach project (http://earth.google.com/outreach/tutorials.html)

### aesthetics

**Plotting aesthetics parameters**

#### Description

Parses various object parameters / columns to KML aesthetics: size of the icons, fill color, labels, altitude, width, ...

#### Usage

`kml_aes(obj, ...)`

#### Arguments

- `obj` space-time object for plotting
- `...` other arguments

#### Details

Valid aesthetics: `colour = "black", fill = "white", shape, whitening, alpha, width = 1, labels, altitude = 0, size, balloon = FALSE`. Specific features (target variables and the connected hot-spots) can be emphasized by using two or three graphical parameters for the same variable. See plotKML package homepage / vignette for more examples.

#### Author(s)

Pierre Roudier

#### See Also

`kml-methods`
baranja

Baranja hill case study

Description

Baranja hill is a 4 by 4 km large study area in the Baranja region, eastern Croatia (corresponds to a size of an aerial photograph). This data set has been extensively used to describe various DEM modelling and analysis steps (see Hengl and Reuter, 2008; Hengl et al., 2010; doi: 10.5194/hess14-11532010). Object barxyz contains 6370 precise observations of elevations (from field survey and digitized from the stereo images); bargrid contains observed probabilities of streams (digitized from the 1:5000 topo map); barstr contains 100 simulated stream networks ("SpatialLines") using barxyz point data as input (see examples below).

Usage

data(bargrid)

Format

The bargrid data frame (regular grid at 30 m intervals) contains the following columns:

- p.obs observed probability of stream (0-1)
- x a numeric vector; x-coordinate (m) in the MGI / Balkans zone 6
- y a numeric vector; y-coordinate (m) in the MGI / Balkans zone 6

Note

Consider using the 30 m resolution grid (see bargrid) as the target resolution (output maps).

Author(s)

Tomislav Hengl

References

- https://geomorphometry.org/baranja-hill/
Examples

library(sp)
library(gstat)
## sampled elevations:
data(barxyz)
prj = "+proj=tmerc +lat_0=0 +lon_0=18 +k=0.9999 +x_0=6500000 +y_0=0 +ellps=bessel +units=m +towgs84=550.499,164.116,475.142,5.80967,2.07902,-11.62386,0.99999445824"
coordinates(barxyz) <- ~x+y
proj4string(barxyz) <- CRS(prj)
## grids:
data(bargrid)
data(barstr)
coordinates(bargrid) <- ~x+y
gridded(bargrid) <- TRUE
proj4string(bargrid) <- barxyz@proj4string
bargrid@grid
## Not run: ## Example with simulated streams:
data(R_pal)
library(rgdal)
library(RSAGA)
pnt = list("sp.points", barxyz, col="black", pch="+")
spplot(bargrid[1], sp.layout=pnt,
    col.regions = R_pal["blue_grey_red"])
## Deriving stream networks using geostatistical simulations:
Z.ovgm <- vgm(psill=1831, model="Mat", range=1051, nugget=0, kappa=1.2)
sel <- runif(length(barxyz$Z))<.2
N.sim <- 5
## geostatistical simulations:
DEM.sim <- krige(Z~1, barxyz[sel,], bargrid, model=Z.ovgm, nmax=20,
    nsim=N.sim, debug.level=-1)
## Note: this operation can be time consuming
stream.list <- list(rep(NA, N.sim))
## derive stream networks in SAGA GIS:
for (i in 1:N.sim) {
    writeGDAL(DEM.sim[i], paste("DEM", i, ".sdat", sep=""),
        drivername = "SAGA", mvFlag = -99999)
    ## filter the spurious sinks:
    rsaga.fill.sinks(in.dem=paste("DEM", i, ".sgrd", sep=""),
        out.dem="DEMflt.sgrd", check.module.exists = FALSE)
    ## extract the channel network SAGA GIS:
    rsaga.geoprocessor(lib="ta_channels", module=0,
        param=list(ELEVATION="DEMflt.sgrd",
            CHNLNTRWK=paste("channels", i, ".sgrd", sep=""),
            CHNLROUTE="channel_route.sgrd",
            SHAPES="channels.shp",
            INIT_GRID="DEMflt.sgrd",
            DIV.Cells=3, MINLEN=40),
            check.module.exists = FALSE,
            show.output.on.console=FALSE)
    stream.list[[i]] <- readOGR("channels.shp", "channels",
        verbose=FALSE)
proj4string(stream.list[[i]]) <- barxyz@proj4string
}

# plot all derived streams at top of each other:
streams.plot <- as.list(rep(NA, N.sim))
for(i in 1:N.sim){
  streams.plot[[i]] <- list("sp.lines", stream.list[[i]])
}
spplot(DEM.sim[1], col.regions=grey(seq(0.4,1,0.025)), scales=list(draw=T),
sp.layout=streams.plot)

## End(Not run)

bigfoot

Bigfoot reports (USA)

Description

2984 observations of bigfoot (with attached dates). The field occurrence records have been obtained from the BigFoot Research Organization (BFRO) website. The BFRO reports generally consist of a description of the event and where it occurred, plus the quality classification. Similar data set has been used by Lozier et al. (2009) to demonstrate possible miss-interpretations of the results of species distribution modeling. The maps in the USAWgrids data set represent typical gridded environmental covariates used for species distribution modeling.

Usage

data(bigfoot)

Format

The bigfoot data frame contains the following columns:

Lon  a numeric vector; x-coordinate / longitude in the WGS84 system
Lat  a numeric vector; y-coordinate / latitude in the WGS84 system
NAME name assigned by the observer (usually referent month / year)
DATE 'POSIXct' class vector

TYPE confidence levels; according to the BFRO website: "Class A" reports involve clear sightings in circumstances where misinterpretation or misidentification of other animals can be ruled out with greater confidence; "Class B" and "Class C" reports are less credible.

The USAWgrids data frame (46,018 pixels; Washington, Oregon, Nevada and California state) contains the following columns:

globedem a numeric vector; elevations from the ETOPO1 Global Relief Model
nlights03 an integer vector; lights at night image for 2003 (Version 2 DMSP-OLS Nighttime Lights Time Series)
sroads a numeric vector; distance to main roads and railroads (National Atlas of the United States)
gcarb  a numeric vector; Global Biomass Carbon Map (New IPCC Tier-1 Global Biomass Carbon Map for the Year 2000)
dTRI a numeric vector; density of pollutant releases (North American Pollutant Releases and Trans- fers database)
twi a numeric vector; Topographic Wetness Index based on the globedem
states an integer vector; USA states
globcov land cover classes based on the MERIS FR images (GlobCover Land Cover version V2.2)
s1 a numeric vector; x-coordinates in the Albers equal-area projection system
s2 a numeric vector; y-coordinates in the Albers equal-area projection system

Note
According to the Time.com, a team of a dozen-plus experts from as far afield as Canada and Sweden have proclaimed themselves 95 percent certain of the mythical animal’s existence on Kemerovo region territory some 3,000 kilometers east of Moscow (announced at the Tashtagol conference in 2011).

Author(s)
Tomislav Hengl

References

- BigFoot Research Organization (http://www.bfro.net)

Examples

```r
## Not run: # Load the BFRO records:
library(sp)
data(bigfoot)
ea.prj <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
+x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs"
library(sp)
coordinates(bigfoot) <- ~Lon+Lat
proj4string(bigfoot) <- CRS("+proj=latlon +datum=WGS84")
library(rgdal)
bigfoot.aea <- spTransform(bigfoot, CRS(aea.prj))
# Load the covariates:
data(USAWgrids)
spatialized(USAWgrids) <- ~s1+s2
proj4string(USAWgrids) <- CRS(aea.prj)
# Visualize data:
data(SAGA_pal)
pnts <- list("sp.points", bigfoot.aea, pch="*", col="yellow")
spplot(USAWgrids[2], col.regions=rev(SAGA_pal[[3]]), sp.layout=pnts)
## End(Not run)
```
check_projection

Extracts the proj4 parameters and checks if the projection matches the referent CRS

Description

Function parse_proj4 gets the proj4 string from a space-time object and check_projection checks if the input projection is compatible with the referent projection system. The referent system is by default the longlat projection with WGS84 datum (KML-compatible coordinates).

Usage

check_projection(obj, control = TRUE, ref_CRS = get("ref_CRS", envir = plotKML.opts))

Arguments

obj object of class Spatial* or Raster*
control logical; if TRUE, a logical value is returned, if FALSE, an error is thrown if the test failed
ref_CRS the referent coordinate system.

Details

A cartographic projection is KML compatible if: (a) geographical coordinates are used, and (b) if they relate to the WGS84 ellipsoid ("+proj=longlat +datum=WGS84"). You can also set your own local referent projection system by specifying plotKML.env(ref_CRS = ...).

Warning

obj needs to have a proper proj4 string (CRS), otherwise check_projection will not run. If the geodetic datum is defined via the +towgs, consider converting the coordinates manually i.e. by using the spTransform or reproject method.

Author(s)

Pierre Roudier, Tomislav Hengl, and Dylan Beaudette

References

• WGS84 (https://spatialreference.org/ref/epsg/4326/)

See Also

reproject, rgdal::CRS-class
Examples

data(eberg)
library(sp)
library(rgdal)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
check_projection(eberg)
# not yet ready for export to KML;
parse_proj4(proj4string(eberg))
eberg.geo <- reproject(eberg)
check_projection(eberg.geo)
# ... now ready for export

\---

\texttt{col2kml} \hspace{2cm} \textit{Convert a color string to the KML format}

\textbf{Description}

Converts some common color formats (internal R colors, hexadecimal format, Munsell color codes) color to KML format.

\textbf{Usage}

\texttt{col2kml(colour)}

\textbf{Arguments}

\begin{itemize}
\item [colour] \hspace{1cm} R color string
\end{itemize}

\textbf{Value}

KML-formatted color as \#aabbggrr where aa=alpha (00 to ff), bb=blue (00 to ff), gg=green (00 to ff), rr=red (00 to ff).

\textbf{Author(s)}

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

\textbf{See Also}

aqp::munsell2rgb

\textbf{Examples}

\texttt{col2kml("white")}
\texttt{col2kml(colors()[2])}
\texttt{hex2kml(rgb(1,1,1))}
\texttt{x <- munsell2kml("10YR", "2", "4")}
\texttt{kml2hex(x)}
count.GridTopology  

Counts the number of occurrences of a list of vector object over a GridTopology

Description

Counts the number of occurrences of a vector object over a "GridTopology" for a list of vector objects (usually multiple realizations of the same process).

Usage

count.GridTopology(x, vectL, ...)

Arguments

x  
object of type "GridTopology"

vectL  
list of vectors of class "SpatialPoint*", "SpatialLines*" or "SpatialPolygons*" (equiprobable realizations of the same process)

...  
(optional) arguments passed to the lower level functions

Author(s)

Tomislav Hengl

See Also

SpatialVectorsSimulations-class, vect2rast

display.pal  

Display a color palette

Description

Plots a color palette in a new window.

Usage

display.pal(pal, sel=1:length(pal), names=FALSE)

Arguments

pal  
list; each palette a vector of HEX-formated colors

sel  
integer; selection of palettes to plot

names  
logical; specifies whether to print also the class names
Details

The internal palettes available in plotKML typically consists of 20 elements. If class names are requested (names=TRUE) than only one palette will be plotted.

Author(s)

Tomislav Hengl and Pierre Roudier

See Also

`SAGA_pal`, `R_pal`, `worldgrids_pal`

Examples

```r
# SAGA GIS palette (http://saga-gis.org/en/about/software.html)
data(SAGA_pal)
names(SAGA_pal)
## Not run: # display palettes:
display.pal(pal=SAGA_pal, sel=c(1,2,7,8,10,11,17,18,19,21,22))
dev.off()
data(worldgrids_pal)
worldgrids_pal["globcov"]
display.pal(pal=worldgrids_pal, sel=c(5), names = TRUE)
dev.off()
# make icons (http://www.statmethods.net/advgraphs/parameters.html):
for(i in 0:25){
  png(filename=paste("icon", i, ".png", sep=""), width=45, height=45,
  bg="transparent", pointsize=16)
  par(mar=c(0,0,0,0))
  plot(x=1, y=1, axes=FALSE, xlab="", ylab="", pch=i, cex=4, lwd=2)
  dev.off()
}
## End(Not run)
```

eberg

### Ebergötzen — soil mapping case study

description

Ebergötzen is 10 by 10 km study area in the vicinity of the city of Göttingen in Central Germany. This area has been extensively surveyed over the years, mainly for the purposes of developing operational digital soil mapping techniques (Gehrt and Böhner, 2001), and has been used by the SAGA GIS development team to demonstrate various processing steps.

eberg table contains 3670 observations (augers) of soil textures at five depths (0–10, 10–30, 30–50, 50–70, and 70–90), and field records of soil types according to the German soil classification system. eberg_grid contains gridded maps at 100 m resolution that can be used as covariates for spatial prediction of soil variables. eberg_grid25 contains grids at finer resolution (25 m).
eberg_zones is a polygon map showing the distribution of parent material (Silt and sand, Sandy material, Clayey derivats, Clay and loess). eberg_contours shows contour lines derived from the 25 m DEM of the area using 10 m equidistance.

Usage
data(eberg)

Format
The eberg data frame (irregular points) contains the following columns:

- **ID**: universal identifier
- **soiltype**: a vector containing factors; soil classes according to the German soil classification system: "A" (Auenboden), "B" (Braunerde), "D" (Pelosol), "G" (Gley), "Ha" (Moor), "Hw" (HMoor), "K" (Kolluvisol), "L" (Parabraunerde), "N" (Ranker), "Q" (Regosol), "R" (Rendzina), "S" (Pseudogley), "Z" (Pararendzina)
- **TAXGRSC**: a vector containing factors; full soil class names according to the German soil classification system (see soiltype column)
- **X**: a numeric vector; x-coordinate (m) in DHDN / Gauss-Krüger zone 3 (German coordinate system)
- **Y**: a numeric vector; y-coordinate (m) in DHDN / Gauss-Krüger zone 3 (German coordinate system)
- **UHDICM_***: a numeric vector; upper horizon depth in cm per horizon
- **LHDICM_***: a numeric vector; lower horizon depth in cm per horizon
- **SNDMHT_***: a numeric vector; sand content estimated by hand per horizon (0-100 percent); see Ad-hoc-AG Boden (2005) for more details
- **SLTMHT_***: a numeric vector; silt content estimated by hand per horizon (0-100 percent)
- **CLYMHT_***: a numeric vector; clay content estimated by hand per horizon (0-100 percent)

The eberg_grid data frame (regular grid at 100 m resolution) contains the following columns:

- **PRMGEO6**: a vector containing factors, parent material classes from the geological map (mapping units)
- **DEMSRT6**: a numeric vector; elevation values from the SRTM DEM
- **T wisRT6**: a numeric vector; Topographic Wetness Index derived using the SAGA algorithm
- **TIRAST6**: a numeric vector; Thermal Infrared (TIR) reflection values from the ASTER L1 image band 14 (2010-06-05T10:26:50Z) obtained via the NASA’s GloVis browser
- **LNCCOR6**: a vector containing factors; Corine Land Cover 2006 classes
- **X**: a numeric vector; x-coordinate (m) in DHDN / Gauss-Krüger zone 3 (German coordinate system)
- **Y**: a numeric vector; y-coordinate (m) in DHDN / Gauss-Krüger zone 3 (German coordinate system)

The eberg_grid25 data frame (regular grid at 25 m resolution) contains the following columns:
DEMTOPx a numeric vector; elevation values from the topographic map
HBTSOLx a vector containing factors; main soil type according to the German soil classification system (see column "soiltype" above) estimated per crop field
TWITOPx a numeric vector; Topographic Wetness Index derived using the SAGA algorithm
NVILANx a numeric vector; NDVI image derived using the Landsat image from the Image 2000 project
x a numeric vector; x-coordinate (m) in DHDN / Gauss-Krueger zone 3 (German coordinate system)
y a numeric vector; y-coordinate (m) in DHDN / Gauss-Krueger zone 3 (German coordinate system)

Note
Texture by hand method can be used to determine the content of soil earth fractions only to an accuracy of ±5–10% (Skaggs et al., 2001). A surveyor distinguishes to which of the 32 texture classes a soil samples belongs to, and then estimates the content of fractions; e.g. texture class St2 has 10% clay, 25% silt and 65% sand (Ad-hoc-AG Boden, 2005).

Author(s)
The Ebergötzen dataset is courtesy of Gehrt Ernst (<Ernst.Gehrt@niedersachsen.de>), the State Authority for Mining, Energy and Geology, Hannover, Germany and Olaf Conrad, University of Hamburg (<conrad@geowiss.uni-hamburg.de>). The original data set has been prepared for this exercise by Tomislav Hengl (<tom.hengl@opengeohub.org>).

References
- https://geomorphometry.org/ebergotzen/

Examples
data(eberg)
data(eberg_grid)
data(eberg_zones)
data(eberg_contours)
Data set gives the spatial locations and reported times of food-and-mouth disease in north Cumbria (UK), 2001. It is of no scientific value, as it deliberately excludes confidential information on farms at risk in the study-region. It is included in the package purely as an illustrative example.

Usage

```r
data(fmd)
```

Format

A matrix containing (x,y,t) coordinates of the 648 observations.

Author(s)

Edith Gabriel <edith.gabriel@univ-avignon.fr>

References


See Also

`northcumbria` for boundaries of the county of north Cumbria.
geopath

Geopath — shortest trajectory line between two geographic locations

Description
Derives a SpatialLines class object showing the shortest path between the two geographic locations and based on the Haversine Formula for Great Circle distance.

Usage
geopath(lon1, lon2, lat1, lat2, ID, n.points, print.geo = FALSE)

Arguments
- lon1: longitude coordinate of the first point
- lon2: longitude coordinate of the second point
- lat1: latitude coordinate of the first point
- lat2: latitude coordinate of the second point
- ID: (optional) point ID character
- n.points: number of intermediate points
- print.geo: prints the distance and bearing

Details
Number of points between the start and end point is derived using a simple formula:

\[
\text{round}\left(\frac{\sqrt{\text{distc}}}{\sqrt{2}}\right)
\]

where distc is the Great Circle Distance.

Value
Bearing is expressed in degrees from north. Distance is expressed in kilometers (Great Circle Distance).

Author(s)
Tomislav Hengl

References

See Also
kml_layer.SpatialLines, kml_layer.STTDF, fossil::earth.bear
## Examples

```r
## Not run:
library(fossil)
ams.ny <- geopath(lon1=4.892222, lon2=-74.005973,
                 lat1=52.373056, lat2=40.714353, print.geo=TRUE)
kml.file = paste0(tempdir(), "/ams.ny.kml")
# write to a file:
kml(ams.ny, file.name=kml.file)

## End(Not run)
```

---

### Description

Gets the proj4 string from an object of type "Spatial" or "Raster".

### Usage

```r
## S4 method for signature 'Spatial'
getCRS(obj)
## S4 method for signature 'Raster'
getCRS(obj)
```

### Arguments

- `obj` object of type "Spatial" or "Raster"

### Details

For more details about the PROJ.4 parameters refer to the [https://proj4.org](https://proj4.org).

### Author(s)

Tomislav Hengl and Pierre Roudier

### See Also

`sp::CRS`, `raster::raster`, `check_projection`

### Examples

```r
data(eberg_grid)
library(sp)
coordinates(eberg_grid) <- ~x+y
gridded(eberg_grid) <- TRUE
library(rgdal)
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
```
library(raster)

r <- raster(eberg_grid[1])

getCRS(r)

r.ll <- reproject(r)

getCRS(r.ll)

description

getWikiMedia.ImageInfo

*Gets EXIF information*

### Description

getWikiMedia.ImageInfo function fetches the EXIF (Exchangeable image file format) data via the Wikimedia API for any donated image. The resulting EXIF data (named list) can then be further used to construct an object of class "SpatialPhotoOverlay", which can be parsed to KML.

### Usage

```
getWikiMedia.ImageInfo(imagename, 
  APIsource = "https://commons.wikimedia.org/w/api.php", 
  module = "imageinfo", 
  details = c("url", "metadata", "size", "extlinks"), testURL = TRUE)
```

### Arguments

- `imagename`: Wikimedia commons unique image title.
- `APIsource`: location of the API service.
- `module`: default module.
- `details`: detailed parameters of interest.
- `testURL`: logical; species if the program should first test whether the image exist at all (recommended).

### Details

Although this is often not visible in picture editing programs, almost any image uploaded to Wikimedia contains useful EXIF metadata. However, it is highly recommended that you insert some important tags in the image header yourself, by using e.g. the EXIF tool (courtesy of Phil Harvey), before uploading the files to Wikimedia. The getWikiMedia.ImageInfo function assumes that all required metadata has already been entered by the user before the upload, hence no further changes in the metadata will be possible. Examples of how to embed EXIF tags into an image file are available [here](#).

To geocode an uploaded image consider adding:

```
{{location|lat deg|lat min|lat sec|NS|long deg|long min|long sec|EW}}
```
tag to the file description, in which case `getWikiMedia.ImageInfo` will automatically look for the attached coordinates via the external links. For practical purposes and because the image properties information determined by the Wikimedia system can are more reliable, the function will rewrite some important EXIF metadata (image width and height) using the actual values determined by Wikimedia server.

For a list of modules and parameters that can be used via `getWikiMedia.ImageInfo`, please refer to [Wikimedia API manual](https://www.mediawiki.org/wiki/API).

**Author(s)**

Tomislav Hengl

**References**

- [Wikimedia API](https://www.mediawiki.org/wiki/API)
- [EXIF tool](https://exiftool.org/)

**See Also**

`spPhoto`, `Rexif::getExifPy`

**Examples**

```r
## Not run: # Photo taken using a GPS-enabled camera:
imagename = "Africa_Museum_Nijmegen.jpg"
x <- getWikiMedia.ImageInfo(imagename)
# Get the GPS info:
x$metadata[grep(names(x$metadata), pattern="GPS")]
# prints the complete list of metadata tags;

## End(Not run)
```

gpxbtour

**GPS log of a bike tour**

**Description**

GPS log of a bike tour from Wageningen (the Netherlands) to Münster (Germany). The table contains 3228 records of GPS locations, speed and elevation.

**Usage**

```r
data(gpxbtour)
```
Format

The data frame contains the following columns:

- lon  longitude (x-coordinate)
- lat  latitude (y-coordinate)
- ele  GPS-estimated elevation in m
- speed GPS-estimated speed in km per hour
- time XML Schema time

Note

The log was produced using the GlobalSat GH-615 GPS watch. The original data log (trackpoints) was first saved to GPX exchange format ([https://www.topografix.com/gpx.asp](https://www.topografix.com/gpx.asp)) and then imported to R using the XML package and formatted to a data frame.

Author(s)

Tomislav Hengl

Examples

```r
## Not run: ## load the data:
data(gpxbtour)
library(sp)
## format the time column:
gpxbtour$time <- as.POSIXct(gpxbtour$time, format="%Y-%m-%d\TH%H:%M:%SZ")
coordinates(gpxbtour) <- ~lon+lat
proj4string(gpxbtour) <- CRS("+proj=longlat +datum=WGS84")
## convert to a STTDF class:
library(spacetime)
library(adehabitatLT)
gpx.ltraj <- as.ltraj(coordinates(gpxbtour), gpxbtour$time, id = "th")
gpx.st <- as(gpx.ltraj, "STTDF")
## Google maps plot:
library(RgoogleMaps)
llc <- c(mean(gpx.st@bbox[2,]), mean(gpx.st@bbox[1,]))
MyMap <- GetMap.bbox(center=llc, zoom=8, destfile="map.png")
PlotOnStaticMap(MyMap, lat=gpx.st@sp@coords[,2], lon=gpx.st@sp@coords[,1],
                FUN=lines, col="black", lwd=4)
## End(Not run)
```
grid2poly  Converts a gridded map to a polygon map

Description

Converts a "SpatialGridDataFrame" object to a polygon map with each available grid node represented with a polygon. To allow further export to KML, grid2poly will, by default, convert any projected coordinates to the lat-lon system (geographic coordinates in the WGS84 system).

Usage

grid2poly(obj, var.name = names(obj)[1], reproject = TRUE,
method = c("sp", "raster", "RSAGA")[1], tmp.file = TRUE,
saga_lib = "shapes_grid", saga_module = 3, silent = FALSE, ...)

Arguments

obj  "SpatialGridDataFrame" object
var.name  target variable column name
reproject  logical; reproject coordinates to lat lon system?
method  decide to convert grids to polygons either using "sp", "raster" or "RSAGA" packages
tmp.file  logical; specify whether to create a temporary file, or to actually write to the working directory (in the case of SAGA GIS is used to convert grids)
saga_lib  string; SAGA GIS library name
saga_module  SAGA GIS module number; see ?rsaga_get_modules for more details
silent  logical; specifies whether to print the SAGA GIS output
...
additional arguments that can be parsed to the rasterToPolygons command

Details

grid2poly is not recommended for large grids (>10e4 pixels). Consider splitting large input grids into tiles before running grid2poly. For converting large grids to polygons consider using SAGA GIS (method = "RSAGA") instead of using the default sp method.

Author(s)

Tomislav Hengl

See Also

vect2rast, raster::rasterToPolygons
Examples

data(eberg_grid)
library(sp)
coordinates(eberg_grid) <- ~x+y
gridded(eberg_grid) <- TRUE
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
data(SAGA_pal)
## Not run: # compare various methods:
system.time(dem_poly <- grid2poly(eberg_grid, "DEMSRT6", method = "raster"))
system.time(dem_poly <- grid2poly(eberg_grid, "DEMSRT6", method = "sp"))
system.time(dem_poly <- grid2poly(eberg_grid, "DEMSRT6", method = "RSAGA"))
## plotting large polygons in R -> not a good idea
# spplot(dem_poly, col.regions = SAGA_pal[[1]])
## visualize the data in Google Earth:
# kml(dem_poly, colour_scale = SAGA_pal[[1]], colour = DEMSRT6, kmz = TRUE)

## End(Not run)

---

HRprec08  
**Daily precipitation for Croatia for year 2008**

Description

The daily measurements of precipitation (rain gauges) for year 2008 kindly contributed by the Croatian National Meteorological Service. HRprec08 contains 175,059 measurements of precipitation sums (489 stations by 365 days).

Usage

data(HRprec08)

Format

The HRprec08 data frames contain the following columns:

- **NAME**: name of the meteorological station
- **Lon**: a numeric vector; x-coordinate / longitude in the WGS84 system
- **Lat**: a numeric vector; y-coordinate / latitude in the WGS84 system
- **DATE**: `Date` class vector
- **PREC**: daily cumulative precipitation in mm (precipitation from the day before)

Note

The precipitation estimates in mm (HRprec08) are collected in a bottle within the rain gauge and readings are usually manual by an observer at 7 a.m. The precipitation collected in the morning refer to the precipitation for previous 24 hours. To project coordinates we suggest using the UTM zone 33N system as this coordinate system was used to prepare the gridded predictors.
Author(s)

Tomislav Hengl and Melita Percec Tadic

References


  Service, 200 p.


See Also

HRtemp08

Examples

data(HRprec08)
library(sp)
## Not run: # subset:
prec.2008.05.01 <- HRprec08[HRprec08$DATE=="2008-05-01",]
coordinates(prec.2008.05.01) <- ~Lon+Lat
proj4string(prec.2008.05.01) <- CRS("+proj=lonlat +datum=WGS84")
# write to KML:
shape = "http://plotkml.r-forge.r-project.org/circle.png"
data(SAGA_pal)
kml(prec.2008.05.01, size = PREC, shape = shape, colour = PREC,colour_scale = SAGA_pal[[9]], labels = PREC)
## End(Not run)

Description

Daily temperatures for Croatia for year 2008

The daily measurements of temperature (thermometers) for year 2008 kindly contributed by the Croatian National Meteorological Service. HRtemp08 contains 56,608 measurements of temperature (159 stations by 365 days).

Usage

data(HRtemp08)
Format

The HRtemp08 data frames contain the following columns:

- **NAME**  name of the meteorological station
- **Lon**  a numeric vector; x-coordinate / longitude in the WGS84 system
- **Lat**  a numeric vector; y-coordinate / latitude in the WGS84 system
- **DATE** 'Date' class vector
- **TEMP**  daily temperature measurements in degree C

Note

The precision of the temperature readings in HRtemp08 is tenth of degree C. On most climatological stations temperature is measured three times a day, at 7 a.m., 1 p.m. and 9 p.m. The daily mean can be calculated as a weighted average.

Author(s)

Tomislav Hengl, Melita Percec Tadic and Benedikt Graeler

References


See Also

HRprec08

Examples

data(HRtemp08)

## Not run:
## examples from: http://dx.doi.org/10.1007/s00704-011-0464-2
library(spacetime)
library(gstat)
library(sp)
sp <- SpatialPoints(HRtemp08[,c("Lon","Lat")])
proj4string(sp) <- CRS("+proj=longlat +datum=WGS84")
HRtemp08.st <- STIDF(sp, time = HRtemp08$DATE-.5,
data = HRtemp08[,c("NAME","TEMP")],
endTime = as.POSIXct(HRtemp08$DATE+.5))
## Country borders:
con0 <- url("http://www.gadm.org/data/rda/HRV_adm1.RData")
load(con0)
stplot(HRtemp08.st[,"2008-07-02::2008-07-03","TEMP"],
na.rm=TRUE, col.regions=SAGA_pal[[1]],

```r
## Not run:
## examples from: http://dx.doi.org/10.1007/s00704-011-0464-2
library(spacetime)
library(gstat)
library(sp)
sp <- SpatialPoints(HRtemp08[,c("Lon","Lat")])
proj4string(sp) <- CRS("+proj=longlat +datum=WGS84")
HRtemp08.st <- STIDF(sp, time = HRtemp08$DATE-.5,
data = HRtemp08[,c("NAME","TEMP")],
endTime = as.POSIXct(HRtemp08$DATE+.5))
## Country borders:
con0 <- url("http://www.gadm.org/data/rda/HRV_adm1.RData")
load(con0)
stplot(HRtemp08.st[,"2008-07-02::2008-07-03","TEMP"],
na.rm=TRUE, col.regions=SAGA_pal[[1]],
```
sp.layout=list("sp.polygons", gadm))

## Load covariates:
con <- url("http://plotkml.r-forge.r-project.org/HRgrid1km.rda")
load(con)
str(HRgrid1km)
## Prepare static covariates:
begin <- as.Date("2008-01-01")
endTime <- as.POSIXct(as.Date("2008-12-31"))
sp.grid <- as(HRgrid1km, "SpatialPixels")
HRgrid1km.st0 <- STFDF(sp.grid, time=begin,
data=HRgrid1km@data[,sel.s], endTime=endTime)
## Prepare dynamic covariates:
sel.d <- which(!names(HRgrid1km) %in% sel.s)
dates <- sapply(names(HRgrid1km)[sel.d],
function(x){strsplit(x, "LST")[[1]][2]})
dates <- as.Date(dates, format="%Y_%m_%d")
## Sort values of MODIS LST bands:
m <- data.frame(MODIS.LST = as.vector(unlist(HRgrid1km@data[,sel.d])))
## >10M values!
## Create an object of type STFDF:
HRgrid1km.stD <- STFDF(sp.grid, time=dates-4, data=m,
endTime=as.POSIXct(dates+4))

## Overlay in space and time:
HRtemp08.stxy <- spTransform(HRtemp08.st, CRS(proj4string(HRgrid1km)))
 OV.s <- over(HRtemp08.stxy, HRgrid1km.st0)
OV.d <- over(HRtemp08.stxy, HRgrid1km.stD)
## Prepare the regression matrix:
regm <- do.call(cbind, list(HRtemp08.stxy@data, OV.s, OV.d))
## Estimate cumulative days:
regm$cday <- floor(unclass(HRtemp08.stxy@endTime)/86400-.5)
str(regm)
## Plot a single station:
scatter.smooth(regm$cday[regm$NAME=="Zavi<5><be>an"],
regm$TEMP[regm$NAME=="Zavi<5><be>an"],
xlab="Cumulative days",
ylab="Mean daily temperature (\260C)",
ylim=c(-12,28), main="GL039 (Zavi\236an)",
col="grey")
## Run PCA so we can filter missing pixels in the MODIS images:
pca <- prcomp(~HRdem+HRdsea+Lat+Lon+HRtwi+MODIS.LST,
data=regm, scale.=TRUE)
 selc <- c("TEMP","Lon","Lat","cday")
regm.pca <- cbind( regm[-pca$na.action, selc],
as.data.frame(pca$x))
## Fit a spatio-temporal regression model:
theta <- min(regm.pca$cday)
 lm.HRtemp08 <- lm(TEMP~PC1+PC2+PC3+PC4+PC5+PC6
+cos((cday-theta)*pi/180), data=regm.pca)
 summary(lm.HRtemp08)
## Prediction locations -> focus on Istria:

```r
data(LST)
gridded(LST) <- ~lon+lat
proj4string(LST) <- CRS("+proj=longlat +datum=WGS84")
LST.xy <- reproject(LST[1], proj4string(HRgrid1km))
LST.xy <- as(LST.xy, "SpatialPixels")
```

## targeted dates:

```r
t.dates <- as.Date(c("2008-02-01","2008-05-01","2008-08-01"),
                   format="%Y-%m-%d")
LST.st <- STF(geometry(LST.xy), time=t.dates)
```

## get values of covariates:

```r
ov.s.IS <- over(LST.st, HRgrid1km.st0)
ov.d.IS <- over(LST.st, HRgrid1km.stD)
LST.stdf <- STFD(geometry(LST.xy), time=t.dates,
                 data=cbind(ov.s.IS, ov.d.IS))
```

## predict Principal Components:

```r
LST.pca <- as.data.frame(predict(pca, LST.stdf@data))
LST.stdf@data[,paste0("PC",1:6)] <- LST.pca
cday.l <- as.vector(sapply(
        floor(unclass(LST.stdf@endTime)/86400-.5),
        rep, nrow(LST.xy@coords)))
LST.stdf@data[,"cday"] <- cday.l
```

## Predict spatio-temporal regression:

```r
LST.stdf@data[,"TEMP.reg"] <- predict(lm.HRtemp08,
                                      newdata=LST.stdf@data)
```

## Plot predictions:

```r
gadm.ll <- as(spTransform(gadm,
             CRS(proj4string(HRgrid1km))), "SpatialLines")
stplot(LST.stdf[,"PC1"], col.regions=SAGA_pal[[1]])
stplot(LST.stdf[,"PC2"], col.regions=SAGA_pal[[1]])
```

## End(Not run)

---

### kml-methods

**Write to a KML file**

**Description**

Writes any Spatial* object (from the sp package) or Raster* object (from the raster package) to a KML file via the `plotKML.fileIO` environment. Various aesthetics parameters can be set via colour, alpha, size, shape arguments. Their availability depends on the class of the object to plot.
Usage

## S4 method for signature 'Raster'

kml(obj, folder.name, file.name, kmz, ...)

## S4 method for signature 'Spatial'

kml(obj, folder.name, file.name, kmz, ...)

## S4 method for signature 'STIDF'

kml(obj, folder.name, file.name, kmz, ...)

## S4 method for signature 'SoilProfileCollection'

kml(obj, folder.name, file.name, kmz, ...)

## S4 method for signature 'SpatialPhotoOverlay'

kml(obj, folder.name, file.name, kmz, ...)

Arguments

- obj: object inheriting from the Spatial* or the Raster* classes
- folder.name: character; folder name in the KML file
- file.name: character; output KML file name
- kmz: logical; specify whether to compress the KML file
- ...: additional aesthetics arguments (see details below)

Details

To `kml` you can also pass folder.name, file.name (output file name *.kml), overwrite (logical; overwrites the existing file) and kmz (logical; specifies whether to compress the KML file) arguments.

Gridded objects (objects of class "SpatialGridDataFrame" or "RasterLayer" require at least one aesthetics parameter to run, usually the `colour`).

Value

A KML file. By default parses the object name and adds a ".kml" extension.

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

See Also

- `kml_open`, `kml_aes`, `kml_close`, `kml_compress`

Examples

```r
# Plotting a SpatialPointsDataFrame object
library(rgdal)
data(eberg)
eberg <- eberg[runif(nrow(eberg))<.1,]
library(sp)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
```
## Not run: # Simple plot
kml(eberg, file = "eberg-0.kml")
# Plot using aesthetics
shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png"
kml(eberg, colour = SNDMHT_A, size = CLYMHT_A,
   alpha = 0.75, file = "eberg-1.kml", shape=shape)
## End(Not run)

---

### kml.tiles

**Write vector object as tiled KML**

**Description**

Writes vector object as tiled KML. Suitable for plotting large vectors i.e. large spatial data sets.

**Usage**

```r
kml.tiles(obj, folder.name, file.name,
   block.x, kml.logo, cpus, home.url=".", desc=NULL,
   open.kml=TRUE, return.list=FALSE, ...)
```

**Arguments**

- `obj` "SpatialPoints*" or "SpatialLines*" or "SpatialPolygons*"; vector layer
- `folder.name` character; KML folder name
- `file.name` character; output KML file name
- `block.x` numeric; size of block in decimal degrees (geographical coordinates)
- `kml.logo` character; optional project logo file (PNG)
- `cpus` integer; specifies number of CPUs to be used by the snowfall package to speed things up
- `home.url` character; optional web-directory where the PNGs will be stored
- `desc` character; optional layer description
- `open.kml` logical; specifies whether to open the KML file after writing
- `return.list` logical; specifies whether to return list of tiled objects
- `...` (optional) aesthetics arguments (see aesthetics)

**Value**

Returns a list of KML files.

**Note**

This operation can be time-consuming for processing very large vectors. To speed up writing of KMLs, use the snowfall package.
kml_compress

Author(s)
Tomislav Hengl

See Also
plotKML, plotKML.GDALobj

Examples
## Not run:
library(sp)
library(snowfall)
library(landmap)
library(rgdal)

data(eberg)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
## plot using tiles:
shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png"
tiles.p <- kml.tiles(eberg["SNDMHT_A"], block.x=0.05,
size=0.8, z.lim=c(20,50), colour=SNDMHT_A, shape=shape,
labels=SNDMHT_A, return.list=TRUE)
## Returns a list of tiles
data(eberg_contours)
tiles.l <- kml.tiles(eberg_contours, block.x=0.05,
colour=Z, z.lim=range(eberg_contours$Z),
colour_scale=SAGA_pal[[1]], return.list=TRUE)
## End(Not run)

kml_compress

Compress a KML file with auxiliary files

Description
Compresses the KML file together with the auxiliary files (images, models, textures) using the
default ZIP program.

Usage
kml_compress(file.name, zip = "", files = "", rm = FALSE, ...)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>file.name</td>
<td>KML file name</td>
</tr>
<tr>
<td>zip</td>
<td>(optional) location of an external ZIP program</td>
</tr>
<tr>
<td>files</td>
<td>a character vector specifying the list of auxiliary files</td>
</tr>
<tr>
<td>rm</td>
<td>logical; specify whether to remove temporary files</td>
</tr>
<tr>
<td>...</td>
<td>other kml arguments</td>
</tr>
</tbody>
</table>
Details

The KMZ file can carry the model files (.dae), textures and ground overlay images. For practical purposes, we recommend that you, instead of compressing the images together with the KML file, consider serving the ground overlay images via a server i.e. as network links. If no internal ZIP program exists, the function looks for the system ZIP program:

```r
Sys.getenv("R_ZIPCMD","zip")
```

External ZIP program can also be specified via the `zip` argument.

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

References

- KMZ description (https://developers.google.com/kml/documentation/?csw=1)

See Also

- `kml-methods`, `kml_open`

Examples

```r
data(eberg)
eberg <- eberg[runif(nrow(eberg))<.1,]
library(sp)
library(rgdal)
library(raster)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
kml.file = paste0(tempdir(), "/eberg.kml")
kml_open(kml.file)
kml_layer(eberg, colour = CLYMHT_A)
kml_close(kml.file)
# compress:
kml_compress(kml.file)
```

---

**kml_description**

Generate a table description from a data frame

Description

Converts a two-column data frame to a table in HTML format. This can then parsed to a KML file as the layer description.
Usage

```r
kml_description(x, iframe = NULL, caption = "Object summary",
    fix.enc = TRUE, cwidth = 150, twidth = 300,
    delim.sign = ",", asText = FALSE)
```

Arguments

- **x**: object of class "data.frame" with two columns
- **iframe**: (optional) iframe content
- **caption**: character; table caption
- **fix.enc**: logical; specify whether to fix encoding
- **cwidth**: numeric; first column width
- **twidth**: numeric; table width
- **delim.sign**: character; delimiter sign
- **asText**: logical; specifies whether to return the formatted table as text or XML

Author(s)

Tomislav Hengl

See Also

- `kml-methods`
- `kml_layer-methods`

Description

Write objects to a KML connection

Usage

```r
kml_layer(obj, ...)
```

Arguments

- **obj**: object inheriting from the Spatial* or the Raster* classes
- **...**: additional aesthetics arguments; see details for each `kml_layer` function and the `kml_aes` function
Value

An XML object that can be further parsed to a KML file (via an open connection).

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

See Also


Examples

```r
library(rgdal)
data(eberg_grid)
library(sp)
library(raster)
gridded(eberg_grid) <- ~x+y
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
data(SAGA_pal)
data(R_pal)
## Not run: # Plot two layers one after the other:
kml_open("eberg_grids.kml")
kml_layer(eberg_grid, colour=DMSRT6, colour_scale=R_pal[["terrain_colors"]])
kml_layer(eberg_grid, colour=TWISRT6, colour_scale=SAGA_pal[[1]])
kml_close("eberg_grids.kml")
# print the result:
library(XML)
xmlRoot(xmlTreeParse("eberg_grids.kml")[["Document"]])
## End(Not run)

# examples with sf
eberg_grid_sf <- sf::st_as_sf(eberg_grid)

# sfc objects
## Not run:
kml_open("eberg_grids.kml")
kml_layer(st_geometry(eberg_grid_sf))
kml_close("eberg_grids.kml")

## End(Not run)

# sf objects
## Not run:
kml_open("eberg_grid_sf.kml")
kml_layer(eberg_grid_sf, colour = DEMSRT6, colour_scale = R_pal[["terrain_colors"]])
kml_layer(eberg_grid_sf, colour = TWISRT6, colour_scale = SAGA_pal[[1]])
kml_close("eberg_grid_sf.kml")
```
## End(Not run)

---

### kml_layer.Raster

**Writes raster objects to KML**

---

### Description

Writes rasters to PNG images and makes a KML code (ground overlays). Works with "RasterLayer" and "RasterStack" class objects. Target attributes can be specified using aesthetics arguments (e.g. "colour").

### Usage

```r
kml_layer.Raster(obj, subfolder.name = paste(class(obj)), plot.legend = TRUE,
                  metadata = NULL, raster_name, 
                  png.width = ncol(obj), png.height = nrow(obj),
                  min.png.width = 800, TimeSpan.begin, TimeSpan.end,
                  layer.name, png.type, ...)```

### Arguments

- **obj**: object of class "RasterLayer", "SpatialPixelsDataFrame" or "SpatialGridDataFrame"
- **subfolder.name**: character; optional subfolder name
- **plot.legend**: logical; specify whether a map legend should be generated automatically
- **metadata**: (optional) specify the metadata object
- **raster_name**: (optional) specify the output file name (PNG)
- **png.width**: (optional) width of the PNG file
- **png.height**: (optional) height of the PNG file
- **min.png.width**: (optional) minimum width of the PNG file
- **TimeSpan.begin**: object of class "POSIXct"; (optional) begin of the sampling period
- **TimeSpan.end**: object of class "POSIXct"; (optional) end of the sampling period
- **layer.name**: character; optional layer name
- **png.type**: character; PNG type
- **...**: additional aesthetics arguments

### Details

Google Earth does not properly handle a 24-bit PNG file which has a single transparent color (read more at Google Earth Help). To force transparency, plotKML will try to set it using the `-matte -transparent \#FFFFFF` option in the ImageMagick convert program (ImageMagick needs to be installed separately and located using `plotKML.env()`). On some Unix run machines the `png.type` argument has to be set manually to avoid producing empty PNGs.
Author(s)
Tomislav Hengl, Pierre Roudier and Dylan Beaudette

See Also
kml-methods, kml_open, kml_layer.RasterBrick, plotKML-method

Examples

```r
data(eberg_grid)
library(sp)
coordinates(eberg_grid) <- ~x+y
grided(eberg_grid) <- TRUE
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
data(SAGA_pal)
library(raster)
r <- raster(eberg_grid["TWISRT6"])
## Not run: # KML plot with a single raster:
kml(r, colour_scale = SAGA_pal[[1]], colour = TWISRT6)
## End(Not run)
```

### kml_layer.RasterBrick

Export a time series of images to KML

**Description**

Writes a series of images to PNGs and uses them to create ground overlays. Works only with "RasterBrick" class objects with time dimension specified via the "@zvalue".

**Usage**

```r
kml_layer.RasterBrick(obj, plot.legend = TRUE, dtime = "", tz = "GMT",
                      z.lim = c(min(minValue(obj), na.rm=TRUE), max(maxValue(obj), na.rm=TRUE)),
                      colour_scale = get("colour_scale_numeric", envir = plotKML.opts),
                      home_url = get("home_url", envir = plotKML.opts),
                      metadata = NULL, html.table = NULL,
                      altitudeMode = "clampToGround", balloon = FALSE,
                      png.width, png.height, min.png.width = 800, png.type, ...)
```

**Arguments**

- `obj` object of class "RasterBrick" (e.g. a time series of images)
- `plot.legend` logical; specify whether a map legend should be generated automatically
- `dtime` temporal support (point or block) expressed in seconds
- `tz` referent time zone
z.lim upper and lower limits (unique for all maps in the time series); the function by default uses the absolute minimum and maximum in values

colour_scale color palette; by default uses the color scale for numeric variables

home_url (optional) URL directory / location of the images

metadata (optional) the metadata object

html.table (optional) the description block (html)

altitudeMode character; the default altitudeMode

balloon logical; specifies whether to display balloon for each element

png.width (optional) width of the PNG files

png.height (optional) height of the PNG files

min.png.width (optional) minimum width of the PNG file

png.type character; PNG type

... additional arguments (see aesthetics)

Details

This method is recommended for visualization of numeric bands representing the same variable i.e. time series of images. To export a stack of images of different type see `kml_layer.Raster`. If the "@zvalue" slot is empty, dates will be added by subtracting days from the current day with 1–day increments.

Author(s)

Tomislav Hengl

See Also

kml-methods, kml_open, kml_layer.Raster, plotKML-method

**kml_layer.SoilProfileCollection**

*Writes a list of soil profiles to KML*

Description

Writes object of type "SoilProfileCollection" (a number of soil profiles with site and horizon data) to KML. Several attributes such as horizontal and vertical exaggeration can be passed via arguments.
Usage

kml_layer.SoilProfileCollection(obj,
   var.name, var.min = 0, var.scale,
   site_names = profile_id(obj),
   method = c("soil_block", "depth_function")[1],
   block.size = 100,
   color.name, z.scale = 1, x.min, max.depth = 300,
   plot.points = TRUE,
   LabelScale = get("LabelScale", envir = plotKML.opts) * 0.7,
   IconColor = "#ff0000ff",
   shape = paste(get("home_url", envir = plotKML.opts),
     "circlesquare.png", sep = ","),
   outline = TRUE, visibility = TRUE, extrude = TRUE, tessellate = TRUE,
   altitudeMode = "relativeToGround", camera.distance = 0.01,
   tilt = 90, heading = 0, roll = 0,
   metadata = NULL, html.table = NULL, plot.scalebar = TRUE,
   scalebar = paste(get("home_url", envir = plotKML.opts),
     "soilprofile_scalebar.png", sep = ","),
   ... )

Arguments

obj object of class "SoilProfileCollection" (package aqp)
var.name target column name in the horizons slot
var.min smallest value
var.scale exaggeration in vertical dimension
site_names site names as listed in the site table
method visualization type (soil block or depth-function)
block.size (optional) size of the block of land
color.name (optional) column name carrying the color information for each horizon
z.scale exaggeration in horizontal direction
x.min offset in longitude direction (in decimal degrees)
max.depth maximum height/depth of a profile in cm
plot.points logical; specifies whether to plot horizon centres with attribute values
LabelScale numeric; specifies size of the labels for each horizon
IconColor colors for the labels for each horizon
shape default icon for Google placemarks
outline logical; specifies whether to draw outline for the soil-depth functions (or simply a line)
visibility logical; specifies whether to make the layer visible
extrude logical; specifies whether to extrude horizon centers
tessellate logical; specifies whether to tessellate polygons
altitudeMode by default relativeToGround
camera.distance distance from a profile in arc degrees
tilt angle between the direction of the LookAt position and the normal to the surface of the earth
heading orientation towards north
roll rotation about the y axis
metadata (optional) spatial metadata for the input object
html.table (optional) tabular content (attributes) for each horizon
plot.scalebar logical; specifies whether to plot a scale bar next to the profile plot
scalebar default icon for the scale bar
... additional style arguments

Details

Horizon depths are typically expressed in cm, hence the default exaggeration factor (z.scale) is 10. It is highly recommended to turn off the terrain layer in Google Earth, otherwise Google Earth will deform the plots in areas of high relief.

Note

The spatial exaggeration needs to be used because often the detail in the background imagery in Google Earth is limited to a spatial accuracy of 2–20 m, hence there is no point of zooming into objects of size of few meters. These exaggeration factors were selected empirically and will need to be adjusted as the detail in the background imagery increases.

Author(s)

Tomislav Hengl, Dylan Beaudette and Pierre Roudier

References

- Algorithms for Quantitative Pedology (https://CRAN.r-project.org/package=aqp)

See Also

kml_layer.SpatialPhotoOverlay, plotKML-method

Examples

```r
## Not run: ## install.packages("aqp", repos="http://R-Forge.R-project.org")
library(aqp)
library(fossil)
library(plyr)
data(ca630)
## Promote to SoilProfileCollection
ca <- join(ca630$lab, ca630$site, type='inner')
depths(ca) <- pedon_key ~ hzn_top + hzn_bot
```
## extract site data
site(ca) <- mlra + ssa + lon + lat + cntrl_depth_to_top + cntrl_depth_to_bot + sampled_taxon_name

## generate SpatialPoints
library(sp)
coordinates(ca) <- lon + lat

## assign CRS data
proj4string(ca) <- "+proj=longlat +datum=NAD83"

## plot changes in base saturation by sum of cations method (pH 8.2):
kml(ca, method = "depth_function", file.name = "ca_bs_8_2.kml", var.name="bs_8.2", balloon = TRUE)

## plot changes in cation exchange capacity by sum of cations method (pH 8.2):
kml(ca, file.name = "ca_CEC8_2.kml", var.name="CEC8.2", IconColor = "#ff009000")

## plot soil profile as 'block':
kml(ca, file.name = "ca_CEC8_2_block.kml", var.name="CEC8.2", balloon = TRUE)

## End(Not run)

---

**kml_layer.SpatialLines**

*W*rites spatial lines to KML*

### Description

W*rites object of class"SpatialLines*" to KML with a possibility to parse attribute variables using several aesthetics arguments.*

### Usage

```r
kml_layer.SpatialLines(obj, subfolder.name = paste(class(obj)),
                          extrude = FALSE, z.scale = 1, metadata = NULL,
                          html.table = NULL, TimeSpan.begin = "", TimeSpan.end = "", ...)
```

### Arguments

- **obj** object of class "SpatialLines*"
- **subfolder.name** character; optional subfolder name
- **extrude** logical; specifies whether to connect the LinearRing to the ground
- **z.scale** vertical exaggeration
- **metadata** (optional) specify the metadata object
- **html.table** optional description block (html) for each GPS point (vertices)
- **TimeSpan.begin** (optional) beginning of the referent time period
- **TimeSpan.end** (optional) end of the referent time period
- **...** additional style arguments (see *aesthetics*)
Details

Only colour and width (aesthetics) are recommended when visualizing SpatialLines* objects. TimeSpan.begin and TimeSpan.end are optional TimeStamp vectors in the format: yyyy-mm-ddThh:mm:sszzzzzzz
Use the same time values for both TimeSpan.begin and TimeSpan.end if the measurements refer to a single moment in time. TimeSpan.begin and TimeSpan.end can be either a single value or a vector of values.

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

See Also

kml-methods, kml_open, kml_layer.SpatialPolygons, plotKML-method

Examples

library(rgdal)
library(sp)
data(eberg_contours)
data(SAGA_pal)
names(eberg_contours)
# KML plot with elevations used as 'colour' argument:
kml.file = paste0(tempdir(), "/eberg_contours.kml")
kml(eberg_contours, file.name = kml.file,
   colour_scale = SAGA_pal[[1]], colour = Z)

kml_layer.SpatialPhotoOverlay

Exports objects of type SpatialPhotoOverlay to KML

Description

Writes object of type SpatialPhotoOverlay to KML together with a COLLADA 3D model file (optional).

Usage

kml_layer.SpatialPhotoOverlay(obj, method = c("PhotoOverlay", "monolith")[1],
   PhotoOverlay.shape = obj@PhotoOverlay$shape, href = obj@filename,
   coords, dae.name = "", heading = obj@PhotoOverlay$heading,
   tilt = obj@PhotoOverlay$tilt, roll = obj@PhotoOverlay$roll,
   near = obj@PhotoOverlay$near, range = obj@PhotoOverlay$range,
   leftFov = obj@PhotoOverlay$leftFov, rightFov = obj@PhotoOverlay$rightFov,
   bottomFov = obj@PhotoOverlay$bottomFov, topFov = obj@PhotoOverlay$topFov,
altitudeMode = "clampToGround", block.size = 100, max.depth = 300, 
            scale.x = 1, scale.y = 1, scale.z = 1, refreshMode = "once", 
            html.table = NULL, ... )

Arguments

obj object of class "SpatialPhotoOverlay" (a photograph with spatial coordinates, metadata and orientation)

method visualization type: either "PhotoOverlay" or "monolith"

PhotoOverlay.shape

href location of the image file

cords (optional) 3D coordinates of the trapezoid corners

dae.name (optional) COLLADA 3D model file name (without the extension)

heading a PhotoOverlay argument; direction (azimuth) of the camera, in degrees

tilt a PhotoOverlay argument; rotation, in degrees, of the camera around the X axis

roll a PhotoOverlay argument; rotation, in degrees, of the camera around the Z axis

near a PhotoOverlay argument; measurement in meters along the viewing direction from the camera viewpoint to the PhotoOverlay shape

range a PhotoOverlay argument; distance in meters from the point specified by <longitude>, <latitude>, and <altitude> to the LookAt position

leftFov a PhotoOverlay argument; angle, in degrees, between the camera’s viewing direction and the left side of the view volume

rightFov a PhotoOverlay argument; angle, in degrees, between the camera’s viewing direction and the right side of the view volume

bottomFov a PhotoOverlay argument; angle, in degrees, between the camera’s viewing direction and the bottom side of the view volume

topFov a PhotoOverlay argument; angle, in degrees, between the camera’s viewing direction and the top side of the view volume

altitudeMode altitude mode

block.size width of the block (100 m by default)

max.depth 300 m by default

scale.x exaggeration in X dimension (COLLADA rectangle)

scale.y exaggeration in Y dimension (COLLADA rectangle)

scale.z exaggeration in Z dimension (COLLADA rectangle)

refreshMode refresh mode for the COLLADA object

html.table (optional) specify the description block (html) for each point

... other additional arguments

Details

The default width and height (100 m and 300 m) were selected based on empirical testing (level of detail in the background imagery in Google Earth). User specified coordinates can be passed via the cords argument. For more info see `makeCOLLADA.rectangle`. 
**kml_layer.SpatialPixels**

*Writes SpatialPixels or SpatialGrid objects to KML*

**Description**

Writes sp classes "SpatialGrid" or "SpatialPixels" to PNG images and makes a KML document (ground overlays). Target attributes can be specified using aesthetics arguments (e.g. "colour").

**Usage**

```r
kml_layer.SpatialPixels(obj, subfolder.name = paste(class(obj)), raster_name, 
plot.legend = TRUE, metadata = NULL, 
png.width = gridparameters(obj)[1,"cells.dim"],
png.height = gridparameters(obj)[2,"cells.dim"],
min.png.width = 800, TimeSpan.begin, TimeSpan.end, 
layer.name, png.type, ...)
```

**Author(s)**

Tomislav Hengl

**References**

- COLLADA Reference ([https://www.khronos.org/collada/](https://www.khronos.org/collada/))

**See Also**

spPhoto, getWikiMedia.ImageInfo

**Examples**

```r
## Not run: # display spatially referenced photograph in Google Earth:
imagename = "Soil_monolith.jpg"
x1 <- getWikiMedia.ImageInfo(imagename)
sm <- spPhoto(filename = x1$url$url, exif.info = x1$metadata)
kml_open("sm.kml")
kml_layer(sm, method="monolith")
kml_close("sm.kml")
kml_compress("sm.kml", files="Soil_monolith_jpg.dae")

## End(Not run)
```
Arguments

obj : object of class "RasterLayer", "SpatialPixelsDataFrame" or "SpatialGridDataFrame"
subfolder.name : character; optional subfolder name
plot.legend : logical; specify whether a map legend should be generated automatically
metadata : (optional) specify the metadata object
raster_name : (optional) specify the output file name (PNG)
png.width : (optional) width of the PNG file
png.height : (optional) height of the PNG file
min.png.width : (optional) minimum width of the PNG file
TimeSpan.begin : object of class "POSIXct"; (optional) begin of the sampling period
TimeSpan.end : object of class "POSIXct"; (optional) end of the sampling period
layer.name : character; optional layer name
png.type : character; PNG type
... : additional aesthetics arguments

Details

Google Earth does not properly handle a 24-bit PNG file which has a single transparent color (read more at Google Earth Help). To force transparency, plotKML will try to set it using the -matte -transparent "\#FFFFFF" option in the ImageMagick convert program (ImageMagick needs to be installed separately and located using plotKML.env()). The PNG export uses the 'cairographics', which will never use a palette and normally creates a larger 32-bit ARGB file, but then always allows transparency. On some Unix run machines the png.type argument has to be set manually to avoid producing empty PNGs.

Author(s)

Tomislav Hengl, Pierre Roudier and Dylan Beaudette

See Also

kml-methods, kml_open, kml_layer.Raster, plotKML-method

Examples

data(eberg_grid)
library(sp)
library(rgdal)
library(raster)
coordinates(eberg_grid) <- ~x+y
gridded(eberg_grid) <- TRUE
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
data(SAGA_pal)
## Not run: ## KML plot with a single raster:
kml(eberg_grid, colour_scale = SAGA_pal[[1]], colour = TWISRT6)
## make a larger image:
**kml_layer.SpatialPoints**

`kml(eberg_grid, colour_scale = SAGA_pal[[1]], colour = TWISRT6, png.width = 600, png.height = 600)`

```R
## End(Not run)
```

---

**kml_layer.SpatialPoints**  
*Writes spatial points to KML*

---

**Description**

Writes object of class "SpatialPoints*" to KML with a possibility to parse attribute variables using several aesthetics arguments.

**Usage**

```R
kml_layer.SpatialPoints(obj, subfolder.name = paste(class(obj)), extrude = TRUE, z.scale = 1, LabelScale = get("LabelScale", envir = plotKML.opts), metadata = NULL, html.table = NULL, TimeSpan.begin = "", TimeSpan.end = "", points_names, ...)
```

**Arguments**

- **obj** object of class "SpatialPoints*"
- **subfolder.name** character; optional subfolder name
- **extrude** logical; specifies whether to connect the point to the ground with a line
- **z.scale** numeric; exaggeration in vertical dimension
- **LabelScale** numeric; scale factor for size of labels
- **metadata** (optional) specify the metadata object
- **html.table** (optional) specify the description block (html) for each point
- **TimeSpan.begin** (optional) beginning of the referent time period
- **TimeSpan.end** (optional) end of the referent time period
- **points_names** character; forces the point labels (size of the character vector must equal the number of the points)
- ... additional style arguments (see aesthetics)

**Details**

`TimeSpan.begin` and `TimeSpan.end` are optional TimeStamp vectors:

```R
yyyy-mm-ddTh:mm:sszzzzzzz
```
For observations at point support (a single moment in time), use the same time values for both 
TimeSpan.begin and TimeSpan.end. TimeSpan.begin and TimeSpan.end can be either a single 
value or a vector of values.

Optional aesthetics arguments are shapes (icons), colour, sizes, altitude (if not a 3D ob-
ject; variable to be used to specify altitude above ground), altitudeMode (altitude mode type 
(clampToGround, relativeToGround or absolute)). Although this function can be used to plot 
over five variables, more than three aesthetics arguments is not recommended (e.g. limit to size and 
colour).

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

See Also

kml_layer.STTDF, plotKML-method

Examples

data(eberg)
data(SAGA_pal)
library(sp)
library(rgdal)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
names(eberg)
# subset to 10 percent:
eberg <- eberg[runif(nrow(eberg))<.1,]
## Not run: # plot the measured CLAY content:
kml(eberg, labels = CLYMHT_A)
shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png"
# color only:
kml(eberg, shape = shape, colour = SLTMHT_A, labels = "", colour_scale = SAGA_pal[[1]])
# two variables at the same time:
kml(eberg, shape = shape, size = CLYMHT_A, colour = SLTMHT_A, labels = "")
# two aesthetics elements are effective in emphasizing hot-spots:
kml(eberg, shape = shape, altitude = CLYMHT_A*10, extrude = TRUE,
  colour = CLYMHT_A, labels = CLYMHT_A, kmz = TRUE)
## End(Not run)

## example of how plotKML is programmed:
data(HRtemp08)
HRtemp08[1,]
library(XML)
p1 = newXMLNode("Placemark")
begin <- format(HRtemp08[1,"DATE"]-.5, "%Y-%m-%dT%H:%M:%SZ")
end <- format(HRtemp08[1,"DATE"]+.5, "%Y-%m-%dT%H:%M:%SZ")
txt <- sprintf("<name>%s</name><TimeStamp><begin>%s</begin><end>%s</end></TimeStamp>
  <Point><coordinates>%4f,%4f,%0f</coordinates></Point>", HRtemp08[1,"NAME"],
  begin, end, HRtemp08[1,"Lon"], HRtemp08[1,"Lat"], 0)
parseXMLAndAdd(txt, parent=p1)
kml_layer.SpatialPolygons

`kml_layer.SpatialPolygons(obj, subfolder.name = paste(class(obj)), extrude = TRUE, tessellate = FALSE, outline = TRUE, plot.labpt = FALSE, z.scale = 1, LabelScale = get("LabelScale", envir = plotKML.opts), metadata = NULL, html.table = NULL, TimeSpan.begin = "", TimeSpan.end = "", colorMode = "normal", ...)`

**Description**

Writes object of class "SpatialPolygons*" to KML with a possibility to parse attribute variables using several aesthetics arguments.

**Usage**

```r
kml_layer.SpatialPolygons(obj, subfolder.name = paste(class(obj)), extrude = TRUE, tessellate = FALSE, outline = TRUE, plot.labpt = FALSE, z.scale = 1, LabelScale = get("LabelScale", envir = plotKML.opts), metadata = NULL, html.table = NULL, TimeSpan.begin = "", TimeSpan.end = "", colorMode = "normal", ...)```

**Arguments**

- **obj**: object of class "SpatialPolygons*"
- **subfolder.name**: character; optional subfolder name
- **extrude**: logical; specifies whether to connect the point to the ground with a line
- **tessellate**: logical; specifies whether to connect the LinearRing to the ground
- **outline**: logical; specifies whether to outline the polygon
- **plot.labpt**: logical; specifies whether to add the label point (polygon centre)
- **z.scale**: numeric; exaggeration in vertical dimension
- **LabelScale**: numeric; scale factor for size of labels
- **metadata**: (optional) specify the metadata object
- **html.table**: optional description block (html) for each GPS point (vertices)
- **TimeSpan.begin**: (optional) beginning of the referent time period
- **TimeSpan.end**: (optional) end of the referent time period
- **colorMode**: (optional) KML color mode (normal or random)
- **...**: additional style arguments (see aesthetics)
kml_layer.STIDF

Details

Label points are by default not plotted. We recommend adding the legend to attribute maps instead. Transparency can be set by using the alpha argument. 

TimeSpan.begin and TimeSpan.end are optional TimeStamp vectors:

```
yyyy-mm-ddThh:mm:sszzzzzzz
```

Use the same time values for both TimeSpan.begin and TimeSpan.end if the measurements refer to a single moment in time. TimeSpan.begin and TimeSpan.end can be either a single value or a vector of values.

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

See Also

kml_layer.SpatialLines, kml_layer.STIDF, plotKML-method

Examples

```r
library(rgdal)
library(sp)
data(eberg_zones)
names(eberg_zones)
## visualize zones using random colors:
kml.file = paste0(tempdir(), "/eberg_zones.kml")
kml(eberg_zones, file.name=kml.file, colorMode = "random")
## with labels:
kml.file2 = paste0(tempdir(), "/eberg_zones2.kml")
kml(eberg_zones, file.name=kml.file2, colour = ZONES,
    plot.labpt = TRUE, labels = ZONES, kmz = TRUE, balloon=TRUE)
```

kml_layer.STIDF

Write irregular spatio-temporal observations (points, lines and polygons) to KML

Description

Writes an object of class "STIDF" (unstructured/irregular spatio-temporal data) to a KML file with a possibility to parse attribute variables using several aesthetics arguments.

Usage

```
kml_layer.STIDF(obj, dtime, ...)
```
Arguments

obj   space-time object of class "STIDF" (spatio-temporal irregular data frame) or class "STFDF" (spatio-temporal full data frame)
dtime  temporal support (point or block) expressed in seconds
...  additional arguments that can be passed to the kml_layer.Spatial method

Details

An object of class "STIDF" contains a slot of type "Spatial*", which is parsed via the kml_layer method depending on the type of spatial object (points, lines, polygons). The dateTime is defined as:

yyyy-mm-ddThh:mm:sszzzzzz

where T is the separator between the date and the time, and the time zone is either Z (for UTC) or zzzzzzz, which represents ±hh:mm in relation to UTC. For more info on how Time Stamps work see https://developers.google.com/kml/documentation/kml_tut. If the time is measured at block support, then:

<TimeStamp><begin> </begin><end> </end></TimeStamp>

tags will be inserted. Temporal support for any spacetime class, if not specified by the user, is determined as a difference between the "time" (indicating begin time) and "endTime" slots.

Author(s)

Tomislav Hengl and Benedikt Graeler

References

  • spacetime package (https://CRAN.R-project.org/package=spacetime)

See Also

kml_layer.STTDF, plotKML-method

Examples

```r
## Not run:
data(HRtemp08)
# format the time column:
HRtemp08$time <- as.POSIXct(HRtemp08$DATE, format="%Y-%m-%d %H:%M:%SZ")

# create a STIDF object:
library(spacetime)
sp <- SpatialPoints(HRtemp08[,c("Lon","Lat")])
```
proj4string(sp) <- CRS("+proj=longlat +datum=WGS84")
HRtemp08_st <- STIDF(sp, time = HRtemp08$ctime, data = HRtemp08[,c("NAME","TEMP")])

# write to a KML file:
HRtemp08_jan <- HRtemp08_st[1:500]
shape <- "http://maps.google.com/mapfiles/kml/pal2/icon18.png"
kml(HRtemp08_jan, dtime = 24*3600, colour = TEMP, shape = shape, labels = "", kmz=TRUE)

## North Carolina SIDS data set:
library(maptools)
fname <- system.file("shapes/sids.shp", package="maptools")[1]
nc <- readShapePoly(fname, proj4string=CRS("+proj=longlat +datum=NAD27"))
time <- as.POSIXct(strptime(c(rep("1974-01-01", length(nc)),
   rep("1979-01-01", length(nc))), format="%Y-%m-%d"), tz = "GMT")
data <- data.frame(BIR = c(nc$BIR74, nc$BIR79), NWBIR = c(nc$NWBIR74, nc$NWBIR79),
   SID = c(nc$SID74, nc$SID79))
# copy polygons:
nc.poly <- rep(slot(nc, "polygons"), 2)
# fix the polygon IDs:
for(i in 1:length(row.names(data))) { nc.poly[[i]]@ID = row.names(data)[i] }
sp <- SpatialPolygons(nc.poly, proj4string=CRS("+proj=longlat +datum=NAD27"))
# create a STIDF object:
nct <- STIDF(sp, time = time, data = data)
# write to a KML file:
kml(nct, colour = SID)

## End(Not run)

---

**kml_layer.STTDF**

*Write a space-time trajectory to KML*

**Description**

Writes an object of class "STTDF" to a KML file with a possibility to parse attribute variables using several aesthetics arguments.

**Usage**

```r
kml_layer.STTDF(obj, id.name = names(obj@data)[which(names(obj@data)=="burst")],
dtime, extrude = FALSE,
start.icon = paste(get("home_url", envir = plotKML.opts),
   "3Dballyellow.png", sep = ""),
end.icon = paste(get("home_url", envir = plotKML.opts),
   "golfhole.png", sep = ""),
LabelScale = 0.8 * get("LabelScale", envir = plotKML.opts), z.scale = 1,
metadata = NULL, html.table = NULL, ... )
```
Arguments

- **obj**: space-time object of class "STTDF" (spatio-temporal irregular data.frames trajectory)
- **id.name**: trajectory ID column name
- **dt ime**: temporal support size (in seconds)
- **extrude**: logical; extrude GPS vertices?
- **start.icon**: start icon name (3Dballyellow.png)
- **end.icon**: destination icon name (golfhole.png)
- **LabelScale**: the default size of icons
- **z.scale**: vertical exaggeration
- **metadata**: (optional) specify the metadata object
- **html.table**: optional description block (html) for each GPS point (vertices)
- **...**: other optional arguments

Details

The date time is defined as yyyy-mm-ddThh:mm:sszzzzzzz, where T is the separator between the date and the time, and the time zone is either Z (for UTC) or zzzzzzz, which represents ±hh:mm in relation to UTC. For more info on how Time Stamps work see https://developers.google.com/kml/documentation/kml_tut. If the time is measured at block support, then:

```xml
<TimeStamp><begin> </begin><end> </end></TimeStamp>
```

tags will be inserted. Temporal support for any spacetime class, if not specified by the user, is determined as a difference between the "time" (indicating begin time) and "endTime" slots.

Author(s)

Tomislav Hengl

References

- spacetime package (https://CRAN.R-project.org/package=spacetime)

See Also

readGPX, plotKML-method
kml_legend.bar  

Generates a legend bar (PNG file)

Description

Produces a PNG file that can be used as a screen overlay — legend bar for numeric and factor type variables.

Usage

kml_legend.bar(x, width, height, pointsize = 14, legend.file, legend.pal, 
    z.lim = range(x, na.rm=TRUE, finite=TRUE), factor.labels, png.type)

Arguments

x             numeric or factor-type vector
width         numeric; (optional) width of image in pixels
height        numeric; (optional) height of image in pixels
pointsize     numeric; point size for the plot
legend.file   PNG file name
legend.pal    character; color palette
z.lim         numeric; lower and upper limits
factor.labels character; class names if applicable
png.type      character; PNG type

Details

When exporting raster layers to KML the legend bar is generated by default. If the width and height are not provided, the function will try to estimate them automatically.

Author(s)

Tomislav Hengl, Pierre Roudier, and Dylan Beaudette

See Also

grDevices::png, kml-methods, kml_layer
kml.legend.whitening

Whitening legend (PNG)

Description

Produces a PNG file that can be used in KML plots (visualization of uncertainty).

Usage

```r
kml.legend.whitening(legend.res = 0.01, width = 120, height = 300, pointsize = 14,
                     x.lim, e.lim, leg.asp = 0.3 * width/height,
                     legend.file = "whitening_legend.png",
                     matte = FALSE, png.type)
```

Arguments

- `legend.res`: numeric; resolution on a 0-1 scale
- `width`: integer; image width
- `height`: integer; image height
- `pointsize`: integer; point size in units for text
- `x.lim`: numeric; upper and lower limits for target variable
- `e.lim`: numeric; upper and lower limits for the normalized error
- `leg.asp`: numeric; legend aspect
- `legend.file`: character; output PNG file name
- `matte`: logical; specify whether to fix transparency using ImageMagick
- `png.type`: character; PNG type

Details

The output PNG file shows a 2D legend with values on the vertical axis and uncertainty on the horizontal axis. Whitening is only valid with Hue-Saturation-Intensity system where Hue’s are used to represent values of the target variable, so that the amount of white color can be linearly used to represent uncertainty (i.e. whitening can not be used with different color palettes; or at least we do not recommend this).

Note

Google Earth does not properly handle a 24-bit PNG file which has a single transparent color. In order to force transparency in the output PNG, the function with try using ImageMagick convert function. ImageMagick needs to be installed separately and located using `plotKML.env()`.

Author(s)

Tomislav Hengl
kml_metadata-methods

Add metadata table to the active layer

Description

Adds a selection of metadata to the description box of an active layer.

Usage

```r
## S4 method for signature 'SpatialMetadata'
kml_metadata(obj, cwidth = 150, twidth = 500, asText = FALSE)
```

Arguments

- `obj` object of class "SpatialMetadata"
- `cwidth` html column width for the field names
- `twidth` html total table width
- `asText` logical; return the output as XML or characters

Details

The `kml_metadata` function, by default, prints out only a number of selected metadata fields:

1. "Citation_title",
2. "Abstract",
3. "Object_Count",
4. "Beginning_Date",

References


See Also

whitening

Examples

```r
## Not run: # create the 2D legend for whitening (PNG file):
kml_legend.whitening(x.lim=c(5,20), e.lim=c(.6,1))
## End(Not run)
```
See data(mdnames) for a complete list of metadata fields.

Author(s)
Tomislav Hengl

See Also
spMetadata

---

**kml_open**

*Open / close a KML file connection*

**Description**

Opens a KML file in write mode and initiates the KML header. The same file connection is further accessible by other `kml_*()` functions such as `kml_layer()` and `kml_close()`. `kml_View` tries to open the produced file using the default application.

**Usage**

```r
kml_open(file.name, folder.name = file.name, kml_open = TRUE,
          kml_visibility = TRUE, overwrite = TRUE, use.Google_gx = FALSE,
          kml_xsd = get("kml_xsd", envir = plotKML.opts),
          xmlns = get("kml_url", envir = plotKML.opts),
          xmlns_gx = get("kml_gx", envir = plotKML.opts))
```

**Arguments**

- `file.name` KML file name
- `folder.name` character string; KML folder name
- `kml_open` logical; specify whether to open the folder by default
- `kml_visibility` logical; specify whether to make the whole folder visible
- `overwrite` logical; if TRUE, "name" will be overwritten if it exists
- `use.Google_gx` logical; specify whether to use the Google’s extended schema
- `kml_xsd` URL of the KML scheme to be used
- `xmlns` URL of the OGC KML standard
- `xmlns_gx` URL of the extended standard
Add a screen overlay

Description

Adds an image file (map legend or logo) as screen overlay. The same file connection is further accessible by other kml_*() functions such as kml_layer() and kml_close(). This allows creation of customized multi-layered KML files.

Usage

```r
kml_screen(image.file, sname = "", position = c("UL","ML","LL","BC","LR","MR","UR","TC")[1],
overlayXY, screenXY, xyunits = c("fraction", "pixels", "insetPixels")[1],
rotation = 0, size = c(0,0) )
```

Arguments

- `image.file`: image file to be used for screen overlay
- `sname`: screen overlay name
- `position`: one of the nine standard positions
- `overlayXY`: manually specified tie point on the overlay image e.g. `x="0" y="1"`
- `screenXY`: manually specified matching tie point on the screen e.g. `x="0" y="1"`
- `xyunits`: values of the XY units ("pixels", "fraction", or "insetPixels")
- `rotation`: (optional) rotation in degrees clock-wise
- `size`: size correction in `x` and `y` direction

Details

If nothing else is specified the function looks for some of the nine typical positions: "UL" (upper left), "ML" (middle left), "LL" (lower left), "BC" (bottom centre), "LR" (lower right), "MR" (middle right), "UR" (upper right), and "TC" (top centre). The `x` and `y` values can be specified in three different ways: as pixels ("pixels"), as fractions of the image ("fraction"), or as inset pixels ("insetPixels") — an offset in pixels from the upper right corner of the image.
Note

The function, by default, calculates with fractions. If you change the `xyunits` type, all other elements need to be expressed in the same units.

Author(s)

Tomislav Hengl

References

- KML Reference (https://developers.google.com/kml/documentation/?csw=1)

See Also

kml-methods

Examples

```r
library(rgdal)
library(sp)
data(eberg_zones)
## Not run: # add logo in the top-center:
kml_open("eberg_screen.kml")
kml_layer(eberg_zones)
logo = "http://meta.isric.org/images/ISRIC_right.png"
kml_screen(image.file = logo, position = "TC", sname = "ISRIC logo")
kml_close("eberg_screen.kml")
kml_compress("eberg_screen.kml")
## End(Not run)
```

### LST

Time series of MODIS LST images

Description

LST contains a spatial sub-sample (Istra region in Croatia) of 46 time series of MODIS LST images (estimated Land Surface Temperature in degrees C) at 1 km resolution. The temporal support size of these images is 8-days.

Usage

data(LST)
Format

The LST data frame contains the following layers:

- LST2008_01_01 8-day MODIS LST mosaic for period 2007-12-29 to 2008-01-04
- LST2008_01_09 8-day MODIS LST mosaic for period 2008-01-05 to 2008-01-13

... subsequent bands

lon  a numeric vector; x-coordinate (m) in the WGS84 system
lat  a numeric vector; y-coordinate (m) in the WGS84 system

Note

Time series of 46 day-time and night-time 8-day composite LST images (MOD11A2 product bands 1 and 5) was obtained from the NASA's FTP server (https://ladsweb.modaps.eosdis.nasa.gov/). The original 8-day composite images were created by patching together images from a period of ±4 days, so that the proportion of clouds can be reduced to a minimum. The "zvalue" slot in the "RasterBrick" object can be used as the dateTime column expressed as:

```
yyyy-mm-ddThh:mm:sszzzzzz
```

where T is the separator between the date and the time, and the time zone is either Z (for UTC) or zzzzzz, which represents ±hh:mm in relation to UTC.

Author(s)

Tomislav Hengl and Melita Percec Tadic

References

- MODIS products (https://lpdaac.usgs.gov/data/get-started-data/)

makeCOLLADA

Generate a COLLADA file representing the 3D model of a rectangle

Description

Produces a COLLADA file representing the 3D model of a rectangle with the image specifies via href wrapped over the surface (as texture fill). This allows free rotation of any rectangular image in the 3D space.
Usage

```r
makeCOLLADA.rectangle(coords, filename, href, DateTime,
                   up_axis = "Z_UP", authoring_tool = "plotKML",
                   technique_profile = "GOOGLEEARTH",
                   double_sided = TRUE)
```

Arguments

- `coords`: a matrix defining the rectangle: 4 points with X, Z and Y coordinates (P1 — upper right, P2 — upper left, P3 — lower right, P4 — lower left)
- `filename`: output filename with *.dae extension
- `href`: location of the image used for wrapping (texture fill)
- `DateTime`: creation / update time (system time)
- `up_axis`: specify which axis is erected
- `authoring_tool`: specify authoring tool
- `technique_profile`: specify technique profile
- `double_sided`: logical; specify whether to drape image on both sides

Details

COLLADA is managed by the nonprofit technology consortium, the Khronos Group. You can also simply drag and drop a COLLADA (.dae) file on top of the virtual Earth.

Author(s)

Tomislav Hengl

References

- COLLADA Schema (https://www.khronos.org/collada/)

See Also

- `kml_layer.SpatialPhotoOverlay`

Examples

```r
## Not run: # image previously uploaded to Wikimedia commons:
imagename = "Soil_monolith.jpg"
x1 <- getWikiMedia.ImageInfo(imagename)
sm <- spPhoto(filename = x1$url$url, exif.info = x1$metadata)
kml(sm, method="monolith")
xmlTreeParse("Soil_monolith_jpg.dae")

## End(Not run)
```
**metadata2SLD.methods**  
*Methods to create a Styled Layer Description (SLD) file*

---

**Description**

Creates a Styled Layer Description (SLD) file, that can be attached to a spatial layer contributed to GeoServer. It writes the "sp.pallete" object (legend entries, titles and colors) to an external file.

**Usage**

```r
## S4 method for signature 'SpatialMetadata'
metadata2SLD(obj, ...)
```

**Arguments**

- `obj`: object of class "SpatialMetadata"
- `...`: other arguments

**Details**

The structure of the SLD file is determined by the object class (Point, Polygon, SpatialPixels).

**Author(s)**

Tomislav Hengl

**See Also**

- `metadata2SLD.SpatialPixels.spMetadata`

---

**metadata2SLD.SpatialPixels**  
*Writes a Styled Layer Description (SLD) file*

---

**Description**

Writes a Styled Layer Description (SLD) file, that can be attached to a spatial layer contributed to GeoServer.

**Usage**

```r
metadata2SLD.SpatialPixels(obj,
  Format_Information_Content = xmlValue(obj@xml[["//formcont"]]),
  obj.name = normalizeFilename(deparse(substitute(obj))),
  sld.file = .set.file.extension(obj.name, ".sld"),
  Citation_title = xmlValue(obj@xml[["//title"]]),
  ColorMap_type = "intervals", opacity = 1,
  brw.trg = 'Greys', target.var, ...)
```
normalizeFilename

Normalize filename string

Description

Remove all reserved characters from the file name.

Arguments

- `obj`: object of class "SpatialMetadata"
- `Format.Information.Content`: character; class of the object to be written to SLD file
- `obj.name`: character; name of the layer
- `sld.file`: character; name of the output file
- `Citation.title`: character; title of the layer
- `ColorMap.type`: character; type of the colorMap see https://docs.geoserver.org
- `opacity`: logical; specifies the opacity
- `brw.trg`: character; color scheme according to www.colorbrewer2.org; default to 'Greys'
- `target.var`: character; target variable used to calculate the class-intervals
- ... additional arguments

Author(s)

Tomislav Hengl

See Also

spMetadata

Examples

```r
## Not run: # generate missing metadata
data(eberg_grid)
library(sp)
coordinates(eberg_grid) <- ~x+y
gridded(eberg_grid) <- TRUE
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
# with locally prepared metadata file:
eberg_TWI <- as(eberg_grid["TWISRT6"], "SpatialPixelsDataFrame")
eberg.md <- spMetadata(eberg_TWI, Target_variable="TWISRT6")
# export to SLD format:
metadata2SLD(eberg.md, "eberg_TWI.sld")
## End(Not run)
```
Usage

normalizeFilename(x, form = c("default", "8.3")[1],
    fix.encoding = TRUE, sub.sign = ".")

Arguments

- **x**: input character
- **form**: target format (standard or the short 8.3 file name)
- **fix.encoding**: logical; specifies whether to fix the encoding
- **sub.sign**: substitution symbol

Details

This function removes all reserved characters: (less than), (greater than), (colon), (double quote), (forward slash), (backslash), (vertical bar or pipe), (question mark), (asterisk), and empty spaces, from the file name. This is important when writing a list of objects to an external file (e.g. KML) as it prevents from creating erroneous file names.

Author(s)

Tomislav Hengl

See Also

- `utils::shortPathName`
- `RSAGA::set.file.extension`

Examples

- `normalizeFilename("name[%.txt")`
- `normalizeFilename("name .txt")`

---

northcumbria

*Polygon boundary of north Cumbria*

Description

This data set gives the boundary of the county of north Cumbria (UK).

Usage

- `data(northcumbria)`

Format

A matrix containing (x,y) coordinates of the boundary.
Author(s)
Edith Gabriel <edith.gabriel@univ-avignon.fr>

See Also

Description
The method writes inputs and outputs of spatial analysis (a list of point, gridded and/or polygon data usually) to KML and opens the KML file in Google Earth (or any other default package used to view KML/KMZ files).

Usage

```
## S4 method for signature 'sf'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    metadata = NULL, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'SpatialPointsDataFrame'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    size, colour, points_names,
    shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png",
    metadata = NULL, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'SpatialLinesDataFrame'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    metadata = NULL, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'SpatialPolygonsDataFrame'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    colour, plot.labpt, labels, metadata = NULL,
    kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'SpatialPixelsDataFrame'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    colour, raster_name, metadata = NULL, kmz = FALSE, open.kml = TRUE, ...)
## S4 method for signature 'SpatialGridDataFrame'
plotKML(obj,
    folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
    file.name = paste(folder.name, ".kml", sep=""),
    colour, raster_name, metadata = NULL, kmz = FALSE, open.kml = TRUE, ...)
```
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   colour, raster_name, metadata = NULL, kmz = FALSE, open.kml = TRUE, ...)
## S4 method for signature 'RasterLayer'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   colour, raster_name, metadata = NULL, kmz = FALSE, open.kml = TRUE, ...)
## S4 method for signature 'SpatialPhotoOverlay'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   dae.name, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'SoilProfileCollection'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   var.name, metadata = NULL, kmz = get("kmz", envir = plotKML.opts),
   open.kml = TRUE, ...)
## S4 method for signature 'STIDF'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   colour, shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png",
   points_names, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'STFDF'
plotKML(obj, ...)
## S4 method for signature 'STSDF'
plotKML(obj, ...)
## S4 method for signature 'STTDF'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   colour, start.icon = "http://maps.google.com/mapfiles/kml/pal2/icon18.png",
   kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'RasterBrickTimeSeries'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   pngwidth = 680, pngheight = 180, pngpointsize = 14,
   kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)
## S4 method for signature 'RasterBrickSimulations'
plotKML(obj,
   folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
   file.name = paste(folder.name, ".kml", sep=""),
   obj.summary = TRUE,
   pngwidth = 680, pngheight = 200, pngpointsize = 14,
plotKML-method

kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...

## S4 method for signature 'SpatialMaxEntOutput'
plotKML(obj,
  folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
  file.name = paste(folder.name, ".kml", sep=""),
  html.file = obj@maxent@html,
  iframe.width = 800, iframe.height = 800, pngwidth = 280,
  pngheight = 280, pngpointsize = 14, colour,
  shape = "http://plotkml.r-forge.r-project.org/icon17.png",
  kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE,
  TimeSpan.begin = obj@TimeSpan.begin, TimeSpan.end = obj@TimeSpan.end, ...)

## S4 method for signature 'SpatialPredictions'
plotKML(obj,
  folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
  file.name = paste(folder.name, ".kml", sep=""),
  colour,
  grid2poly = FALSE, obj.summary = FALSE, plot.svar = FALSE,
  pngwidth = 210, pngheight = 580, pngpointsize = 14,
  metadata = NULL, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)

## S4 method for signature 'SpatialSamplingPattern'
plotKML(obj,
  folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
  file.name = paste(folder.name, ".kml", sep=""),
  colour, kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)

## S4 method for signature 'SpatialVectorsSimulations'
plotKML(obj,
  folder.name = normalizeFilename(deparse(substitute(obj, env = parent.frame()))),
  file.name = paste(folder.name, ".kml", sep=""),
  colour,
  grid2poly = FALSE, obj.summary = TRUE, plot.svar = FALSE,
  kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)

## S4 method for signature 'list'
plotKML(obj,
  folder.name = normalizeFilename(deparse(substitute(obj, env=parent.frame()))),
  file.name = paste(folder.name, ".kml", sep=""),
  size = NULL, colour, points_names="",
  shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png",
  plot.labpt = TRUE, labels="", metadata = NULL,
  kmz = get("kmz", envir = plotKML.opts), open.kml = TRUE, ...)

Arguments

obj input object of specific class; either some sf, or sp, or raster or spacetime package class object, or plotKML composite objects containing both inputs and outputs of analysis

colour colour variable for plotting (see aesthetics)

folder.name character; folder name in the KML file

file.name character; output KML file name

size for point objects for plotting (see aesthetics)
**plotKML-method**

points_names vector of characters that can be used as labels
shape character; icons used for plotting (see aesthetics)
raster_name (optional) specify the output file name (PNG)
var.name target variable name (only valid for visualization of "SoilProfileCollection" class data
metadata (optional) the metadata object
plot.labpt logical; specifies whether to plot centroids for polygon data
labels character vector; list of labels that will attached to the centroids
start.icon icon for the start position (for trajectory data)
da.e.name output DAE file name
html.file specify the location of the html file containing report data (if the input object is of class "SpatialMaxEntOutput")
iframe.width integer; width of the screen for iframe
iframe.height integer; height of the screen for iframe
TimeSpan.begin object of class "POSIXct"; begin of the sampling period
TimeSpan.end object of class "POSIXct"; end of the sampling period
pngwidth integer; width of the PNG plot (screen image)
pngheight integer; height of the PNG plot (screen image)
pngpointsize integer; text size in the PNG plot (screen image)
grid2poly logical; specifies whether to convert gridded object to polygons
obj.summary logical; specifies whether to print the object summary
plot.svar logical; specifies whether to plot the model uncertainty
kmz logical; specifies whether to compress the output KML file
open.kml logical; specifies whether to directly open the output KML file (i.e. in Google Earth)
... (optional) arguments passed to the lower level functions

**Details**

This is a generic function to plot various spatial and spatio-temporal R objects that contain both inputs and outputs of spatial analysis. The resulting plots (referred to as ‘views’) are expected to be cartographically complete as they should contain legends, and data and model descriptions. In principle, plotKML works with both simple spatial objects, and complex objects such as "SpatialPredictions", "SpatialVectorsSimulations", "RasterBrickSimulations", "RasterBrickTimeSeries", "SpatialMaxEntOutput" and similar. To further customize visualizations consider combining the lower level functions kml_open, kml_close, kml_compress, kml_screen into your own plotKML() method.

All ST-classes are coerced to the STIDF format and hence use the plotKML method for STIDFs. The sf objects are processed according to the class of the geometry column. The aesthetics are defined in the same way as for their sp counterparts.
Note

To prepare a list of objects of class "SpatialPointsDataFrame", "SpatialLinesDataFrame", "SpatialPolygonsDataFrame", or "SpatialPixelsDataFrame" consider using the landmap::tile function. Writing large spatial objects via plotKML can be time consuming. Please refer to the package manual for more information.

See Also

SpatialPredictions-class, SpatialVectorsSimulations-class, RasterBrickSimulations-class, RasterBrickTimeSeries-class, SpatialMaxEntOutput-class, SpatialSamplingPattern-class

Examples

plotKML.env(kmz = FALSE)
## -------------- SpatialPointsDataFrame --------- ##
library(sp)
library(rgdal)
data(eberg)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
## subset to 20 percent:
eberg <- eberg[runif(nrow(eberg))<.1,]
## Not run:
## bubble type plot:
plotKML(eberg["CLYMHT_A"], colour_scale=rep("#FFFF00", 2), points_names="")

## plot points with a legend:
shape = "http://maps.google.com/mapfiles/kml/pal2/icon18.png"
kml.file = paste0(tempdir(), "/eberg_CLYMHT_A.kml")
leg.file = paste0(dirname(kml.file), "/kml_legend.png")
kml_open(kml.file)
kml_layer(eberg["CLYMHT_A"], colour=CLYMHT_A, z.lim=c(20,60),
          colour_scale=SAGA_pal[1], shape=shape, points_names="")
kml_legend.bar(x=eberg$CLYMHT_A,
                legend.file=leg.file,
                legend.pal=SAGA_pal[1], z.lim=c(20,60))
kml_screen(image.file=leg.file)
kml_close(kml.file)

## ----- sf objects with sfc_POINT geometry ----- ##
eberg_sf <- sf::st_as_sf(eberg)
## Not run:
plotKML(eberg_sf["CLYMHT_A"], colour_scale = rep("#FFFF00", 2), points_names = "")

## -------------- SpatialLinesDataFrame --------- ##
data(eberg_contours)
## Not run:
plotKML(eberg_contours)
## plotKML-method

```r
## plot contour lines with actual altitudes:
plotKML(eberg_contours, colour=Z, altitude=Z)

## End(Not run)

## ----- sf objects with sfc_LINESTRING geometry ----- ##
eberg_contours_sf <- sf::st_as_sf(eberg_contours)
## Not run:
plotKML(eberg_contours_sf)
plotKML(eberg_contours_sf, colour = Z, altitude = Z)

## End(Not run)

## ------------------ SpatialPolygonsDataFrame --------- ##
data(eberg_zones)
## Not run:
plotKML(eberg_zones["ZONES"])
## add altitude:
zmin = 230
plotKML(eberg_zones["ZONES"], altitude=zmin+runif(length(eberg_zones))*500)

## End(Not run)

## ------ sf objects with sfc_POLYGON geometry ------ ##
eberg_zones_sf <- sf::st_as_sf(eberg_zones)
## Not run:
plotKML(eberg_zones_sf["ZONES"])
plotKML(eberg_zones_sf["ZONES"], altitude = zmin + runif(length(eberg_zones)) * 500)

## End(Not run)

## ------------------ SpatialPixelsDataFrame --------- ##
library(rgdal)
library(raster)
data(eberg_grid)
gridded(eberg_grid) <- ~x+y
proj4string(eberg_grid) <- CRS("+init=epsg:31467")
TWI <- reproject(eberg_grid["TWISRT6"])
data(SAGA_pal)
## Not run: ## set limits manually (increase resolution):
plotKML(TWI, colour_scale = SAGA_pal[[1]])
plotKML(TWI, z.lim=c(12,20), colour_scale = SAGA_pal[[1]])

## End(Not run)

## categorical data:
eberg_grid$LNCCOR6 <- as.factor(paste(eberg_grid$LNCCOR6))
levels(eberg_grid$LNCCOR6)
data(worldgrids_pal)
## attr(worldgrids_pal["corine2k"][[1]], "names")
pal = as.character(worldgrids_pal["corine2k"][[1]][c(1,11,13,14,16,17,18)])
LNCCOR6 <- reproject(eberg_grid["LNCCOR6"])
## Not run:
plotKML(LNCCOR6, colour_scale=pal)
```
## End(Not run)

### SpatialPhotoOverlay

```r
library(RCurl)
imagename = "Soil_monolith.jpg"
urlExists = url.exists("https://commons.wikimedia.org")
if(urlExists){
x1 <- getWikiMedia.ImageInfo(imagename)
sm <- spPhoto(filename = x1$url$url, exif.info = x1$metadata)
# str(sm)
plotKML(sm)
}
```

## End(Not run)

### SoilProfileCollection

```r
library(aqp)
library(plyr)
## sample profile from Nigeria:
lon = 3.90; lat = 7.50; id = "ISRIC:NG0017"; FAO1988 = "LXp"
top = c(0, 18, 36, 65, 87, 127)
bottom = c(18, 36, 65, 87, 127, 181)
ORCDRC = c(18.4, 4.4, 3.6, 3.6, 3.2, 1.2)
hue = c("7.5YR", "7.5YR", "2.5YR", "5YR", "5YR", "10YR")
value = c(3, 4, 5, 5, 5, 7); chroma = c(2, 4, 6, 8, 4, 3)
## prepare a SoilProfileCollection:
prof1 <- join(data.frame(id, top, bottom, ORCDRC, hue, value, chroma),
data.frame(id, lon, lat, FAO1988), type=quote(Var)
inner)
prof1$soil_color <- with(prof1, munsell2rgb(hue, value, chroma))
depths(prof1) <- id ~ top + bottom
site(prof1) <- ~ lon + lat + FAO1988
coordinates(prof1) <- ~ lon + lat
proj4string(prof1) <- CRS("+proj=longlat +datum=WGS84")
prof1
## End(Not run)
```

### STIDF

```r
library(sp)
library(spacetime)
## daily temperatures for Croatia:
data(HRtemp08)
## format the time column:
HRtemp08$ctime <- as.POSIXct(HRtemp08$DATE, format="%Y-%m-%dT%H:%M:%S")
## create a STIDF object:
sp <- SpatialPoints(HRtemp08[,c("Lon","Lat")])
proj4string(sp) <- CRS("+proj=longlat +datum=WGS84")
HRtemp08.st <- STIDF(sp, time = HRtemp08$ctime, data = HRtemp08[,c("NAME","TEMP")])
## subset to first 500 records:
```
HRtemp08_jan <- HRtemp08_st[,1:500]
str(HRtemp08_jan)
## Not run:
plotKML(HRtemp08_jan[,c("TEMP")], LabelScale = .4)
## End(Not run)

## foot-and-mouth disease data:
data(fmd)
fmd0 <- data.frame(fmd)
coordinates(fmd0) <- c("X", "Y")
proj4string(fmd0) <- CRS("+init=epsg:27700")
fmd_sp <- as(fmd0, "SpatialPoints")
dates <- as.Date("2001-02-18") + fmd0$ReportedDay
library(spacetime)
fmd_ST <- STIDF(fmd_sp, dates, data.frame(ReportedDay=fmd0$ReportedDay))
data(SAGA_pal)
## Not run:
plotKML(fmd_ST, colour_scale=SAGA_pal[1])
## End(Not run)

## -------------- STFDF --------- ##
## Not run:
## results of krigeST:
library(gstat)
library(sp)
library(spacetime)
library(raster)
## define space-time variogram
sumMetricVgm <- vgmST("sumMetric",
  space=vgm( 4.4, "Lin", 196.6, 3),
  time =vgm( 2.2, "Lin", 1.1, 2),
  joint=vgm(34.6, "Exp", 136.6, 12),
  stAni=51.7)
## example from the gstat package:
data(air)
rural = STFDF(stations, dates, data.frame(PM10 = as.vector(air)))
rr <- rural[,c("2005-06-01/2005-06-03")]
rr <- as(rr, "STDF")
x1 <- seq(from=6, to=15, by=1)
x2 <- seq(from=48, to=55, by=1)
DE_gridded <- SpatialPoints(cbind(rep(x1, length(x2)), rep(x2, each=length(x1))),
  proj4string=CRS(proj4string(rr@sp)))
gridded(DE_gridded) <- TRUE
DE_pred <- STF(s=as(DE_gridded, "SpatialPoints"), time=rr@time)
DE_kriged <- krigeST(PM10~1, data=rr, newdata=DE_pred,
  modellist=sumMetricVgm)
gridded(DE_kriged@sp) <- TRUE
#stplot(DE_kriged)
## plot in Google Earth:
z.lim = range(DE_kriged@data, na.rm=TRUE)
plotKML(DE_kriged, z.lim=z.lim)
## add observations points:
plotKML(rr, z.lim=z.lim)

## End(Not run)

## -------------- STTDF --------- ##
## Not run:
library(fossil)
library(spacetime)
library(adehabitatLT)
data(gpxbtour)
## format the time column:
gpxbtour$time <- as.POSIXct(gpxbtour$time, format="%Y-%m-%d %H:%M:%SZ")
coordinates(gpxbtour) <- ~lon+lat
proj4string(gpxbtour) <- CRS("+proj=longlat +datum=WGS84")
xy <- as.list(data.frame(t(coordinates(gpxbtour))))
gpxbtour$dist.km <- sapply(xy, function(x) {
  deg.dist(long1=x[1], lat1=x[2], long2=xy[[1]][1], lat2=xy[[1]][2])
})
## convert to a STTDF class:
gpx.ltraj <- as.ltraj(coordinates(gpxbtour), gpxbtour$time, id = "th")
gpx.st <- as(gpx.ltraj, "STTDF")
gpx.st$speed <- gpxbtour$speed
plotKML(gpx.st, colour="speed")

## End(Not run)

## -------------- Spatial Metadata --------- ##
## Not run:
eberg.md <- spMetadata(eberg, xml.file=system.file("eberg.xml", package="plotKML"),
  Target_variable="SNDMHT_A", Citation_title="Ebergotzen profiles")
plotKML(eberg[1:100,"CLYMHT_A"], metadata=eberg.md)

## End(Not run)

## -------------- RasterBrickTimeSeries --------- ##
library(raster)
library(sp)
data(LST)
gridded(LST) <- ~lon+lat
proj4string(LST) <- CRS("+proj=longlat +datum=WGS84")
dates <- sapply(strsplit(names(LST), "LST"), function(x){x[[2]]})
datesf <- format(as.Date(dates, "%Y_%m_%d"), "%Y-%m-%d %H:%M:%SZ")
## begin / end dates +/- 4 days:
TimeSpan.begin = as.POSIXct(unclass(as.POSIXct(datesf))-4*24*60*60, origin="1970-01-01")
TimeSpan.end = as.POSIXct(unclass(as.POSIXct(datesf))+4*24*60*60, origin="1970-01-01")
## pick climatic stations in the area:
pnts <- HRtemp08[which(HRtemp08$NAME=="Pazin")][1,]
pnts <- rbind(pnts, HRtemp08[which(HRtemp08$NAME=="Crni Lug - NP Risnjak")][1,])
pnts <- rbind(pnts, HRtemp08[which(HRtemp08$NAME=="Cres")][1,])
coordinates(pnts) <- c(Lon + Lat)
proj4string(pnts) <- CRS("+proj=longlat +datum=WGS84")

## get the dates from the file names:
LST_ll <- brick(LST[1:5])
LST_ll@title = "Time series of MODIS Land Surface Temperature images"
LST.ts <- new("RasterBrickTimeSeries", variable = "LST", sampled = pnts,
                rasters = LST_ll, TimeSpan.begin = TimeSpan.begin[1:5],
                TimeSpan.end = TimeSpan.end[1:5])
data(SAGA_pal)

## Not run: ## plot MODIS images in Google Earth:
plotKML(LST.ts, colour_scale=SAGA_pal[1])
## End(Not run)

## -------------- Spatial Predictions --------- ##
library(sp)
library(rgdal)
library(gstat)
data(meuse)
coordinates(meuse) <- ~x+y
proj4string(meuse) <- CRS("+init=epsg:28992")

## load grids:
data(meuse.grid)
gridded(meuse.grid) <- ~x+y
proj4string(meuse.grid) <- CRS("+init=epsg:28992")

## Not run: ## fit a model:
library(landmap)
omm <- fit.gstatModel(observations = meuse, formulaString = om~dist,
                      family = gaussian(log), covariates = meuse.grid)

## produce SpatialPredictions:
om.rk <- predict(omm, predictionLocations = meuse.grid)

## plot the whole geostatistical mapping project in Google Earth:
plotKML(om.rk, colour_scale = SAGA_pal[1])

## plot each cell as polygon:
plotKML(om.rk, colour_scale = SAGA_pal[1], grid2poly = TRUE)

## End(Not run)

## -------------- RasterBrickSimulations --------- ##
## Not run:
library(sp)
library(gstat)
data(barxyz)

## define the projection system:
prj = "+proj=tmerc +lat_0=0 +lon_0=18 +k=0.9999 +x_0=6500000 +y_0=0 +ellps=bessel +units=m +tows84=550.499,164.116,475.142,5.80967,2.07902,-11.62386,0.99999445824"
coordinates(barxyz) <- ~x+y
proj4string(barxyz) <- CRS(prj)
data(bargrid)
coordinates(bargrid) <- ~x+y
gridded(bargrid) <- TRUE
proj4string(bargrid) <- CRS(prj)
## fit a variogram and generate simulations:
Z.ovgm <- vgm(psill=1352, model="Mat", range=650, nugget=0, kappa=1.2)

## Note: this operation can be time consuming
sims <- krige(Z~1, barxyz[sel,], bargrid, model=Z.ovgm, nmax=20,
              nsim=10, debug.level=-1)

## specify the cross-section:
t1 <- Line(matrix(c(bargrid@bbox[1,1], bargrid@bbox[1,2], 5073012, 5073012), ncol=2))
transect <- SpatialLines(list(Lines(list(t1), ID="t")), CRS(prj))

## glue to a RasterBrickSimulations object:
library(raster)
bardem_sims <- new("RasterBrickSimulations", variable = "elevations",
                   sampled = transect, realizations = brick(sims))

## plot the whole project and open in Google Earth:
data(R_pal)
plotKML(bardem_sims, colour_scale = R_pal[[4]])

## End(Not run)

## -------------- SpatialVectorsSimulations --------- ##
## Not run:
data(barstr)
data(bargrid)
library(sp)
coordinates(bargrid) <- ~ x+y
gridded(bargrid) <- TRUE

## output topology:
cell.size = bargrid@grid@cellsize[1]
bbox = bargrid@bbox
nrows = round(abs(diff(bbox[1,])/cell.size), 0)
ncols = round(abs(diff(bbox[2,])/cell.size), 0)
gridT = GridTopology(cellcentre.offset=bbox[,1],
                      cellsize=c(cell.size,cell.size),
                      cells.dim=c(nrows, ncols))
bar_sum <- count.GridTopology(gridT, vectL=barstr[1:5])

## NOTE: this operation can be time consuming!
## plot the whole project and open in Google Earth:
plotKML(bar_sum)

## End(Not run)

## -------------- SpatialMaxEntOutput --------- ##
## Not run:
library(maptools)
library(rgdal)
data(bigfoot)
ea.prj <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
       +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs"
data(USAWgrids)

## Not run:
library(maptools)
library(rgdal)
data(bigfoot)
ea.prj <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
       +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs"
data(USAWgrids)

## Not run:
library(maptools)
library(rgdal)
data(bigfoot)
ea.prj <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
       +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs"
data(USAWgrids)

## Not run:
library(maptools)
library(rgdal)
data(bigfoot)
ea.prj <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
       +x_0=0 +y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs"
data(USAWgrids)
bigfoot$Lat > bbox[2,1] & bigfoot$Lat < bbox[2,2]
bigfoot <- bigfoot[sel,]
coordinates(bigfoot) <- ~Lon+Lat
proj4string(bigfoot) <- CRS("+proj=longlat +datum=WGS84")
library(spatstat)
bigfoot.aea <- as.ppp(spTransform(bigfoot, CRS(aea.prj)))
## Load the covariates:
sel.grids <- c("globedem","nlights03","sdroads","gcarb","twi","globcov")
library(landmap)
library(dismo)
## run MaxEnt analysis:
jar <- paste(system.file(package="dismo"), "/java/maxent.jar", sep='')
if(file.exists(jar)){
  bigfoot.smo <- MaxEnt(bigfoot.aea, USAWgrids[sel.grids])
  icon = "http://plotkml.r-forge.r-project.org/bigfoot.png"
data(R_pal)
  plotKML(bigfoot.smo, colour_scale = R_pal["bpy_colors"], shape = icon)
}
## End(Not run)

plotKML.env

---

**plotKML.env**

**plotKML specific environmental variables / paths**

---

### Description

Sets the environmental, package specific parameters and settings (URLs, names, default color palettes and similar) that can be later on passed to other functions.

### Usage

```r
plotKML.env(colour_scale_numeric = "", colour_scale_factor = "", colour_scale_svar = "", ref_CRS, NAflag, icon, LabelScale, size_range, license_url, metadata_sel, kmz, kml_xsd, kml_url, kml_gx, gpx_xsd, fgdc_xsd, inspire_xsd, convert, gdalwarp, gdal_translate, python, home_url, show.env = TRUE, silent = TRUE)
```

### Arguments

- `colour_scale_numeric`  
  default colour scheme for numeric variables
- `colour_scale_factor`  
  default colour scheme for factor variables
- `colour_scale_svar`  
  default colour scheme for model error (e.g. mapping error)
- `ref_CRS`  
  the referent CRS proj4string ("+proj=longlat +datum=WGS84")
- `NAflag`  
  the default missing value flag (usually "+99999")
- `icon`  
  the default icon URL
LabelScale: the default scale factor for labels
size_range: the default size range
license_url: the default license URL
metadata_sel: a list of the default metadata fields for summary
kmz: logical; the default compression setting
kml_xsd: the default KML scheme URL
kml_url: the default KML format URL
kml_gx: the default extended KML scheme URL
gpx_xsd: the default GPX scheme URL
fgdc_xsd: the default metadata scheme URL
inspire_xsd: the default metadata scheme URL
convert: a path to ImageMagick convert program
gdalwarp: a path to gdalwarp program
gdal_translate: a path to gdalwarp program
python: a path to Python program
home_url: the default location of all icons and auxiliary files
show.env: logical; specify whether to print all environmental parameters
silent: logical; specify whether to search for paths for external software

Details

The function will try to locate external software tools under either Windows or Unix platform and then save the results to the plotKML.opts environment. plotKML-package does not look automatically for software paths (unless you specify this manually in your "Rprofile.site"). The external software tools are not required by default and most of operations in plotKML-package can be run without using them. GDAL, SAGA GIS and Python are highly recommended, however, for processing large data sets. The function paths looks for GDAL, ImageMagick, Python, SAGA GIS, in the Windows Registry Hive, the Program Files directory or the usr/bin installation (Unix).

Warning

Under Linux OS you need to install GDAL binaries by using e.g.:
sudo apt-get install gdal-bin

Note

To further customize the plotKML options, consider putting:
library(plotKML); plotKML.env(...,show.env = FALSE)
in your "/etc/Rprofile.site".

Author(s)

Tomislav Hengl, Dylan Beaudette
plotKML.GDALobj

Write tiled objects to KML

Description

Write tiled objects to KML. Suitable for plotting large rasters i.e. large spatial data sets.

Usage

plotKML.GDALobj(obj, file.name, block.x, tiles=NULL, tiles.sel=NULL, altitude=0, altitudeMode="relativeToGround", colour_scale, z.lim=NULL, breaks.lst=NULL, kml.logo, overwrite=TRUE, cpus, home.url=".", desc=NULL, open.kml=TRUE, CRS=attr(obj, "projection"), plot.legend=TRUE)

Arguments

obj "GDALobj" object i.e. a pointer to a spatial layer
file.name character; output KML file name
block.x numeric; size of block in meters or corresponding mapping units
tiles data.frame; tiling definition generated using landmap::tile
tiles.sel integer; selection of tiles to be plotted
altitude numeric; altitude of the ground overlay
plotKML.GDALobj

altitudeMode character; either "absolute", "relativeToGround" or "clampToGround"
colour_scale character; color palette
z.lim numeric; upper lower boundaries
breaks.lst numeric; optional break lines (must be of size length(colour_scale)+1)
kml.logo character; optional project logo file (PNG)
overwrite logical; specifies whether to overwrite PNGs if available
cpus integer; specifies number of CPUs to be used by the snowfall package to speed things up
home.url character; optional web-directory where the PNGs will be stored
desc character; optional layer description
open.kml logical; specifies whether to open the KML file after writing
CRS character; projection string (if missing)
plot.legend logical; indicate whether to plot summary legend

Value

Returns a list of KML files.

Note

This operation can be time-consuming for processing very large rasters e.g. more than 10,000 by 10,000 pixels. To speed up writing of KMLs, use the snowfall package.

Author(s)

Tomislav Hengl

See Also

plotKML, kml.tiles

Examples

## Not run:
library(sp)
library(snowfall)
library(landmap)
library(rgdal)
fn = system.file("pictures/SP27GTIF.TIF", package = "rgdal")
obj <- GDALinfo(fn)
tiles <- getSpatialTiles(obj, block.x=5000,
   return.SpatialPolygons = FALSE)
## plot using tiles:
plotKML.GDALobj(obj, tiles=tiles, z.lim=c(0,185))
## Even better ideas is to first reproject
## the large grid using 'gdalutils::gdalwarp', then tile...

## End(Not run)
A class for spatial simulations containing equiprobable gridded features

Description
A class containing input and output maps containing multiple realizations of the same feature. Objects of this class can be directly visualized in Google Earth by using the `plotKML`-method.

Slots
- variable: character; variable name
- sampled: object of class "SpatialLines"; one or more lines (cross sections) that can be used to visualize how the values change in space
- realizations: object of class "RasterBrick"; multiple realizations of the same feature

Methods
- `plotKML` signature(obj = "RasterBrickSimulations"): plots all objects in Google Earth

Author(s)
Tomislav Hengl

See Also
- `SpatialVectorsSimulations-class`, `RasterBrickTimeSeries-class`, `plotKML-method`

Examples

```r
## Not run: # load input data:
data(barxyz)
# define the projection system:
prj = "+proj=tmerc +lat_0=0 +lon_0=18 +k=0.9999 +x_0=6500000 +y_0=0 +ellps=bessel +units=m +towgs84=550.499,164.116,475.142,5.80967,2.07902,-11.62386,0.99999445824"
library(sp)
coordinates(barxyz) <- ~x+y
proj4string(barxyz) <- CRS(prj)
data(bargrid)
coordinates(bargrid) <- ~x+y
gridded(bargrid) <- TRUE
proj4string(bargrid) <- CRS(prj)
# fit a variogram and generate simulations:
library(gstat)
Z.ovgm <- vgm(psill=1352, model="Mat", range=650, nugget=0, kappa=1.2)
.sel <- runif(length(barxyz$Z))<.2  # Note: this operation can be time consuming
```
sims <- krige(Z~1, bargrid, nmax=20, nsim=10, debug.level=-1)
# specify the cross-section:
t1 <- Line(matrix(c(bargrid@bbox[1,1], bargrid@bbox[1,2], 5073012, 5073012), ncol=2))
transect <- SpatialLines(list(Lines(list(t1), ID="t")), CRS(prj))
# glue to a RasterBrickSimulations object:
bardem_sims <- new("RasterBrickSimulations", variable = "elevations",
sampled = transect, realizations = brick(sims))
# plot the whole project and open in Google Earth:
data(R_pal)
plotKML(bardem_sims, colour_scale = R_pal[[4]])
## End(Not run)

---

**RasterBrickTimeSeries-class**

A class for a time series of regular grids

**Description**

A class containing list of rasters, begin, end times and sample points to allow exploration of the values. Objects of this class can be directly visualized in Google Earth by using the `plotKML` method.

**Slots**

- **variable**: object of class "character"; variable name
- **sampled**: object of class "SpatialPoints"; one or more points that can be used to visualize temporal changes in the target variable
- **rasters**: object of class "RasterBrick"; a time-series of raster objects
- **TimeSpan.begin**: object of class "POSIXct"; begin of sampling for each raster map
- **TimeSpan.end**: object of class "POSIXct"; end of sampling for each raster map

**Methods**

- **plotKML** signature(obj = "RasterBrickTimeSeries"): plots time-series of rasters in Google Earth

**Author(s)**

Tomislav Hengl

**See Also**

`RasterBrickSimulations-class, plotKML-method`
**readGPX**

Import GPX (GPS track) files

**Description**

Reads various elements from a `.gpx` file — metadata, waypoints, tracks and routes — and converts them to dataframes.

**Usage**

```r
readGPX(gpx.file, metadata = TRUE, bounds = TRUE,
        waypoints = TRUE, tracks = TRUE, routes = TRUE)
```

**Arguments**

- `gpx.file` : location of the gpx.file
- `metadata` : logical; specifies whether the metadata should be imported
- `bounds` : logical; specifies whether the bounding box coordinates should be imported
- `waypoints` : logical; specifies whether all waypoints should be imported
- `tracks` : logical; specifies whether all tracks should be imported
- `routes` : logical; specifies whether all routes should be imported

**Details**

Waypoint is a point of interest, or named feature on a map. Track is an ordered list of points describing a path. Route is an ordered list of waypoints representing a series of turn points leading to a destination.

**Author(s)**

Tomislav Hengl

**References**

- GPX data format ([https://www.topografix.com/gpx.asp](https://www.topografix.com/gpx.asp))

**See Also**

`rgdal::readOGR`, `kml_layer.STTDF`

**Examples**

```r
## Not run: # read GPX file from web:
fells_loop <- readGPX("https://www.topografix.com/fells_loop.gpx")
str(fells_loop)
```

`## End(Not run)`
readKML.GBIFdensity  Imports GBIF cell density records

Description
Read GBIF cell (1-degree) density record counts and converts them to a "raster" object.

Usage
readKML.GBIFdensity(kml.file, gbif.url = FALSE, silent = FALSE)

Arguments
kml.file  GBIF cell density file (local file or URL)
gbif.url  logical; species whether the cellid and taxon content information should be also imported (usually not used)
silent  logical; species whether the progress bar should be printed

Details
This document contains data shared through the GBIF Network — see https://www.gbif.org/occurrence for more information. GBIF records are constantly updated and every map derived refers to a certain date indicated in the \texttt{Last update} slot. All usage of these data must be in accordance with the GBIF Data Use Agreement: https://www.gbif.org/terms.

Author(s)
Tomislav Hengl

References
- GBIF cell density description (https://www.gbif.org/occurrence)

See Also
readGPX

Examples
```
# Not run: # reading taxon density maps:
kml.file <- "taxon-celldensity-2294100.kml"
# download.file(paste("http://data.gbif.org/occurrences/taxon/celldensity/", kml.file, sep=""),
# destfile=paste(getwd(), kml.file, sep=""))
# this will not run (you must first accept the data usage agreement);
# instead, obtain the kml file via a web browser, and save it to the working directory:
r <- readKML.GBIFdensity(kml.file)
class(r)
```
Methods to reproject maps to a referent coordinate system (WGS84)

Description

This wrapper function reprojects any vector or raster spatial data to some referent coordinate system (by default: geographic coordinates on the World Geodetic System of 1984 / WGS84 datum).

Usage

```r
## S4 method for signature 'SpatialPoints'
reproject(obj, CRS, ...)
## S4 method for signature 'SpatialPolygons'
reproject(obj, CRS, ...)
## S4 method for signature 'SpatialLines'
reproject(obj, CRS, ...)
## S4 method for signature 'RasterLayer'
reproject(obj, CRS, program = "raster", tmp.file = TRUE,
  NAflag, show.output.on.console = FALSE, method, ...)
## S4 method for signature 'SpatialGridDataFrame'
reproject(obj, CRS, tmp.file = TRUE, program = "raster",
  NAflag, show.output.on.console = FALSE, ...)
## S4 method for signature 'SpatialPixelsDataFrame'
reproject(obj, CRS, tmp.file = TRUE, program = "raster",
  NAflag, show.output.on.console = FALSE, ...)
## S4 method for signature 'RasterBrick'
reproject(obj, CRS)
## S4 method for signature 'RasterStack'
reproject(obj, CRS)
```
reproject

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>obj</td>
<td>Spatial* or Raster* object</td>
</tr>
<tr>
<td>CRS</td>
<td>object of class &quot;CRS&quot;; proj4 string</td>
</tr>
<tr>
<td>program</td>
<td>reprojection engine; either raster package or GDAL</td>
</tr>
<tr>
<td>tmp.file</td>
<td>logical; specifies whether to create a temporary file or not</td>
</tr>
<tr>
<td>NAflag</td>
<td>character; missing value flag</td>
</tr>
<tr>
<td>show.output.on.console</td>
<td>logical; specifies whether to print the progress</td>
</tr>
<tr>
<td>method</td>
<td>character; resampling method e.g. &quot;bilinear&quot;</td>
</tr>
<tr>
<td>...</td>
<td>arguments evaluated in the context of function projectRaster from the raster package</td>
</tr>
</tbody>
</table>

Details

In the case of raster and/or gridded maps, by selecting program = "GDAL" gdalwarp functionality will be initiated (otherwise it tries to reproject via the package raster). This requires that GDAL are installed and located from R via paths().

Warning

obj needs to have a proper proj4 string (CRS), otherwise reproject will not run.

Author(s)

Pierre Roudier, Tomislav Hengl and Dylan Beaudette

References

- Raster package (https://CRAN.R-project.org/package=raster)
- GDAL (https://gdal.org)

See Also

paths, projectRaster, spTransform, CRS-class

Examples

```r
## example with vector data:
data(eberg)
library(sp)
library(rgdal)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
eberg.geo <- reproject(eberg)
## Not run: ## example with raster data:
data(eberg_grid25)
gridded(eberg_grid25) <- ~x+y
proj4string(eberg_grid25) <- CRS("+init=epsg:31467")
```
SAGA_pal

Colour palettes for numeric variables

Description

SAGA_pal contains 22 colour palettes imported from SAGA GIS (Conrad, 2007). R_pal 12 standard colour palettes used in R to visualize continuous and binary variables. Each colour palette consists of 20 colours in the hexadecimal system. Use display_pal function to plot different sets of palettes.

Usage

data(SAGA_pal)
data(R_pal)

Note

rainbow_75, heat colors, terrain_colors, topo_colors, and bpy_colors are the standard color palettes used in R to visualize numeric/continuous variables. soc_pal, pH_pal, tex_pal, BS_pal and CEC_pal palettes are suitable for visualization of soil variables (soil organic carbon, pH, soil texture fractions, Base Saturation and Cation Exchange Capacity). blue_grey_red palette is recommended for visualization of binary variables (values in the range 0-1), and grey_black is a white-to-black type color palette that contains no white color (hence it will not confuse low values with NA values in the PNG/GIF files).
Possibly the most used palettes for visualization of numeric variables are rev(rainbow(65)[1:48]) and SAGA_pal[[1]] (the SAGA GIS default palette). It is however worth mentioning that in the data visualization literature (and the cartography literature in particular), the rainbow (sometimes also called spectral) color ramp is generally recognized as a bad choice for visualization of sequential/continuous variables (Rogowitz and Treinish, 1998; doi: 10.1109/6.736450; Borland and Russell, 2007; doi: 10.1109/MCG.2007.323435).

Author(s)

SAGA GIS has been created by the SAGA GIS development team (lead by J. Böhner and O. Conrad, from the Institute of Geography, University of Hamburg, Germany). The colour palettes have been exported from SAGA (as "sprm" SAGA parameter files) and ported to R. All palettes described here were prepared for R by Tomislav Hengl (<tom.hengl@opengeohub.org>).

### reproject to geographical coords (can take few minutes!):
eberg_grid_ll <- reproject(eberg_grid25[1])

### much faster when using GDAL:
eberg_grid_ll2 <- reproject(eberg_grid25[1], program = "GDAL")

### optional: compare processing times:
system.time(eberg_grid_ll <- reproject(eberg_grid25[1]))
system.time(eberg_grid_ll2 <- reproject(eberg_grid25[1], program="GDAL"))

### End(Not run)
sp.palette-class

A class for color palette

Description

A class for color palette that can be further used to create an object of class "SpatialMetadata".

Slots

- `bounds`: object of class "numeric" or "character"; class boundaries
- `color`: object of class "character"; contains HEX colors
- `icons`: object of class "character"; (optional) contains symbols or URI to icons
- `names`: object of class "character"; class names (optional)
- `type`: object of class "character"; variable type

Note

Size of class boundaries (upper and lower) is 1 element larger than the size of colors and element names.

References

- https://cran.r-project.org/package=RColorBrewer
- https://cran.r-project.org/package=colorspace

See Also

worldgrids_pal, RColorBrewer::display.brewer.all

Examples

data(SAGA_pal)
data(R_pal)
## Not run: # visualize SAGA GIS palettes:
display.pal(pal=SAGA_pal, sel=c(1,2,7,8,10,11,17,18,19,21,22))
dev.off()
display.pal(R_pal)
names(R_pal)
dev.off()

## End(Not run)
SpatialMaxEntOutput-class

Description

A class containing input and output data produced by running the maxent (Maximum Entropy) species distribution modeling algorithm. Object of this class can be directly visualized in Google Earth by using the plotKML-method.

Slots

- sciname: object of class "character"; vector of species name compatible with the rgbif package; usually latin "genus" and "species" name
- occurrences: object of class "SpatialPoints"; occurrence-only records
- TimeSpan.begin: object of class "POSIXct"; begin of the sampling period
- TimeSpan.end: object of class "POSIXct"; end of the sampling period
- maxent: object of class "MaxEnt" (species distribution model); produced as an output of the dismo::maxent function or similar
- sp.domain: object of class "Spatial" (ideally SpatialPolygonsDataFrame or SpatialPixelsDataFrame); assumed spatial domain that can be set by the user or it will be estimated by MaxEnt (see examples below)
- predicted: object of class "RasterLayer"; contains results of prediction produced using the MaxEnt software

Methods

- plotKML signature(obj = "SpatialMaxEntOutput"): plots all MaxEnt output objects in Google Earth

Note

MaxEnt requires the maxent.jar file to be in the 'java' folder of the dismo package (see: system.file("java",package="dismo")). For more info refer to the dismo package documentation. Alternatively use the maxlike package (Royle et al. 2012), which does not require Java.
**SpatialMetadata-class**

**Author(s)**
Tomislav Hengl

**References**

- dismo package (https://CRAN.R-project.org/package=dismo)
- maxlike package (https://CRAN.R-project.org/package=maxlike)
- rgbif package (https://CRAN.R-project.org/package=rgbif)

**See Also**

plotKML-method, dismo::maxent, maxlike::maxlike, rgbif::taxonsearch

---

**SpatialMetadata-class**  
A class for spatial metadata

**Description**

A class containing spatial metadata in the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata.

**Slots**

- xml: object of class "XMLInternalDocument"; a metadata slot
- field.names: object of class "character"; corresponding metadata column names
- palette: object of class "sp.palette"; contains legend names and colors
- sp: object of class "Spatial"; bounding box and projection system of the input object

**Methods**

- summary signature(obj = "SpatialMetadata"): summarize object
- GetPalette signature(obj = "SpatialMetadata"): get only the color slot
- GetNames signature(obj = "SpatialMetadata"): get metadata field names

**Author(s)**

Tomislav Hengl and Michael Blaschek
SpatialPhotoOverlay-class

A class for Spatial PhotoOverlay

### Description

A class for spatial photographs (spatially and geometrically defined) that can be plotted in Google Earth.

### Slots

- `filename` object of class "character"; URI of the filename location (typically a URL)
- `pixmap` object of class "pixmapRGB"; RGB bands of a bitmapped images
- `exif.info` object of class "list"; EXIF photo metadata
- `PhotoOverlay` object of class "list"; list of the camera geometry parameters (KML specifications)
- `sp` object of class "SpatialPoints"; location of the camera

### Extends

Class "pixmapRGB".

### Methods

- `summary` signature(obj = "SpatialMetadata"): summarize object
**SpatialPredictions-class**

A class for spatial predictions produced using gstat package

**Description**

A class containing input and output maps generated through the process of geostatistical mapping. Object of this class can be directly visualized in Google Earth by using the `plotKML-method`.

**Slots**

- **variable**: object of class "character"; variable name
- **observed**: object of class "SpatialPointsDataFrame" (must be 2D); see `sp::SpatialPointsDataFrame`
- **regModel.summary**: contains the summary of the regression model
- **vgmModel**: object of class "data.frame"; contains the variogram parameters passed from gstat
- **predicted**: object of class "SpatialPixelsDataFrame"; see `sp::SpatialPixelsDataFrame`
- **validation**: object of class "SpatialPointsDataFrame" containing results of validation

**Methods**

- **plot** signature(x = "SpatialPredictions"): spatial predictions, regression model (observed vs predicted), original variogram and variogram for residuals
- **plotKML** signature(obj = "SpatialPredictions"): plots all objects in Google Earth
- **summary** signature(obj = "SpatialPredictions"): summarize object by showing the mapping accuracy (cross-validation) and the amount of variation explained by the model

**Note**

"SpatialPredictions" saves results of predictions for a single target variable, which can be of type numeric or factor. Multiple variables can be combined into a list.

**Author(s)**

Tomislav Hengl
SpatialSamplingPattern-class

A class for spatial samples produced using various spsample methods

Description

A class containing input and output objects generated by some sampling optimisation algorithm. Objects of this type can be directly visualized in Google Earth by using the plotKML-method.

Slots

- method: object of class "character": sampling optimisation method
- pattern: object of class "SpatialPoints": sampling points
- sp.domain: object of class "SpatialPolygonsDataFrame": spatial domain / strata

Methods

- plotKML signature(obj = "SpatialSamplingPattern"): plots generated sampling plan in Google Earth

Author(s)

Tomislav Hengl

See Also

plotKML-method, plotKML-method
SpatialVectorsSimulations-class

A class for spatial simulations containing equiprobable line, point or polygon features

Description

A class containing input and output maps generated as equiprobable simulations of the same discrete object (for example multiple realizations of stream networks). Objects of this type can be directly visualized in Google Earth by using the \texttt{plotKML-method}.

Slots

- \texttt{realizations}: object of class "list"; multiple realizations of the same feature e.g. multiple realizations of stream network
- \texttt{summaries}: object of class "SpatialGridDataFrame"; summary measures

Methods

- \texttt{plotKML signature(obj = \"SpatialVectorsSimulations\")}: plots simulated vector objects and summaries (grids) in Google Earth

Author(s)

Tomislav Hengl

See Also

\texttt{RasterBrickSimulations-class, plotKML-method}

Examples

```r
## load a list of equiprobable streams:
data(barstr)
data(bargrid)
library(sp)
coordinates(bargrid) <- ~ x+y
gridded(bargrid) <- TRUE
## output topology:
  cell.size = bargrid@grid@cellsize[1]
bbox = bargrid@bbox
nrows = round(abs(diff(bbox[1,])/cell.size), 0)
ncols = round(abs(diff(bbox[2,])/cell.size), 0)
gridT = GridTopology(cellcentre.offset=bbox[,1], cells.size=c(cell.size,cell.size),
  cells.dim=c(nrows, ncols))
## Not run: ## derive summaries (observed frequency and the entropy or error):
bar_sum <- count.GridTopology(gridT, vectL=barstr[1:5])
## NOTE: this operation can be time consuming!
```
Methods to generate spatial metadata

Description

The `spMetadata` function will try to generate missing metadata (bounding box, location info, session info, metadata creator info and similar) for any Spatial* object (from the sp package) or Raster* object (from the raster package). The resulting object of class `SpatialMetadata-class` can be used e.g. to generate a Layer description documents (&lt;description&gt; tag).
The `read.metadata` function reads the formatted metadata (.xml), prepared following e.g. the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata or INSPIRE standard, and converts them to a data frame.

Usage

```r
## S4 method for signature 'RasterLayer'
spMetadata(obj, bounds, color, ... )
## S4 method for signature 'Spatial'
spMetadata(obj, xml.file, out.xml.file,
  md.type = c("FGDC", "INSPIRE")[1],
  generate.missing = TRUE, GoogleGeocode = FALSE,
  signif.digit = 3, colour_scale, color = NULL, bounds,
  legend_names, icons, validate.schema = FALSE, ...)
```

Arguments

- **obj** some "Spatial" or "Raster" class object with "data" slot
- **xml.file** character; optional input XML metadata file
- **out.xml.file** character; optional output XML metadata file
- **md.type** character; metadata standard FGDC or INSPIRE
- **generate.missing** logical; specifies whether to automatically generate missing fields
- **GoogleGeocode** logical; specifies whether the function should try to use GoogleGeocoding functionality to determine the location name
- **signif.digit** integer; the default number of significant digits (in the case of rounding)
- **colour.scale** the color scheme used to visualize this data
- **color** character; list of colors (rgb()) that can be passed instead of using the palette
- **bounds** numeric vector; upper and lower bounds used for visualization
Details

spMetadata tries to locate a metadata file in the working directory (it looks for a metadata file with the same name as the object name). If no `.xml` file exists, it will load the template xml file available in the system folder (e.g. `system.file("FGDC.xml",package="plotKML")` or `system.file("INSPIRE_ISO19139.xml",package="plotKML")`). The FGDC.xml/INSPIRE_ISO19139.xml files contain typical metadata entries with description and examples. For practical purposes, one metadata object in plotKML can be associated with only one variable i.e. one column in the “data” slot (the first column by default). To prepare a metadata xml file following the FGDC standard, consider using e.g. the Tkme software: Another editor for formal metadata, by Peter N. Schweitzer (U.S. Geological Survey). Before committing the metadata file, try also running a validation test (https://mrdata.usgs.gov/validation/). Before committing the metadata file following the INSPIRE standard, try running the INSPIRE Geoportal Metadata Validator.

spMetadata tries to automatically generate the most useful information, so that a user can easily find out about the input data and procedures followed to generate the visualization (KML). Typical metadata entries include e.g. (FGDC):

- `metadata["idinfo"]["native"]` — Session info e.g.: Produced using R version 2.12.2 (2011-02-25) running on Windows 7 x64.
- `metadata["spdoinfo"]["indspref"]` — Indirect spatial reference estimated using the Google Maps API Web Services.
- `metadata["idinfo"]["spdom"]["bounding"]` — Bounding box in the WGS84 geographical coordinates estimated by reprojecting the original bounding box.

and for INSPIRE metadata:

- `metadata["fileIdentifier"]["CharacterString"]` — Metadata file identifier (not mandatory for INSPIRE-compliant) created by UUIDgenerate from package UUID (version 4 UUID).
- `metadata["dateStamp"]["Date"]` — Metadata date stamp created using Sys.Date() .
- `metadata["identificationInfo"]["MD_DataIdentification"] ["extent"]["EX_Extent"] ["geography"]` — Bounding box in the WGS84 geographical coordinates estimated by reprojecting the original bounding box.

By default, plotKML uses the Creative Commons license, but this can be adjusted by setting the `Use_Constraints` argument.

Author(s)

Tomislav Hengl and Michael Blaschek
References

- Content Standard for Digital Geospatial Metadata (http://www.fgdc.gov/metadata/csdgm/)

See Also

kml_metadata, SpatialMetadata-class, sp::Spatial, kml_open

Examples

```r
## Not run:
library(sp)
library(uuid)
library(rjson)
## read metadata from the system file:
x <- read.metadata(system.file("FGDC.xml", package="plotKML"))
str(x)
## generate missing metadata
data(eberg)
coordinates(eberg) <- ~X+Y
proj4string(eberg) <- CRS("+init=epsg:31467")
## no metadata file specified:
eberg.md <- spMetadata(eberg["SNDMHT_A"])
## this generates some metadata automatically e.g.:
xmlRoot(eberg.md@xml)[["eainfo"]][["detailed"]][["attr"]]
## combine with locally prepared metadata file:
eberg.md <- spMetadata(eberg["SNDMHT_A"],
xml.file=system.file("eberg.xml", package="plotKML"))
## Additional metadata entries can be added by using e.g.:
eberg.md <- spMetadata(eberg["SNDMHT_A"],
md.type="INSPIRE",
CI_Citation_title = 'Ebergotzen data set',
CI_Online_resource_URL = 'http://geomorphometry.org/content/ebergotzen')
## the same using the FGDC template:
eberg.md <- spMetadata(eberg["SNDMHT_A"],
Citation_title = 'Ebergotzen data set',
Citation_URL = 'http://geomorphometry.org/content/ebergotzen')
## Complete list of names:
mdnames <- read.csv(system.file("mdnames.csv", package="plotKML"))
mdnames$field.names
## these can be assigned to the "metadata" environment by using:
```
spPhoto

Generate an object of class "SpatialPhotoOverlay"

Description

spPhoto function can be used to wrap pixel map (pixmapRGB), EXIF (Exchangeable Image File format) data, spatial location information (standing point), and PhotoOverlay (geometry) parameters to create an object of class "SpatialPhotoOverlay". This object can then be parsed to KML and visualized using Google Earth.

Usage

spPhoto(filename, obj, pixmap, exif.info = NULL, ImageWidth = 0,
        ImageHeight = 0, bands = rep(rep(1, ImageHeight*ImageWidth), 3),
        bbox = c(0, 0, 3/36000*ImageWidth, 3/36000*ImageHeight),
        DateTime = "", ExposureTime = "", FocalLength = "50 mm",
        Flash = "No Flash", rotation = 0, leftFov = -30, rightFov = 30,
        bottomFov = -30, topFov = 30, near = 50,
        shape = c("rectangle", "cylinder", "sphere")[1], range = 1000, tilt = 90,
        heading = 0, roll = 0, test.filename = TRUE)

Arguments

filename file name with extension (ideally an URL)
obj object of class "SpatialPoints" (requires a single point object)
pixmap object of class "pixmapRGB" (see package pixmap)
exif.info named list containing all available EXIF metadata
ImageWidth (optional) image width in pixels
ImageHeight (optional) image height in pixels
bands (optional) RGB bands as vectors (see pixmap::pixmapRGB)
bbox (optional) bounding box coordinates (by default 1 pixel is about 1 m in arc degrees)
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DateTime</td>
<td>(optional) usually available from the camera EXIF data</td>
</tr>
<tr>
<td>ExposureTime</td>
<td>(optional) usually available from the camera EXIF data</td>
</tr>
<tr>
<td>FocalLength</td>
<td>(optional) usually available from the camera EXIF data</td>
</tr>
<tr>
<td>Flash</td>
<td>(optional) usually available from the camera EXIF data</td>
</tr>
<tr>
<td>rotation</td>
<td>(optional) rotation angle in 0–90 degrees</td>
</tr>
<tr>
<td>leftFov</td>
<td>(optional) angle, in degrees, between the camera’s viewing direction and the left side of the view volume (-180 – 0)</td>
</tr>
<tr>
<td>rightFov</td>
<td>(optional) angle, in degrees, between the camera’s viewing direction and the right side of the view volume (0 – 180)</td>
</tr>
<tr>
<td>bottomFov</td>
<td>(optional) angle, in degrees, between the camera’s viewing direction and the bottom side of the view volume (-90 – 0)</td>
</tr>
<tr>
<td>topFov</td>
<td>(optional) angle, in degrees, between the camera’s viewing direction and the top side of the view volume (0 – 90)</td>
</tr>
<tr>
<td>near</td>
<td>(optional) measurement in meters along the viewing direction from the camera viewpoint to the PhotoOverlay shape</td>
</tr>
<tr>
<td>shape</td>
<td>(optional) shape type — rectangle (standard photograph), cylinder (for panoramas), or sphere (for spherical panoramas)</td>
</tr>
<tr>
<td>range</td>
<td>(optional) distance from the camera to the placemark</td>
</tr>
<tr>
<td>tilt</td>
<td>(optional) rotation, in degrees, of the camera around the X axis</td>
</tr>
<tr>
<td>heading</td>
<td>(optional) direction (azimuth) of the camera, in degrees (0 – 360)</td>
</tr>
<tr>
<td>roll</td>
<td>(optional) rotation about the y axis, in degrees (0 – 180)</td>
</tr>
<tr>
<td>test.filename</td>
<td>logical; species whether a test should be first performed that the file name really exists (recommended)</td>
</tr>
</tbody>
</table>

Details

The most effective way to import a field photograph to SpatialPhotoOverlay for parsing to KML is to: (a) use the EXIF tool (courtesy of Phil Harvey) to add any important tags in the image file, (b) once you’ve added all important tags, you can upload your image either to a local installation of Mediawiki or to a public portal such as the [Wikimedia Commons](https://commons.wikimedia.org), (c) enter the missing information if necessary and add an image description. Once the image is on the server, you only need to record its unique name and then read all metadata from the Wikimedia server following the examples below.

You can also consider importing images to R by using the pixmap package, and reading the technical information via e.g. the `exif` package. If the image is taken using a GPS enabled camera, by getting the EXIF metadata you can generate the complete SpatialPhotoOverlay object with minimum user interaction. Otherwise, you need to at least specify: creation date, file name, and location of the focal point of the camera (e.g. by creating "SpatialPoints" object).

Value

Returns an object of class "SpatialPhotoOverlay":

- **filename**: URL location of the original image
**spPhoto**

```
 pixmap   optional; local copy of the image (" pixmapRGB" class)
 exif.info list of EXIF metadata
 PhotoOverlay list of the camera geometry parameters (KML specifications)
 sp       location of the camera ("SpatialPoints" class)
```

**Note**

The `spPhoto` function will try to automatically fix the aspect ratio of the ViewVolume settings (`leftFov, rightFov, bottomFov, topFov`), and based on the original aspect ratio as specified in the EXIF data. This might not work for all images, in which case you will have to manually adjust those parameters.

Dimension of `3/36000*ImageWidth` in decimal degrees is about 10 m in nature (3-arc seconds is about 100 m, depending on the latitude).

**Author(s)**

Tomislav Hengl

**References**

- EXIF tool ([https://exiftool.org/](https://exiftool.org/))

**See Also**

`getWikiMedia.ImageInfo`, ` pixmap:: pixmapRGB, spMetadata`

**Examples**

```
## Not run: # two examples with images on Wikimedia Commons
# (1) soil monolith (manually entered coordinates):
imagename = "Soil_monolith.jpg"
# import EXIF data using the Wikimedia API:
x1 <- getWikiMedia.ImageInfo(imagename)
# create a SpatialPhotoOverlay:
sm <- spPhoto(filename = x1$url$url, exif.info = x1$metadata)
# plot it in Google Earth
kml(sm, method="monolith", kmz=TRUE)
# (2) PhotoOverlay (geotagged photo):
imagename = "Africa_Museum_Nijmegen.jpg"
x2 <- getWikiMedia.ImageInfo(imagename)
af <- spPhoto(filename = x2$url$url, exif.info = x2$metadata)
kml(af)

## End(Not run)
```
vect2rast

Convert points, lines and/or polygons to rasters

Description

Converts any "SpatialPoints*", "SpatialLines*", or "SpatialPolygons*" object to a raster map, and (optional) writes it to an external file (GDAL-supported formats; writes to SAGA GIS format by default).

Usage

## S4 method for signature 'SpatialPoints'

text

```r
def vect2rast(obj, fname = names(obj)[1], cell.size, bbox,
               file.name, silent = FALSE, method = c("raster", "SAGA")[1],
               FIELD = 0, MULTIPLE = 1, LINE_TYPE = 0, GRID_TYPE = 2, ... )
```

## S4 method for signature 'SpatialLines'

text

```r
def vect2rast(obj, fname = names(obj)[1], cell.size, bbox,
               file.name, silent = FALSE, method = c("raster", "SAGA")[1],
               FIELD = 0, MULTIPLE = 1, LINE_TYPE = 1, GRID_TYPE = 2, ... )
```

## S4 method for signature 'SpatialPolygons'

text

```r
def vect2rast(obj, fname = names(obj)[1], cell.size, bbox,
               file.name, silent = FALSE, method = c("raster", "SAGA")[1],
               FIELD = 0, MULTIPLE = 0, LINE_TYPE = 1, GRID_TYPE = 2, ... )
```

Arguments

- **obj**: Spatial-PointsDataFrame,-LinesDataFrame or -PolygonsDataFrame object
- **fname**: character; target variable
- **cell.size**: numeric; output cell size
- **bbox**: matrix; output bounding box
- **file.name**: character; (optional) output file name
- **silent**: logical; specifies whether to print the output
- **method**: character; output rasterization engine (either raster package or SAGA GIS)
- **FIELD**: integer; target column in the output shape file (see rsaga.get.usage("grid_gridding",0))
- **MULTIPLE**: integer; method for multiple values (see rsaga.get.usage("grid_gridding",0))
- **LINE_TYPE**: integer; method for lines (see rsaga.get.usage("grid_gridding",0))
- **GRID_TYPE**: integer; preferred target grid type (see rsaga.get.usage("grid_gridding",0))
- **...**: additional arguments that can be passed to the raster::rasterize command
Details

This function basically extends the `rasterize` function available in the raster package. The advantage of vect2rast, however, is that it requires no input from the user’s side i.e. it automatically determines the grid cell size and the bounding box based on the properties of the input data set. The grid cell size is estimated based on the density/size of features in the map (nndist function in spatstat package): (a) in the case of “SpatialPoints” cell size is determined as half the mean distance between the nearest points; (b) in the case of “SpatialLines” half cell size is determined as half the mean distance between the lines; (c) in the case of polygon data cell size is determined as half the median size (area) of polygons of interest. For more details see Hengl (2006); doi: 10.1016/j.cageo.2005.11.008. To process larger vector maps consider using method="SAGA".

Value

Returns an object of type "SpatialGridDataFrame".

Author(s)

Tomislav Hengl

References

- Raster package (https://CRAN.R-project.org/package=raster)
- SpatStat package (https://spatstat.org)

See Also

`vect2rast.SpatialPoints`, `raster::rasterize`

Examples

```r
## Not run:
data(eberg)
library(sp)
library(maptools)
library(spatstat)
coordinates(eberg) <- ~X+Y
data(eberg_zones)
# point map:
x <- vect2rast(eberg, fname = "SNDMHT_A")
image(x)
# polygon map:
x <- vect2rast(eberg_zones)
image(x)
# for large data sets use SAGA GIS:
x <- vect2rast(eberg_zones, method = "SAGA")
## End(Not run)
```
Description

Converts object of class "SpatialPoints*" to a raster map, and (optional) writes it to an external file (GDAL-supported formats; it used the SAGA GIS format by default).

Usage

vect2rast.SpatialPoints(obj, fname = names(obj)[1], cell.size, bbox, file.name, silent = FALSE, method = c("raster", "SAGA")[1], FIELD = 0, MULTIPLE = 1, LINE_TYPE = 0, GRID_TYPE = 2, ... )

Arguments

- **obj** "SpatialPoints*" object
- **fname** target variable name in the "data" slot
- **cell.size** (optional) grid cell size in the output raster map
- **bbox** (optional) output bounding box (class "bbox") for cropping the data
- **file.name** (optional) file name to export the resulting raster map
- **silent** logical; specifies whether to print any output of processing
- **method** character; specifies the gridding method
- **FIELD** character; SAGA GIS argument attribute table field number
- **LINE_TYPE** character; SAGA GIS argument method for rasterization — [0] thin, [1] thick
- ... additional arguments that can be passed to the raster::rasterize command

Value

Returns an object of type "SpatialGridDataFrame".

Author(s)

Tomislav Hengl

See Also

vect2rast
Examples

```r
## Not run:
library(sp)
data(meuse)
coordinates(meuse) <- ~x+y
# point map:
x <- vect2rast(meuse, fname = "om")
data(SAGA_pal)
sp.p <- list("sp.points", meuse, pch="+", cex=1.5, col="black")
spplot(x, col.regions=SAGA_pal[[1]], sp.layout=sp.p)
## End(Not run)
```

whitening

## Not run:
library(sp)
data(meuse)
coordinates(meuse) <- ~x+y
# point map:
x <- vect2rast(meuse, fname = "om")
data(SAGA_pal)
sp.p <- list("sp.points", meuse, pch="+", cex=1.5, col="black")
spplot(x, col.regions=SAGA_pal[[1]], sp.layout=sp.p)
## End(Not run)

### whitening

whitening

whitening

whitening

whitening

whitening

whitening

whitening

whitening

whitening

Description

Derives a ‘whitenned’ color based on the Hue-Saturation-Intensity color model. This method can be used to visualize uncertainty: the original color is leached proportionally to the uncertainty (white color indicates maximum uncertainty).

Usage

```r
whitening(z, zvar, zlim = c(min(z, na.rm=TRUE), max(z, na.rm=TRUE)),
elim = c(.4,1), global.var = var(z, na.rm=TRUE), col.type = "RGB")
```

Arguments

- **z**: numeric; target variable (e.g. predicted values)
- **zvar**: numeric; prediction error (variance)
- **zlim**: upper and lower limits for target variable
- **elim**: upper and lower limits for the normalized error
- **global.var**: global variance (either estimated from the data or specified)
- **col.type**: character; "RGB" or "HEX"

Details

The HSI is a psychologically appealing color model for visualization of uncertainty: hue is used to visualize values and whitening (paleness or leaching percentage) is used to visualize the uncertainty, or in other words the map is incomplete in the areas of high uncertainty. Unlike standard legends for continuous variables, this legend has two axis — one for value range and one for uncertainty range (see also kml_legend.whitening).

The standard range for elim is 0.4 and 1.0 (maximum). This assumes that a satisfactory prediction is when the model explains more than 85% of the total variation (normalized error = 40%). Otherwise, if the value of the normalized error get above 80%, the model accounts for less than 50% of
Whitening is of special interest for visualization of the prediction errors in geostatistics. Formulas to derive the whitening color are explained in Hengl et al. (2004).

Author(s)
Tomislav Hengl and Pierre Roudier

References

Examples
whitening(z=15, zvar=5, zlim=c(10,20), global.var=7)
# significant color;
whitening(z=15, zvar=5, zlim=c(10,20), global.var=4)
# error exceeds global.var -> totally white;

Description
A number of color palettes used to visualize various environmental categorical / factor variables: land cover classes, water types, anthroms, soil types and similar. Each colour palette consists of a variable number of colours (hexadecimal system). Factor levels names are attached as attributes to the palette.

Usage
data(worldgrids_pal)

Format
The list contains:
anthroms  Color palette used for the global map of anthroms (Ellis and Ramankutty, 2008).
bodemfgr  A simplified color palette for soil types.
corine2k  Color palette used in the Corine 2000 project for land cover classes (BÄ¼ttner, et al., 2002).
Note

These colour palettes are only valid for factor-type variables. The names of classes used in the legend can be obtained by loading the palette list.

Author(s)

Tomislav Hengl

References


See Also

SAGA_pal, R_pal
Examples

data(worldgrids_pal)
## Not run: # globcov palette with class names:
display.pal(worldgrids_pal)
dev.off()
display.pal(worldgrids_pal, sel=5, names=TRUE)

## End(Not run)
Index

* classes
  RasterBrickSimulations-class, 76
  RasterBrickTimeSeries-class, 77
  sp.palette-class, 83
  SpatialMaxEntOutput-class, 84
  SpatialMetadata-class, 85
  SpatialPhotoOverlay-class, 86
  SpatialPredictions-class, 87
  SpatialSamplingPattern-class, 88
  SpatialVectorsSimulations-class, 89

* color
  col2kml, 10
  SAGA_pal, 82
  worldgrids_pal, 100

* datasets
  baranja, 5
  bigfoot, 7
  eberg, 12
  fmd, 15
  gpxbtour, 19
  HRprec08, 22
  HRtemp08, 23
  LST, 55
  northcumbria, 60
  SAGA_pal, 82

* methods
  getCRS-methods, 17
  grid2poly, 21
  kml-methods, 26
  kml.tiles, 28
  kml_layer-methods, 31
  kml_layer.Raster, 33
  kml_layer.RasterBrick, 34
  kml_layer.SpatialLines, 38
  kml_layer.SpatialPhotoOverlay, 39
  kml_layer.SpatialPoints, 43
  kml_layer.SpatialPolygons, 45
  kml_layer.STIDF, 46
  kml_layer.STTDF, 48
  kml_legend.bar, 50
  kml_open, 53
  makeCOLLADA, 56
  metadata2SLD-methods, 58
  metadata2SLD.SpatialPoints, 58
  plotKML-method, 61
  plotKML-package, 3
  plotKML.env, 72
  plotKML.GDALobj, 74
  readGPX, 78
  reproject, 80
  spMetadata-methods, 90
  spPhoto, 93
  vect2rast, 96
  vect2rast.SpatialPoints, 98

* utilities
  kml_compress, 29
  normalizeFilename, 59

aesthetics, 4, 28, 33, 38, 42, 43, 63, 64

baranja, 5
bargrid (baranja), 5
barstr (baranja), 5
barxyz (baranja), 5
bigfoot, 7
check_projection, 9, 17
col2km1, 10
color_palettes (SAGA_pal), 82
count.GridTopology, 11
CRS-class, 81
display.pal, 11
eberg, 12
eberg_contours (eberg), 12
eberg_grid (eberg), 12
eberg_grid25 (eberg), 12
eberg_zones (eberg), 12
extractProjValue (check_projection), 9
fmd, 15, 61
geopath, 16
getCRS (getCRS-methods), 17
getCRS, Raster-method (getCRS-methods), 17
getCRS, Spatial-method (getCRS-methods), 17
getCRS-methods, 17
getCRS, Raster (getCRS-methods), 17
getCRS, Spatial (getCRS-methods), 17
GetNames (SpatialMetadata-class), 85
GetNames, SpatialMetadata-method (SpatialMetadata-class), 85
GetPalette (SpatialMetadata-class), 85
GetPalette, SpatialMetadata-method (SpatialMetadata-class), 85
getWikiMedia.ImageInfo, 18, 41, 95
gpxbtour, 19
grid2poly, 21
hex2km1 (col2km1), 10
HRprec08, 22, 24
HRtemp08, 23, 23
kml (kml-methods), 26
kml, Raster-method (kml-methods), 26
kml, SoilProfileCollection-method (kml-methods), 26
kml, Spatial-method (kml-methods), 26
kml, SpatialPhotoOverlay-method (kml-methods), 26
kml, STIDF-method (kml-methods), 26
kml-methods, 26
kml.Spatial (kml-methods), 26
kml.tiles, 28, 75
kml2hex (col2km1), 10
kml_aes, 27
kml_aes (aesthetics), 4
kml_alpha (kml_layer-methods), 31
kml_altitude (kml_layer-methods), 31
kml_altitude_mode (kml_layer-methods), 31
kml_close, 27, 32, 64
kml_close (kml_open), 53
kml_colour (kml_layer-methods), 31
kml_compress, 27, 29, 64
kml_description, 30
kml_layer, 50, 54
kml_layer (kml_layer-methods), 31
kml_layer, RasterBrick-method (kml_layer-methods), 31
kml_layer, RasterLayer-method (kml_layer-methods), 31
kml_layer, RasterStack-method (kml_layer-methods), 31
kml_layer, sf-method (kml_layer-methods), 31
kml_layer, sfc_LINESTRING-method (kml_layer-methods), 31
kml_layer, sfc_MULTILINESTRING-method (kml_layer-methods), 31
kml_layer, sfc_MULTIPOINT-method (kml_layer-methods), 31
kml_layer, sfc_MULTIPOLYGON-method (kml_layer-methods), 31
kml_layer, sfc_POINT-method (kml_layer-methods), 31
kml_layer, sfc_POLYGON-method (kml_layer-methods), 31
kml_layer, SpatialBrick-method (kml_layer-methods), 31
kml_layer, SpatialGrid-method (kml_layer-methods), 31
kml_layer, SpatialLines-method (kml_layer-methods), 31
kml_layer, SpatialPhotoOverlay-method (kml_layer-methods), 31
kml_layer, SpatialPolyline-method (kml_layer-methods), 31
INDEX

kml_layer, SpatialPixels-method, 31
kml_layer, SpatialPoints-method
(kml_layer-methods), 31
kml_layer, SpatialPolygons-method
(kml_layer-methods), 31
kml_layer, STFDF-method
(kml_layer-methods), 31
kml_layer, STIDF-method
(kml_layer-methods), 31
kml_layer, STSDF-method
(kml_layer-methods), 31
kml_layer, STTDF-method
(kml_layer-methods), 31
kml_layer-methods, 31
kml_layer.Raster
, 32, 33, 35, 42
kml_layer.RasterBrick, 34, 34
kml_layer.SoilProfileCollection, 32, 35
kml_layer.SpatialLines, 16, 32, 38, 46
kml_layer.SpatialPhotoOverlay, 37, 39, 57
kml_layer.SpatialPixels, 41
kml_layer.SpatialPoints, 32, 43
kml_layer.SpatialPolygons, 32, 39, 45
kml_layer.STFDF (kml_layer.STIDF), 46
kml_layer.STIDF, 32, 46, 46
kml_layer.STTDF, 16, 32, 44, 47, 48, 78
kml_legend.bar, 50
kml_legend.whitening, 51, 99, 100
kml_metadata, 92
kml_metadata (kml_metadata-methods), 52
kml_metadata, SpatialMetadata-method
(kml_metadata-methods), 52
kml_metadata-methods, 52
kml_open, 27, 30, 32, 34, 35, 39, 42, 53, 64, 92
kml_screen, 54, 64
kml_shape (kml_layer-methods), 31
kml_size (kml_layer-methods), 31
kml_View (kml_open), 53
kml_width (aesthetics), 4

LST, 55

makeCOLLADA, 56
makeCOLLADA.rectangle, 40
metadata (spMetadata-methods), 90
metadata2SLD (metadata2SLD-methods), 58
metadata2SLD.SpatialMetadatabase
(metadata2SLD-methods), 58
metadata2SLD, Spatial
(metadata2SLD-methods), 58
metadata2SLD.SpatialPixels, 58, 58
munsell2kml (col2kml), 10

normalizeFilename, 59
northcumbria, 15, 60

parse_proj4 (check_projection), 9
paths, 81
paths (plotKML.env), 72
plot, SpatialPredictions-method
(SpatialPredictions-class), 87
plot.SpatialPredictions
(SpatialPredictions-class), 87
plotKML, 29, 75
plotKML (plotKML-method), 61
plotKML.list-method (plotKML-method), 61
plotKML, RasterBrickSimulations
(RasterBrickSimulations-class), 76
plotKML, RasterBrickSimulations-method
(plotKML-method), 61
plotKML, RasterBrickTimeSeries
(RasterBrickTimeSeries-class), 77
plotKML, RasterBrickTimeSeries-method
(plotKML-method), 61
plotKML, RasterLayer-method
(plotKML-method), 61
plotKML, sf-method (plotKML-method), 61
plotKML, SoilProfileCollection-method
(plotKML-method), 61
plotKML, SpatialGridDataFrame-method
(plotKML-method), 61
plotKML, SpatialLinesDataFrame-method
(plotKML-method), 61
plotKML, SpatialMaxEntOutput-method
(plotKML-method), 61
plotKML, SpatialPhotoOverlay-method
(plotKML-method), 61
plotKML, SpatialPixelsDataFrame-method
(plotKML-method), 61
plotKML, SpatialPointsDataFrame-method
(plotKML-method), 61
plotKML, SpatialPolygonsDataFrame-method
(plotKML-method), 61
plotKML, SpatialPredictions-method (plotKML-method), 61
plotKML, SpatialSamplingPattern (SpatialSamplingPattern-class), 88
plotKML, SpatialSamplingPattern-method (plotKML-method), 61
plotKML, SpatialVectorsSimulations (SpatialVectorsSimulations-class), 89
plotKML, SpatialVectorsSimulations-method (plotKML-method), 61
plotKML, stars-method (plotKML-method), 61
plotKML, STFDF-method (plotKML-method), 61
plotKML, STIDF-method (plotKML-method), 61
plotKML, STSDF-method (plotKML-method), 61
plotKML, STTDF-method (plotKML-method), 61
plotKML-method, 61
plotKML-package, 3, 73
plotKML.env, 72
plotKML.GDALobj, 29, 74
plotKML.opts (plotKML.env), 72
projectRaster, 81
R_pal, 12, 101
R_pal (SAGA_pal), 82
RasterBrick (kml_layer.RasterBrick), 34
RasterBrickSimulations-class, 76
RasterBrickTimeSeries-class, 77
rasterize, 97
rasterize (vect2rast), 96
RasterLayer (kml_layer.Raster), 33
read.metadata (spMetadata-methods), 90
readGPX, 49, 78, 79
readKML.GBIFdensity, 79
reproject, 9, 80
reproject, RasterBrick-method (reproject), 80
reproject, RasterLayer-method (reproject), 80
reproject, RasterStack-method (reproject), 80
reproject, SpatialGridDataFrame-method (reproject), 80
reproject, SpatialLines-method (reproject), 80
reproject, SpatialPointsDataFrame-method (reproject), 80
reproject, SpatialPoints-method (reproject), 80
reproject, SpatialPolygons-method (reproject), 80
reproject.RasterBrick (reproject), 80
reproject.RasterLayer (reproject), 80
reproject.RasterStack (reproject), 80
reproject.SpatialGrid (reproject), 80
reproject.SpatialPoints (reproject), 80
SAGA_pal, 12, 82, 101
SoilProfileCollection
  (kml_layer.SoilProfileCollection), 35
sp.palette-class, 83
SpatialLines (kml_layer.SpatialLines), 38
SpatialMaxEntOutput-class, 84
SpatialMetadata-class, 85
SpatialPhotoOverlay (spPhoto), 93
SpatialPhotoOverlay-class, 86
SpatialPixels
  (kml_layer.SpatialPixels), 41
SpatialPoints
  (kml_layer.SpatialPoints), 43
SpatialPolygons
  (kml_layer.SpatialPolygons), 45
SpatialPredictions-class, 87
SpatialSamplingPattern-class, 88
SpatialVectorsSimulations-class, 89
spMetadata, 53, 58, 59, 84, 86, 95
spMetadata (spMetadata-methods), 90
spMetadata, RasterLayer-method (spMetadata-methods), 90
spMetadata, Spatial-method (spMetadata-methods), 90
spMetadata-methods, 90
spMetadata.Raster (spMetadata-methods), 90
spMetadata.Spatial (spMetadata-methods), 90
spPhoto, 19, 41, 87, 93
INDEX

spPhoto, SpatialPhotoOverlay  (SpatialPhotoOverlay-class), 86
spTransform, 81
STIDF (kml_layer.STIDF), 46
STTDF (kml_layer.STTDF), 48
summary, SpatialMetadata-method  (SpatialMetadata-class), 85

trajectory (gpxbtour), 19

USAWgrids (bigfoot), 7

vect2rast, 11, 21, 96, 98
vect2rast, SpatialLines-method  (vect2rast), 96
vect2rast, SpatialPoints-method  (vect2rast), 96
vect2rast, SpatialPolygons-method  (vect2rast), 96
vect2rast, SpatialLines (vect2rast), 96
vect2rast, SpatialPoints, 97, 98
vect2rast, SpatialPolygons (vect2rast), 96

whitening, 52, 99

worldgrids_pal, 12, 83, 100