Package 'tmaptools'

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Type Package

Title Thematic Map Tools

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Description
Set of tools for reading and processing spatial data. The aim is to supply the workflow to create thematic maps. This package also facilitates 'tmap', the package for visualizing thematic maps.

License GPL-3

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Suggests tmap, cols4all, rmapshaper, osmdata, OpenStreetMap, raster, png, shiny, shinyjs

URL https://github.com/r-tmap/tmaptools, https://r-tmap.github.io/tmaptools/

BugReports https://github.com/r-tmap/tmaptools/issues

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Contents

`tmaptools-package` *Thematic Map Tools*

Description

This package offers a set of handy tool functions for reading and processing spatial data. The aim of these functions is to supply the workflow to create thematic maps, e.g. read shape files, set map projections, append data, calculate areas and distances, and query OpenStreetMap. The visualization of thematic maps can be done with the tmap package.

Details

This page provides a brief overview of all package functions.

Tool functions (shape)

`approx_areas`	Approximate area sizes of polygons
`approx_distances`	Approximate distances
`bb`	Create, extract or modify a bounding box
`bb_poly`	Convert bounding box to a polygon
`get_asp_ratio`	Get the aspect ratio of a shape object

Tool functions (colors)

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Author(s)

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See Also

Useful links:

- https://github.com/r-tmap/tmaptools
- https://r-tmap.github.io/tmaptools/
- Report bugs at https://github.com/r-tmap/tmaptools/issues

approx_areas *Approximate area sizes of the shapes*

Description

Approximate the area sizes of the polygons in real-world area units (such as sq km or sq mi), proportional numbers, or normalized numbers. Also, the areas can be calibrated to a prespecified area total. This function is a convenient wrapper around st_area.

Usage

```
approx_areas(shp, target = "metric", total.area = NULL)
```

Arguments

shp	shape object, i.e., an sf or sp object.
target	target unit, one of "prop": Proportional numbers. In other words, the sum of the area sizes equals one. "norm": Normalized numbers. All area sizes are normalized to the largest area, of which the area size equals one. "metric" **(default):** Output area sizes will be either "km" (kilometer) or "m" (meter) depending on the map scale "imperial": Output area sizes will be either "mi" (miles) or "ft" (feet) depending on the map scale **other:** Predefined values are "km^2", "m^2", "mi^2", and "ft^2". Other values can be specified as well, in which case to is required). These units are the output units. See orig for the coordinate units used by the shape shp.
total.area	total area size of shp in number of target units (defined by target). Useful if the total area of the shp differs from a reference total area value. For "metric" and "imperial" units, please provide the total area in squared kilometers respectively miles.

Details

Note that the method of determining areas is an approximation, since it depends on the used projection and the level of detail of the shape object. Projections with equal-area property are highly recommended. See https://en.wikipedia.org/wiki/List_of_map_projections for equal area world map projections.

Value

Numeric vector of area sizes (class units).

See Also

approx_distances

Examples

```
if (require(tmap) && packageVersion("tmap") >= "3.99") {
    data(NLD_muni)

    NLD_muni$area <- approx_areas(NLD_muni, total.area = 33893)

    tm_shape(NLD_muni) +
        tm_bubbles(size="area",
                   size.legend = tm_legend(title = expression("Area in " * km^2)))


    # function that returns min, max, mean and sum of area values
    summary_areas <- function(x) {
        list(min_area=min(x),
             max_area=max(x),
             mean_area=mean(x),
             sum_area=sum(x))
    }

    # area of the polygons
    approx_areas(NLD_muni) %>% summary_areas()

    # area of the polygons, adjusted corrected for a specified total area size
    approx_areas(NLD_muni, total.area=33893) %>% summary_areas()

    # proportional area of the polygons
    approx_areas(NLD_muni, target = "prop") %>% summary_areas()

    # area in squared miles
    approx_areas(NLD_muni, target = "mi mi") %>% summary_areas()

    # area of the polygons when unprojected
    approx_areas(NLD_muni %>% sf::st_transform(crs = 4326)) %>% summary_areas()
}
```

---

approx_distances *Approximate distances*

Description

Approximate distances between two points or across the horizontal and vertical centerlines of a bounding box.

Usage

```
approx_distances(x, y = NULL, projection = NULL, target = NULL)
```

Arguments

x	object that can be coerced to a bounding box with bb, or a pair of coordintes (vector of two). In the former case, the distance across the horizontal and vertical centerlines of the bounding box are approximated. In the latter case, y is also required; the distance between points x and y is approximated.
y	a pair of coordintes, vector of two. Only required when x is also a pair of coordintes.
projection	projection code, needed in case x is a bounding box or when x and y are pairs of coordinates. See get_proj4
target	target unit, one of: "m", "km", "mi", and "ft".

Value

If y is specifyed, a list of two: unit and dist. Else, a list of three: unit, hdist (horizontal distance) and vdist (vertical distance).

See Also

approx_areas

Examples

```
## Not run:
if (require(tmap)) {
    data(NLD_prov)

    # North-South and East-West distances of the Netherlands
    approx_distances(NLD_prov)

    # Distance between Maastricht and Groningen
    p_maastricht <- geocode_OSM("Maastricht")$coords
    p_groningen <- geocode_OSM("Groningen")$coords
    approx_distances(p_maastricht, p_groningen, projection = 4326, target = "km")

    # Check distances in several projections
    sapply(c(3035, 28992, 4326), function(projection) {
        p_maastricht <- geocode_OSM("Maastricht", projection = projection)$coords
        p_groningen <- geocode_OSM("Groningen", projection = projection)$coords
        approx_distances(p_maastricht, p_groningen, projection = projection)
    })
}

## End(Not run)
```

bb *Bounding box generator*

Description

Swiss army knife for bounding boxes. Modify an existing bounding box or create a new bounding box from scratch. See details.

Usage

```
bb(
  x = NA,
  ext = NULL,
  cx = NULL,
  cy = NULL,
  width = NULL,
  height = NULL,
  xlim = NULL,
  ylim = NULL,
  relative = FALSE,
  asp.limit = NULL,
  current.projection = NULL,
  projection = NULL,
  output = c("bbox", "matrix", "extent")
)
```

Arguments

x	One of the following: • A shape from class sf, stars, sp, or raster. • A bounding box (st_bbox, Extent (raster package, which will no longer be supported in the future versions), numeric vector of 4 (default order: xmin, ymin, xmax, ymax), or a 2x2 matrix). • Open Street Map search query. The bounding is automatically generated by querying x from Open Street Map Nominatim. See geocode_OSM .
ext	Extension factor of the bounding box. If 1, the bounding box is unchanged. Values smaller than 1 reduces the bounding box, and values larger than 1 enlarges the bounding box. This argument is a shortcut for both width and height with relative=TRUE. If a negative value is specified, then the shortest side of the bounding box (so width or height) is extended with ext, and the longest side is extended with the same absolute value. This is especially useful for bounding boxes with very low or high aspect ratios.
cx	center x coordinate
cy	center y coordinate

width	width of the bounding box. These are either absolute or relative (depending on the argument relative).
height	height of the bounding box. These are either absolute or relative (depending on the argument relative).
xlim	limits of the x-axis. These are either absolute or relative (depending on the argument relative).
ylim	limits of the y-axis. See xlim.
relative	boolean that determines whether relative values are used for width, height, xlim and ylim or absolute. If x is unspecified, relative is set to "FALSE".
asp.limit	maximum aspect ratio, which is width/height. Number greater than or equal to 1. For landscape bounding boxes, 1/asp.limit will be used. The returned bounding box will have an aspect ratio between 1/asp.limit and asp.limit.
current.projection	projection that corresponds to the bounding box specified by x.
projection	projection to transform the bounding box to.
output	output format of the bounding box, one of: • "bbox" a sf::bbox object, which is a numeric vector of 4: xmin, ymin, xmax, ymax. This representation used by the sf package. • "matrix" a 2 by 2 numeric matrix, where the rows correspond to x and y, and the columns to min and max. This representation used by the sp package. • "extent" an raster::extent object, which is a numeric vector of 4: xmin, xmax, ymin, ymax. This representation used by the raster package.

Details

An existing bounding box (defined by x) can be modified as follows:

- Using the extension factor ext.
- Changing the width and height with width and height. The argument relavitve determines whether relative or absolute values are used.
- Setting the x and y limits. The argument relavitve determines whether relative or absolute values are used.

A new bounding box can be created from scratch as follows:

- Using the extension factor ext.
- Setting the center coorinates cx and cy, together with the width and height.
- Setting the x and y limits xlim and ylim

Value

bounding box (see argument output)

See Also

geocode_OSM

Examples

```
if (require(tmap) && packageVersion("tmap") >= "2.0") {

    ## load shapes
    data(NLD_muni)
    data(World)

    ## get bounding box (similar to sp's function bbox)
    bb(NLD_muni)

    ## extent it by factor 1.10
    bb(NLD_muni, ext=1.10)

    ## convert to longlat
    bb(NLD_muni, projection=4326)

    ## change existing bounding box
    bb(NLD_muni, ext=1.5)
    bb(NLD_muni, width=2, relative = TRUE)
    bb(NLD_muni, xlim=c(.25, .75), ylim=c(.25, .75), relative = TRUE)

}

## Not run:
if (require(tmap)) {
    bb("Limburg", projection = 28992)
    bb_italy <- bb("Italy", projection = "+proj=eck4")

    tm_shape(World, bbox=bb_italy) + tm_polygons()
    # shorter alternative: tm_shape(World, bbox="Italy") + tm_polygons()
}
## End(Not run)
```

---

bb_poly *Convert bounding box to a spatial polygon*

Description

Convert bounding box to a spatial (sfc) object . Useful for plotting (see example). The function bb_earth returns a spatial polygon of the 'boundaries' of the earth, which can also be done in other projections (if a feasible solution exists).

Usage

```
bb_poly(x, steps = 100, stepsize = NA, projection = NULL)

bb_earth(
  projection = NULL,
  stepsize = 1,
  earth.datum = 4326,
  bbx = c(-180, -90, 180, 90),
  buffer = 1e-06
)
```

Arguments

x	object that can be coerced to a bounding box with bb
steps	number of intermediate points along the shortest edge of the bounding box. The number of intermediate points along the longest edge scales with the aspect ratio. These intermediate points are needed if the bounding box is plotted in another projection.
stepsize	stepsize in terms of coordinates (usually meters when the shape is projected and degrees of longlat coordinates are used). If specified, it overrules steps
projection	projection in which the coordinates of x are provided. For bb_earth, projection is the projection in which the bounding box is returned (if possible).
earth.datum	Geodetic datum to determine the earth boundary. By default EPSG 4326.
bbx	boundig box of the earth in a vector of 4 values: min longitude, max longitude, min latitude, max latitude. By default c(-180, 180, -90, 90). If for some projection, a feasible solution does not exist, it may be wise to choose a smaller bbx, e.g. c(-180, 180, -88, 88). However, this is also automatically done with the next argument, buffer.
buffer	In order to determine feasible earth bounding boxes in other projections, a buffer is used to decrease the bounding box by a small margin (default 1e-06). This value is subtracted from each the bounding box coordinates. If it still does not result in a feasible bounding box, this procedure is repeated 5 times, where each time the buffer is multiplied by 10. Set buffer=0 to disable this procedure.

Value

sfc object

Examples

```
if (require(tmap) && packageVersion("tmap") >= "2.0") {
    data(NLD_muni)

    current.mode <- tmap_mode("view")
    qtm(bb_poly(NLD_muni))

    # restore mode
```

```
    tmap_mode(current.mode)
}
```

`calc_densities` *Calculate densities*

Description

Transpose quantitative variables to densitiy variables, which are often needed for choroplets. For example, the colors of a population density map should correspond population density counts rather than absolute population numbers.

Usage

```
calc_densities(
  shp,
  var,
  target = "metric",
  total.area = NULL,
  suffix = NA,
  drop = TRUE
)
```

Arguments

`shp`	a shape object, i.e., an `sf` object.
`var`	name(s) of a qualtity variable name contained in the `shp` data
`target`	the target unit, see `approx_areas`. Density values are calculated in `var/target^2`.
`total.area`	total area size of `shp` in number of target units (defined by `unit`), `approx_areas`.
`suffix`	character that is appended to the variable names. The resulting names are used as column names of the returned data.frame. By default, `_sq_<target>`, where target corresponds to the target unit, e.g. `_sq_km`
`drop`	boolean that determines whether an one-column data-frame should be returned as a vector

Value

Vector or data.frame (depending on whether `length(var)==1` with density values.

Examples

```
if (require(tmap) && packageVersion("tmap") >= "3.99") {
data(NLD_muni)

NLD_muni_pop_per_km2 <- calc_densities(NLD_muni,
  target = "km km", var = c("population", "dwelling_total"))
NLD_muni <- sf::st_sf(data.frame(NLD_muni, NLD_muni_pop_per_km2))
```

```
tm_shape(NLD_muni) +
  tm_polygons(
    fill = c("population_km.2", "dwelling_total_km.2"),
    fill.legend =
      list(
        tm_legend(expression("Population per " * km^2)),
        tm_legend(expression("Dwellings per " * km^2)))) +
tm_facets(free.scales = TRUE) +
  tm_layout(panel.show = FALSE)
}
```

`crop_shape` *Crop shape object*

Description

Crop a shape object (from class `sf`, `stars`, `sp`, or `raster`). A shape file `x` is cropped, either by the bounding box of another shape `y`, or by `y` itself if it is a SpatialPolygons object and `polygon = TRUE`.

Usage

```
crop_shape(x, y, polygon = FALSE, ...)
```

Arguments

`x`	shape object, i.e. an object from class `sf`, `stars`, `sp`, or `raster`.
`y`	bounding box, an `st_bbox`, `extent` (`raster` package), or a shape object from which the bounding box is extracted (unless `polygon` is `TRUE` and `x` is an `sf` object).
`polygon`	should `x` be cropped by the polygon defined by `y`? If `FALSE` (default), `x` is cropped by the bounding box of `x`. Polygon cropping only works when `x` is a spatial object and `y` is a `SpatialPolygons` object.
`...`	not used anymore

Details

This function is similar to `crop` from the `raster` package. The main difference is that `crop_shape` also allows to crop using a polygon instead of a rectangle.

Value

cropped shape, in the same class as `x`

See Also

`bb`

Examples

```
if (require(tmap) && packageVersion("tmap") >= "3.99") {
    data(World, NLD_muni, land, metro)

    #land_NLD <- crop_shape(land, NLD_muni)

    #qtm(land_NLD, raster="trees", style="natural")

   metro_Europe <- crop_shape(metro, World[World$continent == "Europe", ], polygon = TRUE)

    qtm(World) +
    tm_shape(metro_Europe) +
     tm_bubbles("pop2010",
                col="red",
                size.legend = tm_legend("European cities")) +
     tm_legend(frame=TRUE)
}
```

---

geocode_OSM *Geocodes a location using OpenStreetMap Nominatim*

Description

Geocodes a location (based on a search query) to coordinates and a bounding box. Similar to geocode from the ggmap package. It uses OpenStreetMap Nominatim. For processing large amount of queries, please read the usage policy (https://operations.osmfoundation.org/policies/nominatim/).

Usage

```
geocode_OSM(
  q,
  projection = NULL,
  return.first.only = TRUE,
  keep.unfound = FALSE,
  details = FALSE,
  as.data.frame = NA,
  as.sf = FALSE,
  geometry = c("point", "bbox"),
  server = "https://nominatim.openstreetmap.org"
)
```

Arguments

q	a character (vector) that specifies a search query. For instance "India" or "CBS Weg 11, Heerlen, Netherlands".
projection	projection in which the coordinates and bounding box are returned. See st_crs for details. By default latitude longitude coordinates (EPSG 4326).

return.first.only
: Only return the first result

keep.unfound
: Keep list items / data.frame rows with NAs for unfound search terms. By default FALSE

details
: provide output details, other than the point coordinates and bounding box

as.data.frame
: Return the output as a data.frame. If FALSE, a list is returned with at least two items: "coords", a vector containing the coordinates, and "bbox", the corresponding bounding box. By default false, unless q contains multiple queries. If as.sf = TRUE (see below), as.data.frame will set to TRUE.

as.sf
: Return the output as sf object. If TRUE, return.first.only will be set to TRUE. Two geometry columns are added: bbox and point. The argument geometry determines which of them is set to the default geometry.

geometry
: When as.sf, this argument determines which column (bbox or point) is set as geometry column. Note that the geometry can be changed afterwards with st_set_geometry.

server
: OpenStreetMap Nominatim server name. Could also be a local OSM Nominatim server.

Value

If as.sf then a sf object is returned. Else, if as.data.frame, then a data.frame is returned, else a list.

See Also

rev_geocode_OSM, bb

Examples

```
## Not run:
if (require(tmap)) {
    geocode_OSM("India")
    geocode_OSM("CBS Weg 1, Heerlen")
    geocode_OSM("CBS Weg 1, Heerlen", projection = 28992)

    data(metro)

    # sample 5 cities from the metro dataset
    five_cities <- metro[sample(length(metro), 5), ]

    # obtain geocode locations from their long names
    five_cities_geocode <- geocode_OSM(five_cities$name_long, as.sf = TRUE)

    # change to interactive mode
    current.mode <- tmap_mode("view")

    # plot metro coordinates in red and geocode coordinates in blue
    # zoom in to see the differences
    tm_shape(five_cities) +
```

```
    tm_dots(col = "blue") +
  tm_shape(five_cities_geocode) +
    tm_dots(col = "red")

  # restore current mode
  tmap_mode(current.mode)
}

## End(Not run)
```

`get_asp_ratio` *Get aspect ratio*

Description

Get the aspect ratio of a shape object, a `tmap` object, or a bounding box

Usage

```
get_asp_ratio(x, is.projected = NA, width = 700, height = 700, res = 100)
```

Arguments

`x`	A shape from class `sf`, `stars`, `sp`, or `Raster`, a bounding box (that can be coerced by `bb`), or a `tmap` object.
`is.projected`	Logical that determined wether the coordinates of `x` are projected (`TRUE`) or longitude latitude coordinates (`FALSE`). By deafult, it is determined by the coordinates of `x`.
`width`	See details; only applicable if `x` is a `tmap` object.
`height`	See details; only applicable if `x` is a `tmap` object.
`res`	See details; only applicable if `x` is a `tmap` object.

Details

The arguments `width`, `height`, and `res` are passed on to `png`. If `x` is a tmap object, a temporarily png image is created to calculate the aspect ratio of a tmap object. The default size of this image is 700 by 700 pixels at 100 dpi.

Value

aspect ratio

Examples

```
if (require(tmap) && packageVersion("tmap") >= "2.0") {
    data(World)

    get_asp_ratio(World)

    get_asp_ratio(bb(World))

    tm <- qtm(World)
    get_asp_ratio(tm)
}

## Not run:
    get_asp_ratio("Germany") #note: bb("Germany") uses geocode_OSM("Germany")

## End(Not run)
```

`get_brewer_pal` *Get and plot a (modified) Color Brewer palette (deprecated)*

Description

Get and plot a (modified) palette from Color Brewer. This function is deprecated. Please use `c4a` instead.

Usage

```
get_brewer_pal(palette, n = 5, contrast = NA, stretch = TRUE, plot = TRUE)
```

Arguments

`palette`	name of the color brewer palette. Run `palette_explorer` or see `brewer.pal` for options.
`n`	number of colors
`contrast`	a vector of two numbers between 0 and 1 that defines the contrast range of the palette. Applicable to sequential and diverging palettes. For sequential palettes, 0 stands for the leftmost color and 1 the rightmost color. For instance, when `contrast=c(.25, .75)`, then the palette ranges from 1/4 to 3/4 of the available color range. For diverging palettes, 0 stands for the middle color and 1 for both outer colors. If only one number is provided, the other number is set to 0. The default value depends on `n`. See details.
`stretch`	logical that determines whether intermediate colors are used for a categorical palette when `n` is greater than the number of available colors.
`plot`	should the palette be plot, or only returned? If `TRUE` the palette is silently returned.

Details

The default contrast of the palette depends on the number of colors, n, in the following way. The default contrast is maximal, so (0, 1), when n = 9 for sequential palettes and n = 11 for diverging palettes. The default contrast values for smaller values of n can be extracted with some R magic: sapply(1:9, tmaptools:::default_contrast_seq) for sequential palettes and sapply(1:11, tmaptools:::default_contrast_div) for diverging palettes.

Value

vector of color values. It is silently returned when plot=TRUE.

See Also

palette_explorer

Examples

```
get_brewer_pal("Blues")
get_brewer_pal("Blues", contrast=c(.4, .8))
get_brewer_pal("Blues", contrast=c(0, 1))
get_brewer_pal("Blues", n=15, contrast=c(0, 1))

get_brewer_pal("RdYlGn")
get_brewer_pal("RdYlGn", n=11)
get_brewer_pal("RdYlGn", n=11, contrast=c(0, .4))
get_brewer_pal("RdYlGn", n=11, contrast=c(.4, 1))

get_brewer_pal("Set2", n = 12)
get_brewer_pal("Set2", n = 12, stretch = FALSE)
```

---

get_neighbours *Get neighbours list from spatial objects*

Description

Get neighbours list from spatial objects. The output is similar to the function poly2nb of the spdep package, but uses sf instead of sp.

Usage

```
get_neighbours(x)
```

Arguments

x	a shape object, i.e., a sf object or a SpatialPolygons(DataFrame) (sp package).

Value

A list where the items correspond to the features. Each item is a vector of neighbours.

`map_coloring` *Map coloring*

Description

Color the polygons of a map such that adjacent polygons have different colors

Usage

```
map_coloring(
  x,
  algorithm = "greedy",
  ncols = NA,
  minimize = FALSE,
  palette = NULL,
  contrast = 1
)
```

Arguments

`x`	Either a shape (i.e. a `sf` or `SpatialPolygons(DataFrame)` (`sp` package) object), or an adjacency list.
`algorithm`	currently, only "greedy" is implemented.
`ncols`	number of colors. By default it is 8 when `palette` is undefined. Else, it is set to the length of `palette`
`minimize`	logical that determines whether `algorithm` will search for a minimal number of colors. If `FALSE`, the `ncols` colors will be picked by a random procedure.
`palette`	color palette.
`contrast`	vector of two numbers that determine the range that is used for sequential and diverging palettes (applicable when `auto.palette.mapping=TRUE`). Both numbers should be between 0 and 1. The first number determines where the palette begins, and the second number where it ends. For sequential palettes, 0 means the brightest color, and 1 the darkest color. For diverging palettes, 0 means the middle color, and 1 both extremes. If only one number is provided, this number is interpreted as the endpoint (with 0 taken as the start).

Value

If `palette` is defined, a vector of colors is returned, otherwise a vector of color indices.

Examples

```
if (require(tmap) && packageVersion("tmap") >= "3.99") {
    data(World, metro)

    World$color <- map_coloring(World, palette="Pastel2")
    qtm(World, fill = "color")

    # map_coloring used indirectly: qtm(World, fill = "MAP_COLORS")

    data(NLD_prov, NLD_muni)
    tm_shape(NLD_prov) +
     tm_fill("name",
             fill.legend = tm_legend_hide()) +
    tm_shape(NLD_muni) +
     tm_polygons("MAP_COLORS",
                 fill_alpha = .25,
                 fill.scale = tm_scale(values = "brewer.greys")) +
    tm_shape(NLD_prov) +
     tm_borders(lwd=2) +
     tm_text("name", options = opt_tm_text(shadow = TRUE)) +
    tm_title("Dutch provinces and\nmunicipalities", bg.color="white")
}
```

---

palette_explorer *Explore color palettes (deprecated)*

Description

This interactive tool has become deprecated and will not be maintained anymore. Please use `c4a_gui` instead.

Usage

```
palette_explorer()

tmap.pal.info
```

Format

An object of class `data.frame` with 40 rows and 4 columns.

Details

`palette_explorer()` starts an interactive tool shows all Color Brewer and viridis palettes, where the number of colors can be adjusted as well as the constrast range. Categorical (qualitative) palettes can be stretched when the number of colors exceeds the number of palette colors. Output code needed to get the desired color values is generated. Finally, all colors can be tested for color blindness. The data.frame `tmap.pal.info` is similar to `brewer.pal.info`, but extended with the color palettes from viridis.

References

https://www.color-blindness.com/types-of-color-blindness/

See Also

get_brewer_pal, dichromat, RColorBrewer

Examples

```
## Not run:
if (require(shiny) && require(shinyjs)) {
    palette_explorer()
}

## End(Not run)
```

---

read_GPX *Read GPX file*

Description

Read a GPX file. By default, it reads all possible GPX layers, and only returns shapes for layers that have any features.

Usage

```
read_GPX(
  file,
  layers = c("waypoints", "routes", "tracks", "route_points", "track_points"),
  remove.empty.layers = TRUE,
  as.sf = TRUE
)
```

Arguments

file	a GPX filename (including directory)
layers	vector of GPX layers. Possible options are "waypoints", "tracks", "routes", "track_points", "route_points". By dedault, all those layers are read.
remove.empty.layers	should empty layers (i.e. with 0 features) be removed from the list?
as.sf	not used anymore

Details

Note that this function returns sf objects, but still uses methods from sp and rgdal internally.

Value

a list of sf objects, one for each layer

read_osm *Read Open Street Map data*

Description

Read Open Street Map data. OSM tiles are read and returned as a spatial raster. Vectorized OSM data is not supported anymore (see details).

Usage

```
read_osm(
  x,
  zoom = NULL,
  type = "osm",
  minNumTiles = NULL,
  mergeTiles = NULL,
  use.colortable = FALSE,
  ...
)
```

Arguments

x	object that can be coerced to a bounding box with bb (e.g. an existing bounding box or a shape). In the first case, other arguments can be passed on to bb (see ...). If an existing bounding box is specified in projected coordinates, plesae specify current.projection.
zoom	passed on to openmap. Only applicable when raster=TRUE.
type	tile provider, by default "osm", which corresponds to OpenStreetMap Mapnik. See openmap for options. Only applicable when raster=TRUE.
minNumTiles	passed on to openmap Only applicable when raster=TRUE.
mergeTiles	passed on to openmap Only applicable when raster=TRUE.
use.colortable	should the colors of the returned raster object be stored in a colortable? If FALSE, a RasterStack is returned with three layers that correspond to the red, green and blue values betweeen 0 and 255.
...	arguments passed on to bb.

Details

As of version 2.0, read_osm cannot be used to read vectorized OSM data anymore. The reason is that the package that was used under the hood, osmar, has some limitations and is not actively maintained anymore. Therefore, we recommend the package osmdata. Since this package is very user-friendly, there was no reason to use read_osm as a wrapper for reading vectorized OSM data.

Value

The output of read_osm is a raster object.

Examples

```
## Not run:
if (require(tmap)) {
    #### Choropleth with OSM background

    # load Netherlands shape
    data(NLD_muni)

    # read OSM raster data
    osm_NLD <- read_osm(NLD_muni, ext=1.1)

    # plot with regular tmap functions
    tm_shape(osm_NLD) +
     tm_rgb() +
    tm_shape(NLD_muni) +
    tm_polygons("population", convert2density=TRUE, style="kmeans", alpha=.7, palette="Purples")

    #### A close look at the building of Statistics Netherlands in Heerlen

    # create a bounding box around the CBS (Statistics Netherlands) building
    CBS_bb <- bb("CBS Weg 11, Heerlen", width=.003, height=.002)

    # read Microsoft Bing satellite and OpenCycleMap OSM layers
    CBS_osm1 <- read_osm(CBS_bb, type="bing")
    CBS_osm2 <- read_osm(CBS_bb, type="opencyclemap")

    # plot OSM raster data
    qtm(CBS_osm1)
    qtm(CBS_osm2)

}

## End(Not run)
```

---

rev_geocode_OSM *Reverse geocodes a location using OpenStreetMap Nominatim*

Description

Reverse geocodes a location (based on spatial coordinates) to an address. It uses OpenStreetMap Nominatim. For processing large amount of queries, please read the usage policy (https://operations.osmfoundation.org/policies/nominatim/).

Usage

```
rev_geocode_OSM(
  x,
  y = NULL,
  zoom = NULL,
```

```
  projection = 4326,
  as.data.frame = NA,
  server = "https://nominatim.openstreetmap.org"
)
```

Arguments

x	x coordinate(s), or a spatial points object (sf or SpatialPoints)
y	y coordinate(s)
zoom	zoom level
projection	projection in which the coordinates x and y are provided.
as.data.frame	return as data.frame (TRUE) or list (FALSE). By default a list, unless multiple coordinates are provided.
server	OpenStreetMap Nominatim server name. Could also be a local OSM Nominatim server.

Value

A data frame or a list with all attributes that are contained in the search result

See Also

geocode_OSM

Examples

```
## Not run:
if (require(tmap)) {
    data(metro)

    # sample five cities from metro dataset
    set.seed(1234)
    five_cities <- metro[sample(length(metro), 5), ]

    # obtain reverse geocode address information
    addresses <- rev_geocode_OSM(five_cities, zoom = 6)
    five_cities <- sf::st_sf(data.frame(five_cities, addresses))

    # change to interactive mode
    current.mode <- tmap_mode("view")
    tm_shape(five_cities) +
     tm_markers(text="name")

    # restore current mode
    tmap_mode(current.mode)
}

## End(Not run)
```

simplify_shape *Simplify shape*

Description

Simplify a shape consisting of polygons or lines. This can be useful for shapes that are too detailed for visualization, especially along natural borders such as coastlines and rivers. The number of coordinates is reduced.

Usage

```
simplify_shape(shp, fact = 0.1, keep.units = FALSE, keep.subunits = FALSE, ...)
```

Arguments

shp	an sf or sfc object.
fact	simplification factor, number between 0 and 1 (default is 0.1)
keep.units	prevent small polygon features from disappearing at high simplification (default FALSE)
keep.subunits	should multipart polygons be converted to singlepart polygons? This prevents small shapes from disappearing during simplification if keep.units = TRUE. Default FALSE
...	other arguments passed on to the underlying function ms_simplify (except for the arguments input, keep, keep_shapes and explode)

Details

This function is a wrapper of ms_simplify. In addition, the data is preserved. Also sf objects are supported.

Value

sf object

Examples

```
## Not run:
if (require(tmap)) {
    data(World)

    # show different simplification factors
    tm1 <- qtm(World %>% simplify_shape(fact = 0.05), title="Simplify 0.05")
    tm2 <- qtm(World %>% simplify_shape(fact = 0.1), title="Simplify 0.1")
    tm3 <- qtm(World %>% simplify_shape(fact = 0.2), title="Simplify 0.2")
    tm4 <- qtm(World %>% simplify_shape(fact = 0.5), title="Simplify 0.5")
    tmap_arrange(tm1, tm2, tm3, tm4)
```

```
    # show different options for keeping smaller (sub)units
    tm5 <- qtm(World %>% simplify_shape(keep.units = TRUE, keep.subunits = TRUE),
        title="Keep units and subunits")
    tm6 <- qtm(World %>% simplify_shape(keep.units = TRUE, keep.subunits = FALSE),
        title="Keep units, ignore small subunits")
    tm7 <- qtm(World %>% simplify_shape(keep.units = FALSE),
        title="Ignore small units and subunits")
    tmap_arrange(tm5, tm6, tm7)
}

## End(Not run)
```

`%>%` *Pipe operator*

Description

The pipe operator from magrittr, `%>%`, can also be used in functions from `tmaptools`.

Arguments

`lhs`	Left-hand side
`rhs`	Right-hand side

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