Package 'googletraffic'

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Title Google Traffic

Version 0.1.7

Description
Create geographically referenced traffic data from the Google Maps JavaScript API <https://developers.google.com/maps/documentation/javascript/examples/layer-traffic>.

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Encoding UTF-8

RoxygenNote 7.3.1

URL https://dime-worldbank.github.io/googletraffic/

BugReports https://github.com/dime-worldbank/googletraffic/issues

Imports dplyr, googleway, htmlwidgets, plotwidgets, png, sf, sp, stringr, webshot2, raster, ColorNameR, schemr

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`gt_load_png_as_traffic_raster` *Converts PNG to raster*

Description

Converts PNG of Google traffic data to raster and translates color values to traffic values

Usage

```
gt_load_png_as_traffic_raster(
  filename,
  location,
  height,
  width,
  zoom,
  traffic_color_dist_thresh = 4.6,
  traffic_color_dist_metric = "CIEDE2000"
)
```

Arguments

`filename`	Filename of PNG file
`location`	Vector of latitude and longitude used to create PNG file using `gt_make_png()`
`height`	Height (in pixels; pixel length depends on zoom) used to create PNG file using `gt_make_png()`
`width`	Width (in pixels; pixel length depends on zoom) used to create PNG file using `gt_make_png()`
`zoom`	Zoom level used to create PNG file using `gt_make_png()`
`traffic_color_dist_thresh`	Google traffic relies on four main base colors: `#63D668` for no traffic, `#FF974D` for medium traffic, `#F23C32` for high traffic, and `#811F1F` for heavy traffic. Slight variations of these colors can also represent traffic. By default, the base colors and all colors within a 4.6 color distance of each base color are used to define traffic; by default, the `CIEDE2000` metric is used to determine color distance. A value of 2.3 is one threshold used to define a "just noticeable distance" (JND) between colors (by default, 2 X JND is used). This parameter changes the color distance from the base colors used to define colors as traffic. For more information, see here.
`traffic_color_dist_metric`	See above; this parameter changes the metric used to calculate distances between colors. By default, `CIEDE2000` is used; `CIE76` and `CIE94` can also be used. For more information, see here.

Value

Returns a raster where each pixel represents traffic level (1 = no traffic, 2 = medium traffic, 3 = traffic delays, 4 = heavy traffic)

References

Markus Hilpert, Jenni A. Shearston, Jemaleddin Cole, Steven N. Chillrud, and Micaela E. Martinez. Acquisition and analysis of crowd-sourced traffic data. CoRR, abs/2105.12235, 2021.

Pavel Pokorny. Determining traffic levels in cities using google maps. In 2017 Fourth International Conference on Mathematics and Computers in Sciences and in Industry (MCSI), pages 144–147, 2017.

Examples

```
## Not run:
## Make png
gt_make_png(location     = c(40.712778, -74.006111),
            height       = 1000,
            width        = 1000,
            zoom         = 16,
            out_filename = "google_traffic.png",
            google_key   = "GOOGLE-KEY-HERE")

## Load png as traffic raster
r <- gt_load_png_as_traffic_raster(filename = "google_traffic.png",
                                   location = c(40.712778, -74.006111),
                                   height   = 1000,
                                   width    = 1000,
                                   zoom     = 16)

## End(Not run)
```

---

gt_make_grid *Creates Grid to Query Google Traffic*

Description

Creates a grid of sf polygons, where traffic data for each polygon can then be queried using `gt_make_raster_from_grid()`.

Usage

```
gt_make_grid(
  polygon,
  zoom,
  height_width_max = 2000,
  height = NULL,
```

```
  width = NULL,
  reduce_hw = 10
)
```

Arguments

polygon	Polygon (sf object or SpatialPolygonsDataframe) in WGS84 CRS the defines region to be queried.
zoom	Zoom level; integer from 5 to 20. For more information about how zoom levels correspond to pixel size, see here and here.
height_width_max	Maximum pixel height and width to check using for each grid (pixel length depends on zoom). If the same number of grids can be made with a smaller height/width, the function will use a smaller height/width. If height and width are specified, that height and width will be used and height_width_max will be ignored. (Default: 2000)
height	Height, in pixels, for each grid (pixel length depends on zoom). Enter a height to manually specify the height; otherwise, a height of height_width_max or smaller will be used.
width	Pixel, in pixels, for each grid (pixel length depends on zoom). Enter a width to manually specify the width; otherwise, a width of height_width_max or smaller will be used.
reduce_hw	Number of pixels to reduce height/width by. Doing so creates some overlap between grids to ensure there is not blank space between grids. (Default: 10).

Value

Returns an sf dataframe with the locations to query, including parameters needed for gt_make_raster_from_grid()

Examples

```
## Make polygon
poly_sf <- c(xmin = -74.02426,
             xmax = -73.91048,
             ymin = 40.70042,
             ymax = 40.87858) |>
  sf::st_bbox() |>
  sf::st_as_sfc() |>
  sf::st_as_sf()

sf::st_crs(poly_sf) <- 4326

## Make grid using polygon
grid_sf <- gt_make_grid(polygon = poly_sf,
                        height  = 2000,
                        width   = 2000,
                        zoom    = 16)
```

gt_make_png *Make Google Traffic PNG*

Description

Make a png file of Google traffic data. The `gt_load_png_as_traffic_raster()` function can then be used to convert the png into a traffic raster

Usage

```
gt_make_png(
  location,
  height,
  width,
  zoom,
  out_filename,
  google_key,
  webshot_zoom = 1,
  webshot_delay = NULL,
  print_progress = TRUE
)
```

Arguments

`location`	Vector of latitude and longitude
`height`	Height (in pixels; pixel length depends on zoom)
`width`	Width (in pixels; pixel length depends on zoom)
`zoom`	Zoom level; integer from 5 to 20. For more information about how zoom levels correspond to pixel size, see here and here.
`out_filename`	Filename of PNG file to make
`google_key`	Google API key, where the Maps JavaScript API is enabled. To create a Google API key, follow these instructions.
`webshot_zoom`	How many pixels should be created relative to height and width values. If `height` and `width` are set to `100` and `webshot_zoom` is set to `2`, the resulting raster will have dimensions of about `200x200` (default: `1`).
`webshot_delay`	How long to wait for Google traffic layer to render. Larger height/widths require longer delay times. If `NULL`, the following delay time (in seconds) is used: `delay = max(height,width)/200`.
`print_progress`	Whether to print function progress (default: `TRUE`)

Value

Returns a PNG file showing traffic levels.

References

Markus Hilpert, Jenni A. Shearston, Jemaleddin Cole, Steven N. Chillrud, and Micaela E. Martinez. Acquisition and analysis of crowd-sourced traffic data. CoRR, abs/2105.12235, 2021.

Pavel Pokorny. Determining traffic levels in cities using google maps. In 2017 Fourth International Conference on Mathematics and Computers in Sciences and in Industry (MCSI), pages 144–147, 2017.

Examples

```
## Not run:
gt_make_png(location     = c(40.712778, -74.006111),
            height       = 1000,
            width        = 1000,
            zoom         = 16,
            out_filename = "google_traffic.png",
            google_key   = "GOOGLE-KEY-HERE")

## End(Not run)
```

`gt_make_raster` *Make Google Traffic Raster*

Description

Make a raster of Google traffic data, where each pixel has one of four values indicating traffic volume (no traffic, light, moderate, and heavy).

Usage

```
gt_make_raster(
  location,
  height,
  width,
  zoom,
  google_key,
  traffic_color_dist_thresh = 4.6,
  traffic_color_dist_metric = "CIEDE2000",
  webshot_zoom = 1,
  webshot_delay = NULL,
  print_progress = TRUE
)
```

Arguments

`location`	Vector of latitude and longitude
`height`	Height (in pixels; pixel length depends on zoom)

`width` Width (in pixels; pixel length depends on zoom)

`zoom` Zoom level; integer from 5 to 20. For more information about how zoom levels correspond to pixel size, see here and here.

`google_key` Google API key, where the Maps JavaScript API is enabled. To create a Google API key, follow these instructions.

`traffic_color_dist_thresh`
Google traffic relies on four main base colors: `#63D668` for no traffic, `#FF974D` for medium traffic, `#F23C32` for high traffic, and `#811F1F` for heavy traffic. Slight variations of these colors can also represent traffic. By default, the base colors and all colors within a 4.6 color distance of each base color are used to define traffic; by default, the `CIEDE2000` metric is used to determine color distance. A value of 2.3 is one threshold used to define a "just noticeable distance" (JND) between colors (by default, 2 X JND is used). This parameter changes the color distance from the base colors used to define colors as traffic. For more information, see here.

`traffic_color_dist_metric`
See above; this parameter changes the metric used to calculate distances between colors. By default, `CIEDE2000` is used; `CIE76` and `CIE94` can also be used. For more information, see here.

`webshot_zoom` How many pixels should be created relative to height and width values. If `height` and `width` are set to `100` and `webshot_zoom` is set to `2`, the resulting raster will have dimensions of about `200x200` (default: `1`).

`webshot_delay` How long to wait for Google traffic layer to render. Larger height/widths require longer delay times. If `NULL`, the following delay time (in seconds) is used: `delay = max(height,width)/200`.

`print_progress` Whether to print function progress (default: `TRUE`)

Value

Returns a georeferenced raster. Raster pixels can contain the following values: 1 = no traffic; 2 = medium traffic; 3 = high traffic; 4 = heavy traffic.

References

Markus Hilpert, Jenni A. Shearston, Jemaleddin Cole, Steven N. Chillrud, and Micaela E. Martinez. Acquisition and analysis of crowd-sourced traffic data. CoRR, abs/2105.12235, 2021.

Pavel Pokorny. Determining traffic levels in cities using google maps. In 2017 Fourth International Conference on Mathematics and Computers in Sciences and in Industry (MCSI), pages 144–147, 2017.

Examples

```
## Not run:
r <- gt_make_raster(location   = c(40.712778, -74.006111),
                    height     = 1000,
                    width      = 1000,
                    zoom       = 16,
```

```
                    google_key = "GOOGLE-KEY-HERE")

## End(Not run)
```

`gt_make_raster_from_grid` *Make Google Traffic Raster Based on Grid of Coordinates*

Description

Make a raster of Google traffic data, where each pixel has one of four values indicating traffic volume (no traffic, light, moderate, and heavy).

Usage

```
gt_make_raster_from_grid(
  grid_param_df,
  google_key,
  traffic_color_dist_thresh = 4.6,
  traffic_color_dist_metric = "CIEDE2000",
  webshot_zoom = 1,
  webshot_delay = NULL,
  return_list_of_rasters = FALSE,
  print_progress = TRUE
)
```

Arguments

`grid_param_df`	Grid parameter dataframe produced from `gt_make_grid()`
`google_key`	Google API key, where the Maps JavaScript API is enabled. To create a Google API key, follow these instructions.
`traffic_color_dist_thresh`	Google traffic relies on four main base colors: `#63D668` for no traffic, `#FF974D` for medium traffic, `#F23C32` for high traffic, and `#811F1F` for heavy traffic. Slight variations of these colors can also represent traffic. By default, the base colors and all colors within a 4.6 color distance of each base color are used to define traffic; by default, the `CIEDE2000` metric is used to determine color distance. A value of 2.3 is one threshold used to define a "just noticeable distance" (JND) between colors (by default, 2 X JND is used). This parameter changes the color distance from the base colors used to define colors as traffic. For more information, see here.
`traffic_color_dist_metric`	See above; this parameter changes the metric used to calculate distances between colors. By default, `CIEDE2000` is used; `CIE76` and `CIE94` can also be used. For more information, see here.

`webshot_zoom` How many pixels should be created relative to height and width values. If `height` and `width` are set to `100` and `webshot_zoom` is set to `2`, the resulting raster will have dimensions of about `200x200` (default: `1`).

`webshot_delay` How long to wait for Google traffic layer to render. Larger height/widths require longer delay times. If `NULL`, the following delay time (in seconds) is used: `delay = max(height,width)/200`.

`return_list_of_rasters`
Instead of merging traffic rasters produced for each grid together into one large raster, return a list of rasters (default: `FALSE`)

`print_progress` Whether to print function progress (default: `TRUE`)

Value

Returns a georeferenced raster. Raster pixels can contain the following values: 1 = no traffic; 2 = medium traffic; 3 = high traffic; 4 = heavy traffic.

References

Markus Hilpert, Jenni A. Shearston, Jemaleddin Cole, Steven N. Chillrud, and Micaela E. Martinez. Acquisition and analysis of crowd-sourced traffic data. CoRR, abs/2105.12235, 2021.

Pavel Pokorny. Determining traffic levels in cities using google maps. In 2017 Fourth International Conference on Mathematics and Computers in Sciences and in Industry (MCSI), pages 144–147, 2017.

Examples

```
## Not run:
## Grab polygon of Manhattan
us_sp <- raster::getData('GADM', country='USA', level=2)
ny_sp <- us_sp[us_sp$NAME_2 %in% "New York",]

## Make Grid
grid_df <- gt_make_grid(polygon = ny_sp,
                        height   = 2000,
                        width    = 2000,
                        zoom     = 16)

## Make raster from grid
r <- gt_make_raster_from_grid(grid_param_df = grid_clean_df,
                              google_key    = "GOOGLE-KEY-HERE")

## End(Not run)
```

`gt_make_raster_from_polygon` *Make Google Traffic Raster Based on Polygon*

Description

Make a raster of Google traffic data, where each pixel has one of four values indicating traffic volume (no traffic, light, moderate, and heavy).

Usage

```
gt_make_raster_from_polygon(
  polygon,
  zoom,
  google_key,
  height_width_max = 2000,
  height = NULL,
  width = NULL,
  traffic_color_dist_thresh = 4.6,
  traffic_color_dist_metric = "CIEDE2000",
  webshot_zoom = 1,
  webshot_delay = NULL,
  reduce_hw = 10,
  return_list_of_rasters = FALSE,
  mask_to_polygon = TRUE,
  print_progress = TRUE
)
```

Arguments

`polygon`	Polygon (`sf` object or `SpatialPolygonsDataframe`) in WGS84 CRS
`zoom`	Zoom level; integer from 5 to 20. For more information about how zoom levels correspond to pixel size, see here and here.
`google_key`	Google API key, where the Maps JavaScript API is enabled. To create a Google API key, follow these instructions.
`height_width_max`	Maximum pixel height and width to check using for each API query (pixel length depends on zoom). If the same number of API queries can be made with a smaller height/width, the function will use a smaller height/width. If `height` and `width` are specified, that height and width will be used and `height_width_max` will be ignored. (Default: `2000`)
`height`	Height, in pixels, for each API query (pixel length depends on zoom). Enter a `height` to manually specify the height; otherwise, a height of `height_width_max` or smaller will be used.

`width` Pixel, in pixels, for each API query (pixel length depends on zoom). Enter a `width` to manually specify the width; otherwise, a width of `height_width_max` or smaller will be used.

`traffic_color_dist_thresh`
Google traffic relies on four main base colors: `#63D668` for no traffic, `#FF974D` for medium traffic, `#F23C32` for high traffic, and `#811F1F` for heavy traffic. Slight variations of these colors can also represent traffic. By default, the base colors and all colors within a 4.6 color distance of each base color are used to define traffic; by default, the `CIEDE2000` metric is used to determine color distance. A value of 2.3 is one threshold used to define a "just noticeable distance" (JND) between colors (by default, 2 X JND is used). This parameter changes the color distance from the base colors used to define colors as traffic. For more information, see here.

`traffic_color_dist_metric`
See above; this parameter changes the metric used to calculate distances between colors. By default, `CIEDE2000` is used; `CIE76` and `CIE94` can also be used. For more information, see here.

`webshot_zoom` How many pixels should be created relative to height and width values. If `height` and `width` are set to `100` and `webshot_zoom` is set to `2`, the resulting raster will have dimensions of about `200x200` (default: `1`).

`webshot_delay` How long to wait for Google traffic layer to render (in seconds). Larger height/widths require longer delay times. If `NULL`, the following delay time (in seconds) is used: `delay = max(height,width)/200`.

`reduce_hw` Number of pixels to reduce height/width by. Doing so creates some overlap between grids to ensure there is not blank space between tiles. (Default: `10`).

`return_list_of_rasters`
Whether to return a list of raster tiles instead of mosaicing together. (Default: `FALSE`).

`mask_to_polygon`
Whether to mask raster to `polygon`. (Default: `TRUE`).

`print_progress` Show progress for which grid / API query has been processed. (Default: `TRUE`).

Value

Returns a georeferenced raster. Raster pixels can contain the following values: 1 = no traffic; 2 = medium traffic; 3 = high traffic; 4 = heavy traffic.

References

Markus Hilpert, Jenni A. Shearston, Jemaleddin Cole, Steven N. Chillrud, and Micaela E. Martinez. Acquisition and analysis of crowd-sourced traffic data. CoRR, abs/2105.12235, 2021.

Pavel Pokorny. Determining traffic levels in cities using google maps. In 2017 Fourth International Conference on Mathematics and Computers in Sciences and in Industry (MCSI), pages 144–147, 2017.

Examples

```
## Not run:
## Grab polygon of Manhattan
us_sp <- raster::getData('GADM', country='USA', level=2)
ny_sp <- us_sp[us_sp$NAME_2 %in% "New York",]

## Make raster
r <- gt_make_raster_from_polygon(polygon    = ny_sp,
                                 height     = 2000,
                                 width      = 2000,
                                 zoom       = 16,
                                 google_key = "GOOGLE-KEY-HERE")

## End(Not run)
```

`gt_mosaic` *Mosaic rasters with different origins and resolutions*

Description

The `raster::mosaic()` function requires rasters to have the same origin and resolution. However, when producing multiple rasters to query traffic data across a large study area, the rasters will not have the same origins and may not have the same resolutions (in cases where rasters at different latitudes are queried). `gt_mosaic()` allows for mosaicing rasters with different origins and resolutions.

Usage

```
gt_mosaic(r_list)
```

Arguments

`r_list`	List of rasters

Value

Returns a raster.

Examples

```
r1 <- raster::raster(ncol=10, nrow=10, xmn = -10, xmx = 1,  ymn = -10, ymx = 1)
r2 <- raster::raster(ncol=10, nrow=10, xmn = 0,   xmx = 10, ymn = 0,   ymx = 10)
r3 <- raster::raster(ncol=10, nrow=10, xmn = 9,   xmx = 20, ymn = 9,   ymx = 20)

r123 <- list(r1, r2, r3)

r <- gt_mosaic(r123)
```

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