Package 'quadkeyr'

March 24, 2025

Title Generate Raster Images from QuadKey-Identified Datasets

Version 0.1.0

Description A set of functions of increasing complexity allows users to
(1) convert QuadKey-identified datasets,
based on 'Microsoft's Bing Maps Tile System', into Simple Features data frames,
(2) transform Simple Features data frames into rasters, and
(3) process multiple 'Meta' ('Facebook') QuadKey-identified human mobility files
directly into raster files.
For more details, see D'Andrea et al. (2024) <doi:10.21105/joss.06500>.

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URL https://docs.ropensci.org/quadkeyr/,
https://github.com/ropensci/quadkeyr

BugReports https://github.com/ropensci/quadkeyr/issues

Encoding UTF-8

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(>= 1.0.0), shinytest2 (>= 0.3.2), testthat (>= 3.1.10), tidyr
(>= 1.3.0), viridis (>= 0.6.4), withr

VignetteBuilder knitr

Depends R (>= 4.1.0)

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1.7.4), stars (>= 0.6.2)

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Contents

`add_regular_polygon_grid` *Add the rows needed to complete a regular QuadKey polygon grid derived from the bounding box of the* `quadkey` *column of a data.frame.*

Description

This function estimates the bounding box of the quadkeys given in the quadkey column and adds rows to complete the quadkeys and the geometry needed to create a regular grid. All other columns for the introduced QuadKeys will be filled with NAs.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_identified_data_to_raster.html

Usage

```
add_regular_polygon_grid(data)
```

Arguments

`data`	A data.frame with a `quadkey` column.

Value

A list with three elements:

- `data` A `sf` POLYGON data.frame with all the QuadKeys within the bounding box of the ones provided in the `quadkey` column of the input dataset, and the rest of the original variables. The columns `quadkey` and `geometry` are returned for all the grid, The values of the newly added QuadKeys will be NA for the rest of the variables.
- `num_rows` The number of columns of the regular grid.
- `num_cols` The number of rows of the regular grid.

Examples

```
# Read the file with the data
path <- paste0(
  system.file("extdata", package = "quadkeyr"),
  "/cityA_2020_04_15_0000.csv"
)
data <- read.csv(path)
data <- format_fb_data(data)

add_regular_polygon_grid(data = data)
```

apply_weekly_lag *Apply a 7 day lag to the variable* n_crisis

Description

Applying a week lag to the data will create raster images showing the mobility a week before the date of interest. This function works only for QuadKeys reported without NAs for n_crisis and percent_change variables .

Usage

```
apply_weekly_lag(data)
```

Arguments

data	A data.frame with the columns quadkey, day, hour and n_crisis.

Value

A data.frame with the extra columns n_crisis_lag_7 and percent_change_7.

- n_crisis_lag_7, is the same variable defined as n_crisis in the Facebook mobility data.frame with a 7 day lag applied.
- percent_change_7 is the difference between the n_crisis value between weeks expressed as percentage.

Examples

```
files <- read_fb_mobility_files(
  path_to_csvs = paste0(system.file("extdata",
    package = "quadkeyr"
  ), "/"),
  colnames = c(
    "lat",
    "lon",
    "quadkey",
    "date_time",
    "n_crisis",
    "percent_change"
  ),
  coltypes = list(
    lat = "d",
    lon = "d",
    quadkey = "c",
    date_time = "T",
    n_crisis = "c",
    percent_change = "c"
  )
)
```

```
apply_weekly_lag(data = files)
```

`create_qk_grid` *Create grid of QuadKeys for a particular zoom or level of detail.*

Description

Generates a grid comprising all the QuadKeys within the area defined by the maximum and minimum coordinates of latitude and longitude along with a specified zoom level.

Usage

```
create_qk_grid(xmin, xmax, ymin, ymax, zoom)
```

Arguments

`xmin`	Minimum value in the x axis (longitude)
`xmax`	Maximum value in the y axis (latitude)
`ymin`	Minimum value in the x axis (longitude)
`ymax`	Maximum value in the Y axis (latitude)
`zoom`	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Value

A list returning the QuadKeys as a data.frame (`data`), the number of rows (`num_rows`) and columns (`num_cols`) of the grid.

Examples

```
grid <- create_qk_grid(
  xmin = -59,
  xmax = -57,
  ymin = -35,
  ymax = -34,
  zoom = 12
)
```

create_stars_raster *Create a* stars *raster*

Description

The use of a template enables the creation of an accurate raster, even in the presence of NAs.

Usage

```
create_stars_raster(template, nx, ny, data, var)
```

Arguments

template	A sf POLYGON data.frame to use as template. Check stars::st_as_stars() documentation for more details.
nx	Integer; number of cells in x direction.
ny	Integer; number of cells in y direction.
data	A sf POLYGON data.frame with the variable we want to represent in the raster.
var	The column name of the variable to plot.

Value

A stars object.

See Also

st_as_stars, st_rasterize

Examples

```
# Basic workflow
# Read the data
path <- paste0(
  system.file("extdata", package = "quadkeyr"),
  "/cityA_2020_04_15_0000.csv"
)
data <- read.csv(path)
data <- format_fb_data(data)

complete_polygon_grid <- add_regular_polygon_grid(data = data)

stars_object <- create_stars_raster(
  data = complete_polygon_grid$data,
  template = complete_polygon_grid$data,
  var = "percent_change",
  nx = complete_polygon_grid$num_cols,
  ny = complete_polygon_grid$num_rows
)
```

```
stars_object

# Other workflow
grid <- create_qk_grid(
  xmin = -59,
  xmax = -57,
  ymin = -35,
  ymax = -34,
  zoom = 12
)

grid_coords <- get_qk_coord(data = grid$data)

polygrid <- grid_to_polygon(grid_coords)

data("data_provided")
data_raster <- polygrid |>
  dplyr::inner_join(data_provided,
    by = c("quadkey")
  )

raster <- create_stars_raster(
  template = data_raster,
  nx = grid$num_cols,
  ny = grid$num_rows,
  data = data_raster,
  var = "variable"
)
```

`format_fb_data` *Format the Facebook mobility data*

Description

This function removes unnecessary characters such as `\\N` and ensures that the format of the date and QuadKeys is correct.

Usage

```
format_fb_data(data, keep_format = NULL)
```

Arguments

`data`	A data.frame with a `quadkey` and `date_time` columns and other variables
`keep_format`	Vector of column names, besides `date_time`, `day` and `quadkey`, that you don't want to convert to a number.

Value

A data.frame without \N, quadkey without scientific notation and a new column day and hour

See Also

read_fb_mobility_files

Examples

```
data(result_read_fb_mobility_data)
format_fb_data(data = result_read_fb_mobility_data)
```

---

get_qk_coord *Get lat/long coordinates from the QuadKey*

Description

Reads the QuadKey as a string and extracts the lat/long coordinates of the upper-left corner of the QuadKey.

Usage

```
get_qk_coord(data)
```

Arguments

data	A dataframe with a quadkey column.

Value

A sf POINT data.frame containing the tiles XY coordinates (tileX, tileY), the QuadKeys (quadkey), and a geometry column.

See Also

quadkey_to_tileXY

tileXY_to_pixelXY

pixelXY_to_latlong

Examples

```
grid <- create_qk_grid(
  xmin = -59,
  xmax = -40,
  ymin = -38,
  ymax = -20,
  zoom = 6
)

# quadkey column in grid$data converted to geographic coordinates
grid_coords <- get_qk_coord(data = grid$data)

plot(grid_coords)
```

`get_regular_polygon_grid` *Get regular QuadKey polygon grid derived from the bounding box of the* `quadkey` *column of a data.frame.*

Description

This function estimates the bounding box of the QuadKeys given in the `quadkey` column and adds the rows needed to complete a regular grid.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/facebook_mobility_csvs_to_raster_files.html

Usage

```
get_regular_polygon_grid(data)
```

Arguments

`data`	A data.frame with a `quadkey` column.

Value

A list with three elements:

- `data` An `sf` POLYGON data.frame with all the QuadKeys within the bounding box of the `quadkey` column of a data.frame. Only the columns `quadkey`, `tileX`, `tileY` and `geometry` are returned.
- `num_rows` The number of columns of the regular grid.
- `num_cols` The number of rows of the regular grid.

Examples

```
# Data File
path <- paste0(
  system.file("extdata", package = "quadkeyr"),
  "/cityA_2020_04_15_0000.csv"
)
data <- read.csv(path)
data <- format_fb_data(data)

get_regular_polygon_grid(data = data)
```

`grid_to_polygon` *Convert a grid of QuadKeys to square polygons*

Description

The main argument of this function, the grid of geographic coordinates (lat/long WG84) represents the upper-left corner of the QuadKey. To transform these coordinates into square polygons, the function supplements the grid by adding a row and column of tiles. These points introduce QuadKeys located at the border of the area using the internal function `complete_grid_for_polygons()`. The function builds the polygons using all the points of the grid. Note that it's possible to associate each QuadKey with its square polygon.

Usage

```
grid_to_polygon(data)
```

Arguments

`data`	A `sf` POINT data.frame with a `quadkey` and `geometry` column.

Value

A sf POLYGON data.frame with a quadkey column.

Examples

```
grid <- create_qk_grid(
  xmin = -59,
  xmax = -57,
  ymin = -35,
  ymax = -34,
  zoom = 11
)

grid_coords <- get_qk_coord(data = grid$data)

polygrid <- grid_to_polygon(grid_coords)
polygrid
```

ground_res *Ground resolution at a specified latitude and zoom level*

Description

Determines the ground resolution (in meters per pixel) at a specified latitude and zoom level. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
ground_res(latitude, zoom)
```

Arguments

latitude	Latitude (in degrees) at which to measure the ground resolution.
zoom	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Value

the ground resolution (meters / pixel)

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
ground_res(
  latitude = 0,
  zoom = 6
)
```

latlong_to_pixelXY *Convert lat/long coordinates to pixel XY coordinates*

Description

Converts a point from latitude/longitude WGS-84 coordinates (in degrees) into pixel XY coordinates at a specified zoom level. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
latlong_to_pixelXY(lat, lon, zoom)
```

Arguments

lat	Latitude of the point, in degrees.
lon	Longitude of the point, in degrees.
zoom	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar quadkeyr functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A list returning pixel X and pixel Y coordinates.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
latlong_to_pixelXY(
  lat = -35,
  lon = -50,
  zoom = 6
)
```

---

latlong_to_quadkey *Convert latitude/longitude coordinates into QuadKeys*

Description

Converts a point from latitude/longitude WGS-84 coordinates (in degrees) into a Quadkey at a specified zoom level. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
latlong_to_quadkey(lat, lon, zoom)
```

Arguments

lat	Latitude of the point, in degrees.
lon	Longitude of the point, in degrees.
zoom	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar quadkeyr functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A dataframe with latitude (lat), longitude (lon), zoom level (zoom) and the QuadKey as a string (quadkey).

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
latlong_to_quadkey(
  lat = 35.63051,
  lon = 139.69116,
  zoom = 20
)
latlong_to_quadkey(
  lat = c(-4, -25.33, -25.66),
  lon = c(-53, -60.33, -70.66),
  zoom = 4
)
```

---

mapscale *Map scale (1 : N)*

Description

Determines the map scale at a specified latitude, zoom level, and screen resolution. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
mapscale(latitude, zoom, screen_dpi)
```

Arguments

latitude	Latitude (in degrees) at which to measure the map scale.
zoom	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).
screen_dpi	Resolution of the screen, in dots per inch.

Value

The map scale, expressed as the denominator N of the ratio 1 : N.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
mapscale(
  latitude = 0,
  zoom = 6,
  screen_dpi = 96
)
```

---

mapsize *Map size in pixels*

Description

Determines the map width and height (in pixels) at a specified zoom level. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
mapsize(zoom)
```

Arguments

zoom	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Value

The map width and height in pixels.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
mapsize(zoom = 6)
```

`missing_combinations` *Detect dates and hours missing in filenames*

Description

Facebook mobility data is reported daily at 3 different hours (0, 8, 16). This function reads the data extracted from the current files and detects if any file for a particular day or hour is missing.

Usage

```
missing_combinations(data, hour_col = "hour", date_col = "day")
```

Arguments

`data`	A data.frame with one column for the raster's date and another for the hour. If not explicitly specified in the function's arguments, the column names are `day` and `hour`.
`hour_col`	The name of the column with the hour information.
`date_col`	The name of the column with the date information.

Value

A data.frame with the missing days and hours, if any.

Examples

```
# Sample dataset
data <- data.frame(
  country = c("US", "MX", "MX"),
  day = c("2023-01-01", "2023-01-03", "2023-01-05"),
  hour = c(0, 8, 16)
)

missing_combinations(data)
```

`pixelXY_to_latlong` *Convert pixel XY coordinatess into lat/long coordinates.*

Description

Converts a pixel from pixel XY coordinates at a specified zoom level into latitude/longitude WGS-84 coordinates (in degrees). For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
pixelXY_to_latlong(pixelX, pixelY, zoom)
```

Arguments

`pixelX`	X coordinate of the point, in pixels.
`pixelY`	Y coordinates of the point, in pixels.
`zoom`	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left QuadKey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A list with the longitude and latitude.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
pixelXY_to_latlong(
  pixelX = 768,
  pixelY = 1280,
  zoom = 3
)
```

`pixelXY_to_tileXY` *Convert pixel XY coordinates into tile XY coordinates*

Description

Converts pixel XY coordinates into tile XY coordinates of the tile containing the specified pixel. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
pixelXY_to_tileXY(pixelX, pixelY)
```

Arguments

`pixelX`	Pixel X coordinate.
`pixelY`	Pixel Y coordinate.

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A list returning the tile X and tile Y coordinates.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
pixelXY_to_tileXY(
  pixelX = 5916,
  pixelY = 9894
)
```

polygon_to_raster *Create and save raster images for different dates and times*

Description

Creates one raster by each date and time reported and saves it as a `.tif`.

Usage

```
polygon_to_raster(
  data,
  nx,
  ny,
  template,
  var = "percent_change",
  filename,
  path
)
```

Arguments

`data`	A `sf` POLYGON data.frame with the variable we want to represent in the raster.
`nx`	Integer; number of cells in x direction.
`ny`	Integer; number of cells in y direction.
`template`	A `sf` POLYGON data.frame
`var`	The column name of the variable to plot.
`filename`	Select a name for the file. The date and time will be included automatically in the name.
`path`	Path where the files should be stored.

Value

as many .tif files as dates and times in the dataset

See Also

`st_as_stars`, `st_rasterize`

`missing_combinations`

Examples

```
files <- read_fb_mobility_files(
  path_to_csvs = paste0(system.file("extdata",
    package = "quadkeyr"
  ), "/"),
  colnames = c(
```

```
    "lat", "lon",
    "quadkey", "date_time",
    "n_crisis", "percent_change"
  ),
  coltypes = list(
    lat = "d",
    lon = "d",
    quadkey = "c",
    date_time = "T",
    n_crisis = "c",
    percent_change = "c"
  )
)

# Get a regular grid and create the polygons
regular_grid <- get_regular_polygon_grid(data = files)

# Keep only the QuadKeys reported
files_polygons <- files |>
  dplyr::inner_join(regular_grid$data,
    by = c("quadkey")
  )

# Generate the raster files
polygon_to_raster(
  data = files_polygons,
  nx = regular_grid$num_cols,
  ny = regular_grid$num_rows,
  template = files_polygons,
  var = "percent_change",
  filename = "cityA",
  path = paste0(
    system.file("extdata",
      package = "quadkeyr"
    ),
    "/"
  )
)
```

---

qkmap_app *Launch the Shiny App*

Description

This function launches the Shiny app.

Usage

```
qkmap_app()
```

Value

This function does not return any value. It launches the Shiny app.

Examples

```
if(interactive()){
qkmap_app()
}
```

---

quadkey_df_to_polygon *Convert data.frame with* quadkey *column to a* sf *POLYGON data.frame*

Description

Convert data.frame with quadkey column to a sf POLYGON data.frame

Usage

```
quadkey_df_to_polygon(data)
```

Arguments

data	A data.frame with a quadkey column

Value

The same original data.frame with a sf POLYGON data.frame with a geometry column.

See Also

quadkey_df_to_polygon

Examples

```
# Quadkey as string
quadkey_to_polygon(quadkey = "213")

# QuadKeys as column in a data.frame
# get data file
path <- paste0(
  system.file("extdata", package = "quadkeyr"),
  "/cityA_2020_04_15_0000.csv"
)
data <- read.csv(path)
data <- format_fb_data(data)

quadkey_df_to_polygon(data = data)
```

quadkey_to_latlong *Convert a string of Quadkey numbers to lat/long coordinates*

Description

This function converts Quadkeys to latitude/longitude WGS-84 coordinates (in degrees). For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
quadkey_to_latlong(quadkey_data)
```

Arguments

quadkey_data	A single QuadKey as a string or a vector with unique QuadKeys.

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar quadkeyr functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A sf POINT data.frame with a quadkey column. The latitude/longitude coordinates represent the upper-left corner of the QuadKey.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

See Also

quadkey_to_tileXY

tileXY_to_pixelXY

pixelXY_to_latlong

Examples

```
quadkey_to_latlong(quadkey_data = "213")
quadkey_to_latlong(quadkey_data = c("213", "212", "210"))
```

quadkey_to_polygon *Convert a QuadKey into a square polygon*

Description

This functions creates a `sf` POLYGON data.frame from a QuadKey string.

Usage

```
quadkey_to_polygon(quadkey)
```

Arguments

quadkey	The QuadKey as a string

Value

A `sf` POLYGON data.frame with a `quadkey` and `geometry` column.

See Also

quadkey_df_to_polygon

Examples

```
# Quadkey as string
quadkey_to_polygon(quadkey = "213")

# QuadKeys as column in a data.frame
# get data file
path <- paste0(
  system.file("extdata", package = "quadkeyr"),
  "/cityA_2020_04_15_0000.csv"
)
data <- read.csv(path)
data <- format_fb_data(data)

quadkey_df_to_polygon(data = data)
```

quadkey_to_tileXY *Convert a QuadKey into tile XY coordinates.*

Description

For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
quadkey_to_tileXY(quadkey)
```

Arguments

quadkey	A QuadKey as a single string.

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left QuadKey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar quadkeyr functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A list returning the tile X, tile Y coordinates and the zoom level.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
quadkey_to_tileXY(quadkey = "213")
```

`read_fb_mobility_files` *Read all the .csv files in a folder and format the data.*

Description

This function reads all the `.csv` files in a particular folder. These files consistently contain identical columns, with variations only in location, day, and time. As a result, we can uniformly apply specific formatting to columns across these files.

Usage

```
read_fb_mobility_files(path_to_csvs, colnames, coltypes, keep_format = NULL)
```

Arguments

`path_to_csvs`	Path to the folder where the `.csv` files are stored
`colnames`	Columns to include in the results (as character). For more information go to `readr::read_csv()`
`coltypes`	Column specifications (as strings). See vignette("readr", package = "readr") for more details. documentation.
`keep_format`	Vector of column names, besides `date_time`, `day` and `quadkey`, that you don't want to convert to a number.

Value

A data.frame with the information of all the files read.

See Also

`format_fb_data`

`read_csv`

Examples

```
files <- read_fb_mobility_files(
  path_to_csvs = paste0(system.file("extdata",
    package = "quadkeyr"
  ), "/"),
  colnames = c( # The columns not listed here will be omitted
    "lat",
    "lon",
    "quadkey",
    "date_time",
    "n_crisis",
    "percent_change",
    "day",
```

```
    "hour"
  ),
  coltypes = list(
    lat = "d",
    lon = "d",
    quadkey = "c",
    date_time = "T",
    n_crisis = "c",
    percent_change = "c",
    day = "D",
    hour = "i"
  )
)

head(files)
```

`regular_qk_grid` *Convert a incomplete QuadKey* `sf` *POINT data.frame into a regular grid.*

Description

This function completes `sf` POINT data.frame grid of QuadKeys using the bounding box of the data provided.

Usage

```
regular_qk_grid(data)
```

Arguments

`data`	A `sf` POINT data.frame

Value

A list with three elements:

- `data` A `sf` POINT data.frame, with the rows needed to complete the grid.
- `num_rows` The number of columns of the regular grid.
- `num_cols` The number of rows of the regular grid.

See Also

`create_qk_grid`

`quadkey_to_latlong`

Examples

```
quadkey_vector <- c("213", "210", "211")

qtll <- quadkey_to_latlong(quadkey = quadkey_vector)

regular_qk_grid(qtll)
```

`tileXY_to_pixelXY` *Convert tile XY coordinates into pixel XY coordinates*

Description

Converts tile XY coordinates into pixel XY coordinates of the upper-left pixel of the specified tile. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
tileXY_to_pixelXY(tileX, tileY)
```

Arguments

`tileX`	Tile X coordinate.
`tileY`	Tile Y coordinate.

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

A list returning the pixel X and pixel Y coordinates.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
tileXY_to_pixelXY(
  tileX = 3,
  tileY = 5
)
```

`tileXY_to_quadkey` *Convert tile XY coordinates into a QuadKey.*

Description

Converts tile XY coordinates into a QuadKey at a specified zoom level. For further information, refer to the Microsoft Bing Maps Tile System documentation.

Usage

```
tileXY_to_quadkey(tileX, tileY, zoom)
```

Arguments

`tileX`	Tile X coordinate.
`tileY`	Tile Y coordinate.
`zoom`	Zoom or level of detail, from 1 (lowest detail) to 23 (highest detail).

Details

Converting latitude/longitude coordinates into a QuadKey and then back to latitude/longitude won't yield identical values, unless the initial latitude/longitude coordinates correspond to the upper-left Quadkey's pixel and tile XY coordinates at the same zoom level.

Understanding this distinction is crucial for the accurate use of these functions in coordinate conversions.

For a detailed explanation on how to use this and other similar `quadkeyr` functions, read the the vignette: https://docs.ropensci.org/quadkeyr/articles/quadkey_to_sf_conversion.html

Value

The QuadKey as a string.

References

https://learn.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system

Examples

```
tileXY_to_quadkey(
  tileX = 23,
  tileY = 38,
  zoom = 6
)
```

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