

Package ‘freestiler’

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Title Create Vector Tiles from Spatial Data

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Description Create vector tile archives in 'PMTiles' format from 'sf' spatial data frames. Supports 'Mapbox Vector Tile' ('MVT') and 'MapLibre Tile' ('MLT') output formats. Uses a 'Rust' backend via 'extendr' for fast, in-memory tiling with zero external system dependencies.

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URL <https://walker-data.com/freestiler/>,
<https://github.com/walkerke/freestiler/>

BugReports <https://github.com/walkerke/freestiler/issues>

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freestyle	<i>Create vector tiles from spatial data</i>
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Description

Creates a PMTiles archive containing vector tiles from one or more sf data frames. Supports both Mapbox Vector Tile (MVT) and MapLibre Tile (MLT) formats, multi-layer output, feature dropping, point clustering, and feature coalescing.

Usage

```
freestyle(
  input,
  output,
  layer_name = NULL,
  tile_format = "mvt",
  min_zoom = 0L,
  max_zoom = 14L,
  base_zoom = NULL,
  drop_rate = NULL,
  cluster_distance = NULL,
  cluster_maxzoom = NULL,
  coalesce = FALSE,
  simplification = TRUE,
  generate_ids = TRUE,
  overwrite = TRUE,
  quiet = FALSE
)
```

Arguments

input	An sf data frame, or a named list of sf/freestyle_layer objects for multi-layer output.
output	Character. Path for the output .pmtiles file.

layer_name	Character. Name for the tile layer. If NULL, derived from the output filename. Only used for single-layer input.
tile_format	Character. Tile encoding format: "mvt" (default) for Mapbox Vector Tiles or "mlt" for MapLibre Tiles.
min_zoom	Integer. Minimum zoom level (default 0).
max_zoom	Integer. Maximum zoom level (default 14).
base_zoom	Integer. Zoom level at and above which all features are present (no dropping). NULL (default) uses each layer's own max_zoom. The drop-rate curve is also computed relative to base_zoom, so lowering it produces gentler thinning at low zooms. Inspired by tippecanoe's -B / --base-zoom.
drop_rate	Numeric. Exponential drop rate for feature thinning (e.g. 2.5). At each zoom level below base_zoom, features are retained at a rate of $1/\text{drop_rate}^{(\text{base_zoom} - \text{zoom})}$. Points are thinned using spatial ordering; polygons/lines are thinned by area. NULL (default) disables drop-rate thinning.
cluster_distance	Numeric. Pixel distance for point clustering. Points within this radius are merged into cluster features with a point_count attribute. NULL (default) disables clustering.
cluster_maxzoom	Integer. Maximum zoom level for clustering. Above this zoom, individual points are shown. Default is max_zoom - 1.
coalesce	Logical. Whether to merge features with identical attributes within each tile (default FALSE). Lines sharing endpoints are merged; polygons are grouped into MultiPolygons.
simplification	Logical. Whether to snap geometries to the tile pixel grid at each zoom level (default TRUE). This provides zoom-adaptive simplification and prevents slivers between adjacent polygons.
generate_ids	Logical. Whether to assign sequential feature IDs (default TRUE).
overwrite	Logical. Whether to overwrite existing output file (default TRUE).
quiet	Logical. Whether to suppress progress messages (default FALSE).

Details

Input data in any coordinate reference system (CRS) is automatically reprojected to WGS84 (EPSG:4326) before tiling.

Value

The output file path (invisibly).

Examples

```
## Not run:
library(sf)
nc <- st_read(system.file("shape/nc.shp", package = "sf"))
```

```

# Single layer
freestile(nc, "nc.pmtiles", layer_name = "counties")

# Multi-layer
pts <- st_centroid(nc)
freestile(
  list(counties = nc, centroids = pts),
  "nc_layers.pmtiles"
)

# With dropping and coalescing
freestile(nc, "nc_drop.pmtiles", drop_rate = 2.5, coalesce = TRUE)

# With point clustering
freestile(pts, "pts.pmtiles", cluster_distance = 50, cluster_maxzoom = 8)

## End(Not run)

```

```
freestile_file
```

```
Create vector tiles from a spatial file
```

Description

Reads a GeoParquet, GeoPackage, Shapefile, or other spatial file directly into the tiling engine. Input data in any coordinate reference system is automatically reprojected to WGS84 (EPSG:4326) before tiling.

Usage

```

freestile_file(
  input,
  output,
  layer_name = NULL,
  tile_format = "mvt",
  min_zoom = 0L,
  max_zoom = 14L,
  base_zoom = NULL,
  drop_rate = NULL,
  cluster_distance = NULL,
  cluster_maxzoom = NULL,
  coalesce = FALSE,
  simplification = TRUE,
  overwrite = TRUE,
  quiet = FALSE,
  engine = "geoparquet"
)

```

Arguments

input	Character. Path to the input spatial file.
output	Character. Path for the output .pmtiles file.
layer_name	Character. Name for the tile layer. If NULL, derived from the output filename.
tile_format	Character. "mvt" (default) or "mlt".
min_zoom	Integer. Minimum zoom level (default 0).
max_zoom	Integer. Maximum zoom level (default 14).
base_zoom	Integer. Zoom level at and above which all features are present. NULL (default) uses max_zoom.
drop_rate	Numeric. Exponential drop rate. NULL (default) disables.
cluster_distance	Numeric. Pixel distance for clustering. NULL disables.
cluster_maxzoom	Integer. Max zoom for clustering. Default max_zoom - 1.
coalesce	Logical. Whether to merge features with identical attributes (default FALSE).
simplification	Logical. Whether to snap geometries to the tile pixel grid (default TRUE).
overwrite	Logical. Whether to overwrite existing output (default TRUE).
quiet	Logical. Whether to suppress progress (default FALSE).
engine	Character. Backend engine: "geoparquet" (default, for GeoParquet files) or "duckdb" (for any file format DuckDB supports).

Details

The GeoParquet engine requires compilation with `FREESTILER_GEOPARQUET=true`. The DuckDB engine uses the Rust DuckDB backend when included in the build (enabled by default for native builds), or falls back to the R duckdb package. Control backend selection with `options(freestiler.duckdb_backend = "auto"|"rust"|"r")`.

Value

The output file path (invisibly).

Examples

```
## Not run:
freestile_file("data.parquet", "output.pmtiles")
freestile_file("data.gpkg", "output.pmtiles", engine = "duckdb")

## End(Not run)
```

Description

Aggregates points into H3 hexagons at zoom-appropriate resolutions and writes a PMTiles archive in which low zooms show coarse hexagons, intermediate zooms show progressively finer hexagons, and zooms at or above `base_zoom` show individual points. Aggregations (count, sum, mean, etc.) are computed in DuckDB via the H3 community extension; the function then assembles the per-resolution hex layers and the raw-point layer via `freestyle()`.

Usage

```
freestyle_h3(
  input,
  output,
  agg = "count",
  hex_layer_prefix = "h3",
  point_layer_name = "points",
  min_zoom = 0L,
  max_zoom = 14L,
  base_zoom = NULL,
  h3_resolutions = NULL,
  source_crs = NULL,
  db_path = NULL,
  tile_format = "mvt",
  fade = FALSE,
  fade_overlap = 1L,
  overwrite = TRUE,
  quiet = FALSE
)
```

Arguments

<code>input</code>	An sf data frame of POINT geometry, or a character SQL query that returns a geometry column when executed against DuckDB. (DuckDB's spatial functions such as <code>ST_Read()</code> and <code>read_parquet()</code> are available.)
<code>output</code>	Character. Path for the output <code>.pmtiles</code> file.
<code>agg</code>	Aggregation specification: <ul style="list-style-type: none"> • "count" (default): single count = <code>COUNT(*)</code> property. • Named character vector of SQL aggregation expressions, e.g. <code>c(n = "COUNT(*)", avg_pop = "AVG(pop)", total = "SUM(pop)")</code>. • Named list of <code>prop_name = c(fn, column)</code> for callers who don't want to write SQL, e.g. <code>list(n = c("count", "*"), avg_pop = c("mean", "pop"))</code>. Supported fn values: "count", "sum", "mean"/"avg", "min", "max", "median".

hex_layer_prefix	Character. Prefix for the per-resolution hex MVT layer names. Default "h3" produces "h3_r01", "h3_r02", etc.
point_layer_name	Character. MVT layer name for raw points (default "points").
min_zoom, max_zoom	Integer. Global zoom range (default 0–14).
base_zoom	Integer or NULL. Zoom level at and above which raw points take over from hex aggregations. Default NULL resolves to $\text{max_zoom} - 2L$, clamped so $\text{min_zoom} \leq \text{base_zoom} \leq \text{max_zoom}$. If $\text{base_zoom} == \text{min_zoom}$, no hex layers are created.
h3_resolutions	Optional override of the zoom \rightarrow H3 resolution mapping. Accepts NULL (use built-in defaults), an unnamed integer vector with length($\text{min_zoom} : (\text{base_zoom} - 1L)$) entries mapped positionally, or a named integer vector with names that parse to integer zoom levels (sparse overrides; defaults fill the rest). All resolutions must be integers in 0:15. The same resolution appearing in non-contiguous zoom runs (e.g. zooms 4–5 and 8) is rejected.
source_crs	Character or NULL. CRS of geometry returned by SQL input, e.g. "EPSG:4326" (default for sf input, since sf is auto-transformed to WGS84) or "EPSG:3857". Ignored for sf input. For SQL input, if NULL, a warning is emitted and the geometry is assumed to be "EPSG:4326".
db_path	Character or NULL. Path to an existing DuckDB database file, or NULL/"" (default) for an in-memory database.
tile_format	Character. "mvt" (default) or "mlt".
fade	Logical. If TRUE, adjacent hex layer zoom windows overlap by fade_overlap zooms so <code>view_h3_tiles()</code> can cross-fade between resolutions. Default FALSE (disjoint windows, clean zoom breaks).
fade_overlap	Integer. Zooms of overlap on each side (only used when fade = TRUE, default 1L).
overwrite	Logical. Whether to overwrite an existing output file (default TRUE).
quiet	Logical. Suppress progress messages (default FALSE).

Details

Each distinct H3 resolution becomes its own MVT source-layer (named "<hex_layer_prefix>_r<resolution>", e.g. "h3_r05"); raw points are emitted as a separate source-layer (point_layer_name). With the default fade = FALSE, per-layer zoom windows are disjoint so the rendered map swaps between resolutions cleanly. With fade = TRUE, adjacent windows overlap by fade_overlap zooms so the companion `view_h3_tiles()` helper can cross-fade between resolutions.

DuckDB and the H3 community extension are required. With sf input the data is written to DuckDB via a temporary Parquet (or `dbWriteTable`) roundtrip; with character SQL input, the user query is wrapped in a temporary view inside DuckDB.

Value

The output file path (invisibly).

Point volume at base_zoom

The raw-point layer is encoded without thinning: every input point is written to every tile that contains it from base_zoom up (and from base_zoom - fade_overlap when fade = TRUE). For very large inputs the tiles at the first point zoom can get heavy. Raising base_zoom defers points to higher zooms, where each tile covers less area and so holds fewer points. Per-layer feature dropping for the points layer is on the roadmap.

Antimeridian and polar cells

Hexagons that cross the antimeridian are split at +/-180 degrees so they render correctly on both sides of the dateline instead of as world-spanning slivers. The rare cells that contain a pole receive the same split and render approximately (the polygon edge follows the cell boundary vertices, so the polar cap itself is not filled).

See Also

[freestyle\(\)](#), [view_h3_tiles\(\)](#)

Examples

```
## Not run:
library(sf)
pts <- st_as_sf(data.frame(
  x = runif(50000, -100, -80),
  y = runif(50000, 30, 45),
  w = rnorm(50000, 100, 10)
), coords = c("x", "y"), crs = 4326)

freestyle_h3(pts, "wind.pmtiles",
  agg = c(n = "COUNT(*)", avg_w = "AVG(w)"),
  min_zoom = 2, max_zoom = 12, base_zoom = 10)

view_h3_tiles("wind.pmtiles", agg_column = "n")

# Cross-fade between resolutions
freestyle_h3(pts, "wind_fade.pmtiles",
  agg = "count",
  min_zoom = 2, max_zoom = 12, base_zoom = 10,
  fade = TRUE)

## End(Not run)
```

```
freestyle_layer
```

```
    Create a layer specification with per-layer zoom range
```

Description

Wraps an sf object with optional per-layer zoom range overrides for use in multi-layer tile generation.

Usage

```
freestile_layer(input, min_zoom = NULL, max_zoom = NULL)
```

Arguments

<code>input</code>	An sf data frame.
<code>min_zoom</code>	Integer. Minimum zoom level for this layer. If NULL, uses the global <code>min_zoom</code> from <code>freestile()</code> .
<code>max_zoom</code>	Integer. Maximum zoom level for this layer. If NULL, uses the global <code>max_zoom</code> from <code>freestile()</code> .

Value

A `freestile_layer` object (list with class attribute).

Examples

```
## Not run:
library(sf)
nc <- st_read(system.file("shape/nc.shp", package = "sf"))
roads <- st_read("roads.shp")

freestile(
  list(
    counties = freestile_layer(nc, min_zoom = 0, max_zoom = 10),
    roads = freestile_layer(roads, min_zoom = 8, max_zoom = 14)
  ),
  "layers.pmtiles"
)

## End(Not run)
```

```
freestile_query
```

Create vector tiles from a DuckDB SQL query

Description

Executes a SQL query via DuckDB's spatial extension and pipes the results into the tiling engine. Uses the Rust DuckDB backend when included in the build (enabled by default for native builds), or falls back to the R duckdb package. Control backend selection with `options(freestiler.duckdb_backend = "auto"|"rust"|"r")`.

Usage

```

freestyle_query(
  query,
  output,
  db_path = NULL,
  layer_name = NULL,
  tile_format = "mvt",
  min_zoom = 0L,
  max_zoom = 14L,
  base_zoom = NULL,
  drop_rate = NULL,
  cluster_distance = NULL,
  cluster_maxzoom = NULL,
  coalesce = FALSE,
  simplification = TRUE,
  overwrite = TRUE,
  quiet = FALSE,
  source_crs = NULL,
  streaming = "auto"
)

```

Arguments

query	Character. A SQL query that returns a geometry column. DuckDB spatial functions like <code>ST_Read()</code> and <code>read_parquet()</code> are available. Multi-statement SQL is supported: setup statements (e.g., <code>LOAD h3;</code>) are executed first, then the final <code>SELECT</code> is used for tiling.
output	Character. Path for the output <code>.pmtiles</code> file.
db_path	Character. Path to a DuckDB database file, or <code>NULL</code> (default) for an in-memory database.
layer_name	Character. Name for the tile layer. If <code>NULL</code> , derived from the output filename.
tile_format	Character. <code>"mvt"</code> (default) or <code>"mlt"</code> .
min_zoom	Integer. Minimum zoom level (default 0).
max_zoom	Integer. Maximum zoom level (default 14).
base_zoom	Integer. Zoom level at and above which all features are present. <code>NULL</code> (default) uses <code>max_zoom</code> .
drop_rate	Numeric. Exponential drop rate. <code>NULL</code> (default) disables.
cluster_distance	Numeric. Pixel distance for clustering. <code>NULL</code> disables.
cluster_maxzoom	Integer. Max zoom for clustering. Default <code>max_zoom - 1</code> .
coalesce	Logical. Whether to merge features with identical attributes (default <code>FALSE</code>).
simplification	Logical. Whether to snap geometries to the tile pixel grid (default <code>TRUE</code>).
overwrite	Logical. Whether to overwrite existing output (default <code>TRUE</code>).

quiet	Logical. Whether to suppress progress (default FALSE).
source_crs	Character or NULL. CRS of the geometry returned by query, for example "EPSG:4326" or "EPSG:4267". Used only by the R duckdb fallback; ignored by the Rust DuckDB backend.
streaming	Character. DuckDB query execution mode: "auto" (default) enables the streaming point pipeline for large queries, "always" forces it, and "never" uses the existing in-memory path.

Details

When using the R fallback, `source_crs` must be supplied explicitly so the query result can be interpreted or reprojected correctly. Pass "EPSG:4326" if the SQL already returns WGS84 geometry, or the source CRS string (for example "EPSG:4267") to have DuckDB reproject to WGS84 before tiling. For file-based input where the CRS is embedded in the file, use `freestyle_file()` with `engine = "duckdb"` instead, which auto-detects the source CRS.

Value

The output file path (invisibly).

Examples

```
## Not run:
# Query a GeoParquet file
freestyle_query(
  "SELECT * FROM read_parquet('data.parquet') WHERE pop > 50000",
  "output.pmtiles"
)

# Query a Shapefile
freestyle_query(
  "SELECT * FROM ST_Read('counties.shp')",
  "counties.pmtiles"
)

# Query with an existing DuckDB database
freestyle_query(
  "SELECT * FROM my_table WHERE region = 'West'",
  "west.pmtiles",
  db_path = "my_database.duckdb"
)

## End(Not run)
```

`serve_tiles`*Serve PMTiles files via local HTTP server with CORS*

Description

Start a local HTTP server to serve PMTiles files with CORS headers and HTTP range request support. This allows PMTiles to be consumed by mapgl and MapLibre GL JS. The server runs in the background and can be stopped with `stop_server()`.

Usage

```
serve_tiles(path, port = 8080)
```

Arguments

<code>path</code>	Path to a directory containing PMTiles files, or a single PMTiles file. If a single file, its directory will be served.
<code>port</code>	Port number for the HTTP server. Default is 8080.

Details

If a server is already running on the requested port, it is stopped first.

The server uses `httpuv` (a dependency of Shiny) to serve static files with the CORS and range-request headers that PMTiles requires. Works well for files up to ~1 GB. For larger files, consider an external server like `npx http-server /path --cors -c-1`.

Value

Invisibly returns a list with `url`, `port`, and `dir`. The server handle is stored internally so it can be stopped with `stop_server()`.

See Also

[stop_server\(\)](#), [view_tiles\(\)](#)

Examples

```
## Not run:
# Serve a directory
serve_tiles("/tmp/tiles")

# Serve a single file (its directory is served)
serve_tiles("us_bgs.pmtiles")

# Stop when done
stop_server()

## End(Not run)
```

stop_server	<i>Stop a local tile server</i>
-------------	---------------------------------

Description

Stop a local tile server

Usage

```
stop_server(port = NULL)
```

Arguments

port Port number to stop, or NULL to stop all running servers.

Value

Invisibly returns TRUE if a server was stopped.

See Also

[serve_tiles\(\)](#)

Examples

```
## Not run:
serve_tiles("tiles/")
stop_server()       # stop all
stop_server(8080)   # stop specific port

## End(Not run)
```

view_h3_tiles	<i>View an H3 hexagonal-binning PMTiles archive</i>
---------------	---

Description

Reads the metadata from a PMTiles archive produced by [freestyle_h3\(\)](#) and builds a mapgl map with one fill layer per H3 resolution plus a circle layer for raw points. Automatically detects whether the archive was built with `fade = FALSE` (disjoint zoom windows, clean breaks) or `fade = TRUE` (overlapping windows, cross-fade) and styles accordingly.

Usage

```
view_h3_tiles(
  input,
  agg_column = NULL,
  stops = NULL,
  palette = "viridis",
  hex_opacity = 0.9,
  point_color = "#0868ac",
  point_radius = NULL,
  background_style = NULL,
  hex_layer_prefix = "h3",
  point_layer_name = "points",
  port = 8080
)
```

Arguments

input	Path to a local .pmtiles file produced by freestyle_h3() .
agg_column	Character or NULL. Aggregation column to drive the hex color scale. If NULL, the first non-h3_id numeric field in the metadata is used.
stops	List with values and colors (equal length, sorted by values) defining the shared color scale across all hex layers. If NULL, the documented quick-look default is used.
palette	Character. Named palette used to generate default colors when stops is NULL. Currently supports "viridis" (default), "magma", "plasma", "cividis", "inferno", "rocket", "mako", "turbo" if viridisLite is installed; otherwise falls back to a five-color blue ramp.
hex_opacity	Numeric. Peak fill opacity for hex layers (default 0.9). In fade mode this is the opacity at each layer's center zoom.
point_color	Character. Color for the raw-point circles (default "#0868ac").
point_radius	mapgl expression or NULL. If NULL, a zoom-interpolated default is used.
background_style	mapgl style passed to mapgl::maplibre() ; if NULL uses mapgl::maplibre() defaults.
hex_layer_prefix	Character. Prefix used when the archive was written. Must match the value passed to freestyle_h3() ; default "h3".
point_layer_name	Character. Name of the raw-points MVT layer in the archive. Must match the value passed to freestyle_h3() ; default "points".
port	Integer. Port for the local PMTiles server (default 8080).

Details

The default color scale is a documented quick-look ramp (5 evenly spaced breaks across 1, 10, 100, 1000, 10000). For production maps, pass an explicit `stops = list(values = ..., colors = ...)` derived from your data. Embedding real aggregation statistics in PMTiles metadata is on the roadmap.

Value

A mapgl map object.

See Also

[freestyle_h3\(\)](#), [view_tiles\(\)](#)

Examples

```
## Not run:
view_h3_tiles("wind.pmtiles", agg_column = "n",
  stops = list(values = c(1, 10, 100, 1000, 10000),
    colors = viridisLite::viridis(5)))

## End(Not run)
```

view_tiles

Quickly view a PMTiles file on an interactive map

Description

Starts a local tile server (if needed) and creates an interactive mapgl map showing the tileset. Layer type and styling are auto-detected from the PMTiles metadata when possible.

Usage

```
view_tiles(
  input,
  layer = NULL,
  layer_type = NULL,
  color = NULL,
  opacity = 0.5,
  port = 8080,
  promote_id = NULL
)
```

Arguments

input	Path to a local .pmtiles file.
layer	Character. Source layer name to display. If NULL (default), the first layer in the tileset is used.
layer_type	Character. Map layer type: "fill", "line", or "circle". If NULL, auto-detected from the PMTiles metadata geometry type.
color	Fill, line, or circle color. Default is "navy" for fill and line layers, "steelblue" for circle layers.

opacity	Numeric opacity (0–1). Default is 0.5.
port	Port for the local tile server. Default is 8080.
promote_id	Character. Property name to use as the feature ID for hover interactivity. If NULL, no feature promotion is used.

Value

A mapgl map object (can be piped into further mapgl operations).

See Also

[serve_tiles\(\)](#), [freestile\(\)](#)

Examples

```
## Not run:
freestile(nc, "nc.pmtiles", layer_name = "counties")
view_tiles("nc.pmtiles")

# Override auto-detection
view_tiles("roads.pmtiles", layer_type = "line", color = "red")

# Point data
view_tiles("airports.pmtiles", layer_type = "circle", color = "orange")

## End(Not run)
```

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