Package 'timescapes'

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Title Quantifying Temporal Structure Across Landscapes

Version 0.1.0

Description Calculates interpretable mathematical summaries of binary conditions observed through time, based on metrics presented in Wan, Ho Yi (2025) <doi:10.1007/s10980-025-02252-4>. Metrics can be calculated for a single binary vector or independently for every cell in a raster time series.

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Encoding UTF-8

Imports terra

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

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URL https://github.com/LoganHysen/timescapes

BugReports https://github.com/LoganHysen/timescapes/issues

NeedsCompilation no

Author Logan Hysen [aut, cre, cph],
Ramcharan Reddy Mannam [aut, cph],
Abhiram Moturi [aut, cph],
Ho Yi Wan [aut, cph]

Maintainer Logan Hysen <hysenlog@msu.edu>

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ts_list_metrics *List available binary timescape metrics*

Description

List available binary timescape metrics

Usage

```
ts_list_metrics()
```

Value

A character vector of exact metric names accepted by `ts_metric()` and `ts_raster_metric()`.

Examples

```
ts_list_metrics()
```

ts_metric *Calculate a binary timescape metric*

Description

Calculates one named metric for a numeric vector in which `1` means that a condition is present and `0` means that it is absent. Metric names must match `ts_list_metrics()` exactly. If `x` contains any missing value, the result is `NA_real_`.

Usage

```
ts_metric(x, metric, ...)
```

Arguments

`x`	A non-empty numeric vector containing only `0`, `1`, or `NA`.
`metric`	One exact metric name returned by `ts_list_metrics()`.
`...`	Named metric-specific arguments. `core_time_index` and `n_core_periods` accept `min_core_period`, a positive whole number of time steps. If omitted, 15 is used with a warning once per call. `gap_mean` and `gap_max` accept `include_boundary_gaps` (default `TRUE`); set it to `FALSE` to count only absence runs between presence periods.

Value

One numeric value.

Metrics

Let n be the number of time steps, let an occupied period be a maximal run of ones, and let a gap be any maximal run of zeros, including leading and trailing runs by default. With `include_boundary_gaps = FALSE`, only gaps between presence periods count. No qualifying gaps (including an all-zero series with boundary gaps excluded) returns 0.

- `total_time`: sum of the series; range 0 to n.
- `n_periods`: number of occupied periods; range 0 to `ceiling(n / 2)`.
- `gap_mean`: arithmetic mean of gap lengths, or 0 when no gaps occur.
- `gap_max`: maximum gap length, or 0 when no gaps occur.
- `duration_sd`: sample standard deviation of occupied-period lengths, or 0 when fewer than two occupied periods occur.
- `edge_density`: number of changes between adjacent time steps divided by `n - 1`; returns 0 for a one-step series.
- `autocorr`: Pearson correlation between steps 1 through `n - 1` and steps 2 through n; returns NA when the correlation is undefined.
- `aggregation`: proportion of adjacent time-step pairs that are equal; returns 0 for a one-step series.
- `core_time_index`: proportion of occupied time in presence runs whose full length is at least `min_core_period`; returns 0 when no presence occurs.
- `n_core_periods`: number of such qualifying presence runs.

Time steps are unitless ordered observations; their duration is user-defined.

References

Wan, H. Y. (2025). It's about time: Temporal fragmentation and metrics for habitat change. Landscape Ecology, 40, 226. doi:10.1007/s10980025022524

Examples

```
x <- c(1, 1, 0, 0, 1, 1, 1, 0)
ts_metric(x, "n_periods")
ts_metric(x, "gap_mean")
ts_metric(x, "core_time_index", min_core_period = 3)
```

`ts_raster_metric` *Calculate a binary timescape metric for each raster cell*

Description

Applies one named timescape metric independently to every cell of a `terra::SpatRaster`, treating its layers as ordered time steps. Raster cells must contain only `0`, `1`, or NA through time. A cell containing any NA receives an NA result.

Usage

```
ts_raster_metric(r, metric, ...)
```

Arguments

`r`	A `terra::SpatRaster` whose layers are ordered time steps.
`metric`	One exact metric name returned by `ts_list_metrics()`.
`...`	Named metric-specific arguments passed to `ts_metric()`, including `include_boundary_gaps = TRUE` for gap metrics and a positive whole number `min_core_period` for core metrics. Omitting `min_core_period` uses 15 time steps and warns once per raster call, rather than once per cell.

Value

A one-layer `terra::SpatRaster` containing the selected metric.

Examples

```
r <- terra::rast(nrows = 2, ncols = 2, nlyrs = 4)
terra::values(r) <- matrix(
  c(
    1, 1, 0, 1,
    0, 0, 0, 0,
    1, 0, 1, 0,
    1, 1, 1, 1
  ),
  nrow = terra::ncell(r),
  byrow = TRUE
)
ts_raster_metric(r, "n_periods")
```

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