

Package ‘gravitas’

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Type Package

Title Explore Probability Distributions for Bivariate Temporal Granularities

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Suggests knitr, tsibbledata (>= 0.1.0), purrr (>= 0.3.2), testthat (>= 2.1.0), covr, rmarkdown, readr

VignetteBuilder knitr

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Description Provides tools for systematically exploring large quantities of temporal data across cyclic temporal granularities (deconstructions of time) by visualizing probability distributions. Cyclic time granularities can be circular, quasi-circular or aperiodic. 'gravitas' computes cyclic single-order-up or multiple-order-up granularities, check the feasibility of creating plots for any two cyclic granularities and recommend probability distributions plots for exploring periodicity in the data.

BugReports <https://github.com/Sayani07/gravitas/issues>

License GPL-3

URL <https://github.com/Sayani07/gravitas/>

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Contents

create_gran	2
cricket	4
gran_advice	5
gran_obs	6
harmony	7
is_harmony	8
print.gran_advice	9
prob_plot	10
run_app	11
search_gran	12
smart_meter10	13
validate_gran	14

Index **15**

create_gran	<i>Build dynamic temporal granularities</i>
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Description

Create time granularities that accommodate for periodicities in data, both single and multiple order up. Periodic ones might include time granularities like minute of the day, hour of the week and aperiodic calendar categorizations may include day of the month or week of the quarter. For non-temporal data, supports only periodic deconstructions.

Usage

```
create_gran(
  .data,
  gran1 = NULL,
  hierarchy_tbl = NULL,
  label = TRUE,
  abbr = TRUE,
  ...
)
```

Arguments

.data	A tsibble object.
gran1	the granularity to be created. For temporal data, any combination of "second", "minute", "qhour", "hhour", "hour", "day", "week", "fortnight", "month", "quarter", "semester" or "year" can be chosen in the form of finer to coarser unit. For example, for the granularity hour of the week, value is "hour_week".
hierarchy_tbl	A hierarchy table specifying the hierarchy of units and their relationships.
label	Logical. TRUE will display the month as an ordered factor of character string such as "January", "February". FALSE will display the month as an ordered factor such as 1 to 12, where 1 stands for January and 12 for December.
abbr	logical. FALSE will display abbreviated labels.
...	Other arguments passed on to individual methods.

Value

A tsibble with an additional column of granularity.

Examples

```
library(dplyr)
library(ggplot2)
library(lvplot)
# Search for granularities
smart_meter10 %>%
  search_gran(highest_unit = "week")

# Screen harmonies from the search list
## Not run:
smart_meter10 %>%
  harmony(
    ugran = "day",
    filter_in = "wknd_wday"
  )

## End(Not run)
# visualize probability distribution of
# the harmony pair (wknd_wday, hour_day)
smart_meter10 %>%
dplyr::filter(customer_id == "10017936") %>%
  prob_plot(
    gran1 = "wknd_wday",
    gran2 = "hour_day",
    response = "general_supply_kwh",
    plot_type = "quantile",
    quantile_prob = c(0.1, 0.25, 0.5, 0.75, 0.9)
  ) +
  scale_y_sqrt()

#' # Compute granularities for non-temporal data
```

```

library(tsibble)
cricket_tsibble <- cricket %>%
mutate(data_index = row_number()) %>%
as_tsibble(index = data_index)

hierarchy_model <- tibble::tibble(
  units = c("index", "over", "inning", "match"),
  convert_fct = c(1, 20, 2, 1)
)
cricket_tsibble %>%
  create_gran(
    "over_inning",
    hierarchy_model
  )

cricket_tsibble %>%
  filter(batting_team %in% c("Mumbai Indians",
                           "Chennai Super Kings"))%>%
  prob_plot("inning", "over",
            hierarchy_model,
            response = "runs_per_over",
            plot_type = "lv")

# Validate if given column in the data set
# equals computed granularity
validate_gran(cricket_tsibble,
  gran = "over_inning",
  hierarchy_tbl = hierarchy_model,
  validate_col = "over"
)

```

cricket

Cricket data set for different seasons of Indian Premier League

Description

The Indian Premier League played by teams representing different cities in India from 2008 to 2016.

Usage

```
cricket
```

Format

A tibble with 8560 rows and 11 variables.

season years representing IPL season

match_id match codes

batting_team name of batting team

bowling_team name of bowling team
inning innings of the match
over overs of the inning
wicket number of wickets in each over
dot_balls number of balls with no runs in an over
runs_per_over Runs for each over
run_rate run rate for each over

Source

<https://www.kaggle.com/josephgpinto/ipl-data-analysis/data>

Examples

```
data(cricket)

library(tsibble)
library(dplyr)
library(ggplot2)

# convert data set to a tsibble ----
cricket_tsibble <- cricket %>%
  mutate(data_index = row_number()) %>%
  as_tsibble(index = data_index)
# set the hierarchy of the units in a table ----
hierarchy_model <- tibble::tibble(
  units = c("index", "over", "inning", "match"),
  convert_fct = c(1, 20, 2, 1)
)
# Compute granularities ----
cricket_tsibble %>%
  create_gran("over_inning",
             hierarchy_model)
# Visualise distribution of runs across granularities ----
cricket_tsibble %>%
  filter(batting_team %in% c("Mumbai Indians",
                           "Chennai Super Kings")) %>%
  prob_plot("inning", "over",
            hierarchy_model,
            response = "runs_per_over",
            plot_type = "lv")
```

Description

Recommendations on plot choices, interaction, number of observations and intra or inter facet homogeneity. Important summaries before drawing distribution plots.

Usage

```
gran_advice(.data, gran1, gran2, hierarchy_tbl = NULL, ...)
```

Arguments

```
.data          a tibble.
gran1, gran2   granularities.
hierarchy_tbl A hierarchy table specifying the hierarchy of units and their relationships.
...           other arguments to be passed for appropriate labels.
```

Value

Summary check points before visualizing distribution across bivariate granularities

Examples

```
library(dplyr)
library(ggplot2)

smart_meter10 %>%
  filter(customer_id == "10017936") %>%
  gran_advice(gran1 = "wknd_wday",
              gran2 = "hour_day")

# choosing quantile plots from plot choices
smart_meter10 %>%
  filter(customer_id == "10017936") %>%
  prob_plot(
    gran1 = "wknd_wday",
    gran2 = "hour_day",
    response = "general_supply_kwh",
    plot_type = "quantile",
    quantile_prob = c(0.1, 0.25, 0.5, 0.75, 0.9)
  ) +
  scale_y_sqrt()
```

gran_obs

Cross tabulation of granularities useful for validating if number of observations are sufficient to compute probability distributions

Description

Cross tabulation of granularities useful for validating if number of observations are sufficient to compute probability distributions

Usage

```
gran_obs(.data, gran1, gran2, hierarchy_tbl = NULL)
```

Arguments

<code>.data</code>	A tsibble object.
<code>gran1</code>	One of the temporal granularities to check for harmonies.
<code>gran2</code>	The second temporal granularity in the pair.
<code>hierarchy_tbl</code>	A hierarchy table specifying the hierarchy of units and their relationships for non-temporal case.

Value

A tibble with number of observations for each granularity.

Examples

```
library(tsibbledata)
vic_elec %>% gran_obs("hour_day", "day_week")
```

<code>harmony</code>	<i>Get possible set of harmonies for a given tsibble</i>
----------------------	--

Description

Interaction of pair of granularities, categorised as harmony and clash. `harmony ()` screens out harmony pairs from list of all possible pairs of granularities.

Usage

```
harmony(
  .data,
  ugran = "year",
  lgran = NULL,
  hierarchy_tbl = NULL,
  filter_in = NULL,
  filter_out = NULL,
  facet_h = NULL,
  ...
)
```

Arguments

<code>.data</code>	A tsibble object.
<code>ugran</code>	Typically set as the most coarse unit required in the analysis. Default is "year".
<code>lgran</code>	For "regular" tsibble, <code>lgran</code> is the interval of the tsibble. It needs to be specified for "irregular" time intervals. Typically serves as the finest unit required for analysis.
<code>hierarchy_tbl</code>	A hierarchy table specifying the hierarchy of units and their relationships.

filter_in	Choices of temporal units to be kept. Can be column names if #' required granularity already exists in the tsibble. For example, a column with public holidays which needs to be treated as granularity, can be included here for checking how it interacts with other granularities.
filter_out	Choices of temporal units to be discarded.
facet_h	highest level of facets allowed.
...	added arguments to be passed.

Value

A tibble of harmonies and their levels. The levels can be used to decide which granularities to be plotted across x-axis/facets for exploratory aid.

Examples

```
library(tsibbledata)
vic_elec %>% harmony(lgran = "hour", ugran = "week")
```

is_harmony	<i>Check if two temporal granularities are harmonies</i>
------------	--

Description

Interaction of pair of granularities, categorised as harmony and clash

Usage

```
is_harmony(
  .data,
  gran1,
  gran2,
  hierarchy_tbl = NULL,
  facet_h = NULL,
  x_h = NULL
)
```

Arguments

.data	A tsibble object.
gran1	One of the temporal granularities to check for harmonies.
gran2	The second temporal granularity in the pair.
hierarchy_tbl	A hierarchy table specifying the hierarchy of units and their relationships.
facet_h	highest level of facet variable that can be considered in harmony pair.
x_h	highest level of x-axis variable that can be considered in harmony pair.

Value

TRUE if two granularities are harmonies.

Examples

```
library(tsibbledata)
vic_elec %>% is_harmony("hour_day", "day_week")
```

`print.gran_advice` *Advice summaries for granularities*

Description

Recommendations on plot choices, interaction, number of observations and intra or inter facet homogeneity. Important summaries before drawing distribution plots.

Usage

```
## S3 method for class 'gran_advice'
print(x, ...)
```

Arguments

- `x` An object of class `gran_advice`
- `...` other arguments to be passed for appropriate labels.

Value

Print check points before visualizing distribution across bivariate granularities

Examples

```
library(dplyr)
library(ggplot2)

smart_meter10 %>%
  filter(customer_id == "10017936") %>%
  gran_advice(gran1 = "wknd_wday",
             gran2 = "hour_day")
```

 prob_plot

Plotting probability distributions across granularities

Description

Plot probability distribution of univariate series across bivariate temporal granularities.

Usage

```
prob_plot(
  .data,
  gran1 = NULL,
  gran2 = NULL,
  hierarchy_tbl = NULL,
  response = NULL,
  plot_type = NULL,
  quantile_prob = c(0.01, 0.1, 0.25, 0.5, 0.75, 0.9, 0.99),
  facet_h = NULL,
  symmetric = TRUE,
  alpha = 0.8,
  threshold_nobs = NULL,
  ...
)
```

Arguments

.data	a tsibble
gran1	the granularity which is to be placed across facets. Can be column names if required granularity already exists in the tsibble. For example, a column with public holidays which needs to be treated as granularity, can be included here.
gran2	the granularity to be placed across x-axis. Can be column names if required granularity already exists in the tsibble.
hierarchy_tbl	A hierarchy table specifying the hierarchy of units and their relationships.
response	response variable to be plotted.
plot_type	type of distribution plot. Options include "boxplot", "lv" (letter-value), "quantile", "ridge" or "violin".
quantile_prob	numeric vector of probabilities with value in [0,1] whose sample quantiles are wanted. Default is set to "decile" plot.
facet_h	levels of facet variable for which facetting is allowed while plotting bivariate temporal granularities.
symmetric	If TRUE, symmetric quantile area <- is drawn. If FALSE, only quantile lines are drawn instead of area. If TRUE, length of quantile_prob should be odd and ideally the quantile_prob should be a symmetric vector with median at the middle position.

alpha level of transparency for the quantile area
 threshold_nobs the minimum number of observations below which only points would be plotted
 ... other arguments to be passed for customising the obtained ggplot object.

Value

a ggplot object which can be customised as usual.

Examples

```
library(tsibbledata)
library(ggplot2)
library(tsibble)
library(lvplot)
library(dplyr)

smart_meter10 %>%
  filter(customer_id %in% c("10017936")) %>%
  prob_plot(
    gran1 = "day_week", gran2 = "hour_day",
    response = "general_supply_kwh", plot_type = "quantile",
    quantile_prob = c(0.1, 0.25, 0.5, 0.75, 0.9),
    symmetric = TRUE,
    outlier.colour = "red",
    outlier.shape = 2, palette = "Dark2"
  )

cricket_tsibble <- cricket %>%
  mutate(data_index = row_number()) %>%
  as_tsibble(index = data_index)

hierarchy_model <- tibble::tibble(
  units = c("index", "over", "inning", "match"),
  convert_fct = c(1, 20, 2, 1)
)

cricket_tsibble %>%
  prob_plot("inning", "over",
    hierarchy_tbl = hierarchy_model,
    response = "runs_per_over",
    plot_type = "lv"
  )
```

run_app

Runs a shiny app demonstrating functionalities of gravitas

Description

Runs a local shiny app that demonstrates how distributions of univariate time series can be explored across bivariate time granularities

Usage

```
run_app()
```

Value

opens a local shiny app

Author(s)

Sayani Gupta

Examples

```
## Not run:  
run_app()  
  
## End(Not run)
```

search_gran

Search for granularities

Description

Get set of possible granularities that can be considered exhaustively depending on the frequency of the data.

Usage

```
search_gran(  
  .data,  
  lowest_unit = NULL,  
  highest_unit = NULL,  
  hierarchy_tbl = NULL,  
  filter_in = NULL,  
  filter_out = NULL,  
  ...  
)
```

Arguments

<code>.data</code>	A tsibble object.
<code>lowest_unit</code>	Typically set as the finest unit required for analysis. For "regular" tsibble, <code>lgran</code> is the interval of the tsibble. It needs to be specified for "irregular" time intervals. For non-temporal data, default is the first unit specified in the hierarchy table.
<code>highest_unit</code>	Typically set as the most coarse unit required for analysis. For temporal data, default is "year" and for non-temporal data, default is set as the last unit specified in the hierarchy table.

hierarchy_tbl A hierarchy table specifying the hierarchy of units and their relationships.
filter_in Choices of temporal units to be kept.
filter_out Choices of temporal units to be discarded.
... Other arguments to be passed.

Value

Set of possible granularities.

Examples

```
library(tsibbledata)
vic_elec %>% search_gran(lowest_unit = "hour", highest_unit = "month")
```

smart_meter10	<i>Smart meter data for ten households</i>
---------------	--

Description

Customer Trial data conducted as part of Smart Grid Smart City (SGSC) project (2010-2014) based in Newcastle, New South Wales and areas in Sydney. It contains half hourly interval meter readings (KWh) of electricity consumption of households.

Usage

```
smart_meter10
```

Format

A tsibble with 259, 235 rows and 3 columns.

customer_id household ID

reading_datetime Date time for which data is recorded (index)

general_supply_kwh electricity supplied to this household

Source

<https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details?q=smart-meter>

validate_gran	<i>Validate created granularities with existing columns</i>
---------------	---

Description

Validate created granularities with existing columns

Usage

```
validate_gran(
  .data,
  gran = NULL,
  hierarchy_tbl = NULL,
  validate_col = NULL,
  ...
)
```

Arguments

.data	A tsibble object.
gran	the granularity to be created for validation.
hierarchy_tbl	A hierarchy table.
validate_col	A column in the data which acts as validator.
...	Other arguments passed on to individual methods.

Value

A tsibble with an additional column of granularity.

Examples

```
library(dplyr)
library(tsibble)
cricket_tsibble <- cricket %>%
  mutate(data_index = row_number()) %>%
  as_tsibble(index = data_index)

hierarchy_model <- tibble::tibble(
  units = c("index", "ball", "over", "inning", "match"),
  convert_fct = c(1, 6, 20, 2, 1)
)
cricket_tsibble %>% validate_gran(
  gran = "over_inning",
  hierarchy_tbl = hierarchy_model,
  validate_col = "over"
)
```

Index

* datasets

cricket, [4](#)

smart_meter10, [13](#)

create_gran, [2](#)

cricket, [4](#)

gran_advice, [5](#)

gran_obs, [6](#)

harmony, [7](#)

is_harmony, [8](#)

print.gran_advice, [9](#)

prob_plot, [10](#)

run_app, [11](#)

search_gran, [12](#)

smart_meter10, [13](#)

validate_gran, [14](#)