A template for the *arxiv* style

A Preprint

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Abstract

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***K*eywords** blah · blee · bloo · these are optional and can be removed

1 Introduction

Spatio-temporal data

Motivation: Many focus on spatio/ temporal solely -> spatio-temporal vector data structure for data analysis sections

2 Existing data structure for spatio and temporal data

There has been a large class of implementations dedicated to processing the spatial data. This includes `sf` (E. J. Pebesma 2018) and its precedent `sp` (E. Pebesma and Bivand 2005) for ... and `raster` (Hijmans 2020) and `terra` (Hijmans 2021) for raster data. While these implementations specialised in geographic manipulations with different type of simple features, it doesn't incorporate a temporal dimension in the data

structure. Project like `stars` (E. Pebesma 2021) and `spacetime` (Bivand, Pebesma, and Gomez-Rubio 2013) by R-Spatial allows for both space and time dimension for raster and vector data, but the underlying data structure is a multi-dimensional array, which could be difficult to operate for R users who are more familiar with the operation in 2D dataframe/ tibble.

In the temporal aspect, the `tsibble` (Wang, Cook, and Hyndman 2020) structure and its tidyverts ecosystem have provided a [...] workflow to work with temporal data. In a tsibble structure, temporal data is characterised by `index` and `key` where `index` is the temporal identifier and `key` is the identifier for multiple series, which could be used as a spatio identifier. However, a tsibble object, by construction, always requires the `index` in its structure. This makes it less appealing for spatio-temporal data since the output of calculated spatio-specific variables (i.e. features of each series) don't have the time dimension. Analysts will either need to have an additional step to join this output to the original tsibble or operate with variables stored in two separate objects. In addition, the long form structure of a tsibble object means spatio variables (i.e. longitude, latitude, and features of each series if joined back to the tsibble) of each spatio identifier will be repetitively recorded at each timestamp. This repetition is unnecessary and would inflate the object size for long series.

3 A new data structure for spatio-temporal data

Intro to cubble:

- list-column: rowwise_df with temporal variables, including the time index, nested.
  - Focus on spatio: those output per station
- long form: grouped_df
  - Focus on temporal

Compatible with tidyverse manipulation and tsibble

4 Examples

Daily climate data (prcp, tmax, and tmin) from RNOAA - lots of stations across Australia

An exploratory data analysis questions: What's the climate profile look like in Australia

- General features: Any general trend/ fluctuation in prcp, tmax, and tmin?
- Local features: Any station stands out from the crowd?

4.1 Manipulation

- data quality check: filter out stations have variables not properly recorded
- data summary:
  - daily -> monthly/ weekly,
  - summarise by mean for tmax/ tmin, sum for prcp
-

4.2 Graphics

Static + interactive -> tooltip to show additional information upon hovering

- Where are those stations on the map?
  - Mention mostly aero, airport, and lighthouse

Summary

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