DSCI 574: Spatial and Temporal Models

Contents

An introduction to modelling temporal and spatial data in Python. For time series data, covers decomposition, classical models like exponential smoothing and ARIMA, machine learning, anomaly detection, and more. For spatial data, covers geospatial basics, visualization tools, spatial models such as kriging, and more.

- GitHub Repository
- Canvas Course Page
- Course Jupyter Book
- Learning Objectives

Environment set up

The course will use Python and draw on packages such as `pandas`, `geopandas`, and `statsmodels`.

You can install all the dependencies you need for the course using `conda`:

```
conda env create -f mds574.yaml
```

Teaching team

Position	Name
Lecture & lab instructor	Katie Burak
TA	Cindy Zhang
TA	Puria Azadi Moghadam
TA	Ailar
TA	Jordan Yu
TA	Matin Daghyani
TA	Eric Lee

Lectures

Lecture	Topic	Optional Reading
1	Introduction to time series	FPP Chapter 2, FPP Chapter 3
2	Introduction to forecasting	FPP Chapter 5, FPP Chapter 8
3	ARIMA models	FPP 9
4	Forecasting with machine learning	Model evaluation for forecasting
5	Forecast uncertainty, anomaly detection, and imputation	• Outlier detection with isolation forest • Probabilistic Forecasts: Pinball Loss Function
6	Advanced time series forecasting methods	• Illustrated Guide to Recurrent Neural Networks • Illustrated Guide to LSTM • Model selection
7	Introduction to spatial data	
8	Spatial modelling tutorial	

See Reference Material for the acronyms uses in the optional reading.

Labs and Quizzes

You are responsible for the following deliverables, which will determine your course grade:

Assessment	Weight
Lab 1	12.5%
Lab 2	12.5%
Quiz 1	25%
Lab 3	12.5%
Lab 4	12.5%
Quiz 2	25%

Office Hours

See the MDS calendar for an up-to-date schedule of office hours.

Reference Material

The below references are either freely available online, or electronic versions are available via the UBC Library.

🌟 = Recommended

Time series

1. Forecasting Principles and Practice (FPP) 3rd edition, Hyndman & Athanasopoulos (2021) 🌟
2. Advanced Forecasting with Python With State-of-the-Art-Models Including LSTMs, Facebook's Prophet, and Amazon's DeepAR, Joos Korstanje (2021) 🌟
3. Introduction to Time Series and Forecasting (ITSF), Brockwell & Davis (2016).
4. Time Series Analysis and its Application: With R Examples (TSAA), Shumway & Stoffer (2017)
5. Forecasting with Exponential Smoothing (FES), Hyndman et al. (2008)
6. Business Forecasting: Practical Problems and Solutions, Gilliland et al. (2015).

7. Flexible Imputation of Missing Data, van Buuren (2018).

Spatial analysis

- Geographic Data Science with Python, Sergio J. Rey, Dani Arribas-Bel, Levi J. Wolf (2021) 🌟
- Spatial Data Science with applications in R, Edzer Pebesma & Roger Bivand (2021). 🌟

Policies

- **Plagiarism**: Students should write in their own words and cite relevant sources as appropriate. If you copy other's work or external sources without citations, that's considered plagiarism and **will receive a 0 on the whole assignment as well as getting reported for academic misconduct to UBC**.
- **ChatGPT & AI tools**: LLMs, such as ChatGPT, can be helpful tools if we use them responsibly. In this course, students are permitted to use these tools to gather more information, review concepts, or brainstorm, and students must cite these tools if they use them for assignment. Having said all this, it is not permitted to write any given assignment via copying and pasting AI-generated responses.

Attendance

There are no formal requirements for attendance. However, for your own benefits, I highly recommend you attend the lectures/labs in-person.

Academic concession and Regrade requests

Please see the general MDS policies.

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