CIVE 650 - Spatiotemporal Data Analysis (2025 Fall)

Course project: Probabilistic Interpolation for Land Surface Temperature Data

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Monitoring land surface temperature is critical for climate research. However, real-world data often have missing/unknown values due to limited observations or sensor failure. This project aims to build probabilistic imputation/interpolation models for land surface temperature data.

Instructions

- We provide one-month land surface temperature data. The data was collected in 2020 from the Terra platform on the MODIS (Moderate Resolution Imaging Spectroradiometer) satellite (see `https://modis.gsfc.nasa.gov/data/`). Please read the `readme.txt` file for the data description.
- For land surface temperature interpolation, you should build probabilistic imputation models with three-dimensional inputs (longitude, latitude, time). Compare the performance (e.g., RMSE, R^2, Continuous Ranked Probability Score [CRPS]) of different designs (e.g., different kernel structures if you use Gaussian processes to build your solution). Please elaborate on how you design and train your models, similar to the reading paper. You can use any software packages in this project. If using GP as the key model, you may need to use sparse GP for model scalability.
- Examine your results by visualizing the predictive mean and standard deviation.
- Note: Use only the training data when developing your model. The purpose of the test data is for performance evaluation only.

Alternative project

You are free to choose a different project if the main scientific question fits the scope of this course—modeling spatiotemporal data.

Format

- Format of the report: single column, font size 11, maximum 10 pages (including references). The report should include sections such as abstract, introduction, methodologies, results, conclusion, and references.
- The final submission includes the report and source code.
- Due time/date: 5 p.m., December 10, 2025.

Evaluation

Projects will be evaluated based on:

- Novelty of the research question (if you choose to work on your own project). Is the problem worth investigating, e.g., an interesting and real-world problem?
- The solution. Did you choose the right solution for your research question?
- Technical quality. Does the technical solution/material make sense and is the proposed solution reasonable?
- Presentation and writing of the report. Are the idea and the solution clearly conveyed? Are the figures and tables carefully crafted? Is the report well structured and well reasoned?
- In-class presentation of the project. (Week 12/13).
- Code. Are we able to reproduce the results based on the submitted codes.