

Course Project

ISE 540:530 Forecasting Analytics

Aim: The aim of this project is to put the methods and theory learnt during the course into use by applying them to a real-world challenge. Methods implemented in this project do not have to be those that are learnt in class (that is, a team may decide to implement methods that were not directly taught in class). However, all methods implemented have to be formulated and evaluated methodically using a rigorous scientific procedure.

About the project:

For the project in this course, you have two options:

Option 1. Select your own project. This is worked out independently (not in teams). The student must provide a justification into why they would like to go for an independent, individual project (e.g., a topic that relates to their research or job). The student must have identified and already have access to a dataset. The student must get an approval from the course instructor about the topic/data and its suitability to be a course project.

Main milestones for option #1 (individual projects):

- Deadline to get approval from instructor about the project: 03/25/2024
- Submission of Report #1: 04/01/2024 – Data Exploration & Description
- Submission of Report #2: 04/15/2024 – Modeling & Forecasting Experiments
- Submission of Report #3: 04/28/2024 – Final Report

Option 2. Project competition (encouraged). This is worked out in teams of ~3. The topic of this challenge is to forecast the plane-of-array (POA) irradiance, given historical POA irradiance measurements, as well as information from other exogenous variables (more description of the data in the appendix). Students will be asked to regularly submit 12-hour ahead forecasts. The next day, true values are revealed, and the students receive their forecast scores and team ranks. The total rank at the end of the project is decided based on

a weighted average of four submissions throughout the course. Forecast evaluations will be in terms of MAE. Below are the deliverables:

- First forecast submission (only forecasts needed): 03/24/2024 midnight.
- Submission of Report #1: 03/31/2024 midnight.
- Second forecast submission (only forecasts needed): 03/31/2024 midnight.
- Third forecast submission (only forecasts needed): 04/14/2024 midnight.
- Fourth forecast submission (only forecasts needed): 04/28/2024 midnight.
- Submission of Report #2 (Final): 04/28/2024 midnight.

Your final MAE = $0.1 * MAE_1 + 0.2 * MAE_2 + 0.35 * MAE_3 + 0.35 * MAE_4$,

where MAE_i is the MAE of the i th submission during the course.

Project Grading Scheme:

	Individual Project	Project competition
Report #1	12 pts	25 pts
Report #2	25 pts	-
Forecast Accuracy	-	12 pts
Final report	50 pts	50 pts
Final presentation	13 pts	13 pts
Total	100 pts	100 pts

Appendix:

Motivation: The large-scale penetration of renewables (e.g., solar, wind) into the power grid necessitates accurate intra-day and day-ahead forecasts in order to predict, ahead of time, the generation levels from renewable energy assets. Such forecasts are extremely important to optimally operate renewable-dominant power systems (e.g., unit commitment, economic dispatch, market participation).

Further reading: Sweeney, Conor, Ricardo J. Bessa, Jethro Browell, and Pierre Pinson. "*The future of forecasting for renewable energy*." Wiley Interdisciplinary Reviews: Energy and Environment 9, no. 2 (2020): e365.

Variable Description:

DATE_TIME	Date/time information
AIRTEMP	Air temperature (Celsius)
RH_AVG	Humidity (%)
DEWPT	Dew point temperature (Celsius)
WS	Wind speed (m/s)
GHI	Global Horizontal Irradiance (W/m ²) measured from a horizontal pyranometer mounted on a sun tracker
DNI	Direct Normal Irradiance (W/m ²) measured from a horizontal pyranometer mounted on a sun tracker
DIFF	Diffuse Irradiance (W/m ²) measured from a horizontal pyranometer mounted on a sun tracker
POA	Plane-of-Array Irradiance (W/m ²) measured from a pyranometer that has the exact same tilting of the solar panels (W/m ²)