ISYE 7406 Project Proposal

Predicting Abnormal Grid Conditions

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Project Description

The stability of the electric grid is a complex and critical responsibility of many governmental and nongovernmental organizations across the country. One of these organizations is ISO New England (ISO-NE), a regional transmission organization and grid operator serving the New England region of the United States. Of course, keeping the grid operating normally is not always possible, but there are a number of well-defined factors that affect the operating capability of the electric system. Grid operators like ISO-NE keep close tabs on these factors and use these factors to anticipate abnormal grid events to prevent the ill effects of massive outages or unplanned surges.

Forecasted weather conditions, predicted energy demand, and planned outages are examples of data that these companies use to adequately plan their operations and ensure the stability of the grid. Using this public grid data, can we build a model to accurately predict future abnormal grid conditions?

Data Source

ISO-NE publishes a number of historic datasets to their public website. There are two datasets that will be useful for this analysis:

1. *Power System Status Archive*: every instance ISO-NE has declared abnormal system status. See footnote[1] for URL. The linked page contains hyperlinks to historical data for each year on record. Here, the data is then available for download as HTML or CSV. Specific power system statuses are described in detail on the ISO-NE website[2].
2. *Seven Day Capacity Forecast Archive*: historic weather, generating capacity, and demand forecasts. See footnote[3] for URL. This page provides HTML and CSV dataset downloads after navigating to a specific year and month.

Given the quantity of data files (at least one file for each day since 2017), one of our initial concerns is the retrieval of all of this data, which may need to be automated if not available in bulk from the website. We will also take care in cross-referencing historic datapoints across these files.

Research Questions and Methods

Primarily, we are interested in the ability to accurately predict abnormal grid conditions. Additionally, which factors are most important and provide the most predictive power in planning grid operations into the future? We will evaluate classification methods possibly including, but not limited to, logistic regression, k-nearest neighbors, or support vector machine.

[1] https://www.iso-ne.com/markets-operations/system-forecast-status/current-system-status/power-system-status-list
[2] https://www.iso-ne.com/markets-operations/system-forecast-status/current-system-status/alert-descriptions
[3] https://www.iso-ne.com/markets-operations/system-forecast-status/seven-day-capacity-forecast-list

Furthermore, we'll consider techniques for variable selection and, if applicable, handling multicollinearity. In dealing with public data from a primary source, we also may need to perform cleaning, imputation, or other data integrity tasks to produce a workable dataset.

We hope that the utility and impact of such a classifier is self-evident. Undoubtedly, there are professionals within these energy market organizations and regulating entities who build and update complex models every day; however, the open use and collaboration within this domain is valuable in building consensus and enabling strategic innovation and decision-making. With the challenges facing the evolving energy market and the widespread adoption of renewable energy, as extreme weather events grow more frequent and energy usage grows higher, predictability and planning for our electric systems are more important than ever.