Project Proposal Group 6

Aishanee Sinha
Ketki Maddiwar
Utkarsh Tripathi
Leela Prasad Dammalapati

Project Title:

Energy Consumption and Demand Forecasting in the US using EIA Dataset.

Abstract:

The project focuses on improving the accuracy of energy demand predictions in the United States using daily/hourly energy consumption data from the **U.S. Energy Information Administration (EIA)** via the **EIA Open Data API** and real-time weather data from **OpenWeatherMap**. We propose to forecast daily and peak electricity consumption based on historical data, weather conditions, and external factors. It involves data preprocessing, feature engineering, exploratory data analysis (EDA), and building predictive models such as Random Forest, ARIMA, and LSTM to generate accurate demand forecasts. These insights are crucial for optimizing grid performance, resource allocation, and preventing energy shortages. A pipeline will be developed to integrate real-time weather data, and an interactive dashboard will be deployed to visualize current and forecasted energy demand trends, correlations with weather patterns, and seasonal consumption shifts. This will enable U.S. energy providers to better manage power generation, reduce operational costs, and implement demand-response strategies during peak usage periods or extreme weather events.

Datasets:

1. **U.S. Energy Information Administration (EIA) Open Data**:
   - **Source**: EIA Open Data API
   - **Description**: This dataset provides historical and real-time electricity consumption data across various U.S. regions. Key attributes include **timestamp**, **region**, and **electricity consumption in megawatt-hours (MWh)**. It allows users to track demand patterns and analyze consumption trends over time.
2. **OpenWeatherMap API**:
   - **Source**: OpenWeatherMap API
   - **Description**: Real-time and historical weather data, including key variables such as **temperature**, **humidity**, **wind speed**, and **precipitation**. These factors are critical in understanding how weather conditions influence electricity demand, especially during extreme weather events.

Both datasets will be integrated to forecast energy demand based on consumption patterns and weather influences, enabling accurate predictions and improved grid performance.

References:

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6. Mosavi, Amir, Ramesh K. Aggarwal, and Taha M. Zayed. "A Comprehensive Review on Energy Demand Forecasting Techniques with a Focus on Machine Learning Models." *Energies* 12, no. 7 (2019): 1301. https://www.mdpi.com/1996-1073/12/7/1301.