Phase 2 Innovation

Introduction

In today's dynamic energy markets, accurate forecasting of electricity prices is crucial for utilities, traders, and consumers. The ability to predict future electricity prices with high precision can lead to significant cost savings and improved decision-making. Traditional time series forecasting methods are limited in their accuracy and often struggle to capture the intricate patterns in electricity price data. Therefore, this project aims to leverage advanced time series forecasting techniques, such as Facebook Prophet and deep learning models, to enhance the accuracy of electricity price predictions.

Problem Statement

Electricity prices are influenced by a wide range of factors, including supply and demand dynamics, weather conditions, market regulations, and geopolitical events. These factors create complex and non-linear patterns in electricity price time series data. Accurate forecasting is essential for energy suppliers to optimise their operations, traders to make profitable decisions, and consumers to plan their energy usage efficiently. Conventional forecasting methods, like ARIMA and Exponential Smoothing, may not provide the required accuracy due to their inability to capture the complexity of these patterns.

Objectives

The primary objectives of this project are as follows:

1. Implement advanced time series forecasting techniques to predict electricity prices.
2. Improve forecasting accuracy compared to traditional methods.
3. Develop a robust and scalable forecasting model that can handle large datasets.

Methodology

Data Collection

1. Gather historical electricity price data from reliable sources, such as market exchanges, governmental agencies, and industry databases.
2. Collect supplementary data, including weather data, market news, and geopolitical events, which can be used as exogenous variables in the forecasting models.

Data Preprocessing

1. Perform data cleaning and transformation to handle missing values, outliers, and inconsistencies.
2. Prepare the data for time series analysis, ensuring it is in a suitable format for modelling.

Model Selection

1. Facebook Prophet: Implement the Prophet forecasting model, a robust tool for time series data with daily observations that exhibit patterns on multiple time scales.
2. Deep Learning Models: Explore various deep learning models like recurrent neural networks (RNNs), long short-term memory networks (LSTMs), and hybrid models to capture complex dependencies in the data.

Model Training

1. Divide the dataset into training and testing sets to evaluate model performance.
2. Fine-tune the selected models and optimise hyperparameters for accuracy.

Model Evaluation

1. Use appropriate evaluation metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE) to assess the model's performance.
2. Compare the performance of advanced models to traditional methods for benchmarking.

Model Deployment

1. Deploy the selected forecasting model to predict future electricity prices.
2. Provide a user-friendly interface for users to access forecasts and visualise the results.

Conclusion

Accurate electricity price forecasting is crucial for various stakeholders in the energy market. By leveraging advanced time series forecasting techniques like Facebook Prophet and deep learning models, this project aims to improve forecasting accuracy and enable better decision-making. The proposed methodology outlines the steps required to achieve this goal, and the project timeline provides a roadmap for its execution. Upon successful completion, this project will contribute to the efficiency and competitiveness of the electricity market.