Time Series Forecasting for Electrical Load

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Importance

Energy forecasting is very vital in the enhancement of the operation of the power grid, minimizing energy wastage and even in the management of sustainable natural resources. The following project uses time series analysis to forecast the household electrical load with the help of a well-described data set and provides the analysis of consumption and seasonal trends.

What Do You Want to Do in General?

The project focuses on the creation of the effective forecasting models based on the analysis of time series data. These are the specific objectives to understand and interpret trends and seasonality of the data by decomposing the data into trend, seasonality and residual components. ARIMA, ETS, Seasonal Naïve and multiple linear regression models will be created and assessed to forecast future energy consumption, and the performance of the models will be evaluated with Root Mean Square Error (RMSE), Mean Absolute Percent Error (MAPE) and Mean Absolute Error (MAE). Box-Cox transformation and ADF tests will be employed to achieve variance stabilization and stationarity of the data which will in turn increase the robustness of the models.

What Did You Do So Far?

Data preprocessing:

We interpolated missing values to maintain continuity, combining Date and Time into a formatted datetime field, and structuring the dataset as a **tsibble** for efficient temporal analysis.

Exploratory Data Analysis (EDA):

Seasonal analysis revealed that submeter 3, associated with heating and cooling appliances, showed pronounced winter peaks, while submeters 1 and 2 exhibited similar seasonal trends, suggesting shared dependencies.

Correlation analysis revealed that there is a very high positive correlation of 0.99 between the global intensity and the global active power which shows that they are highly correlated and are good predictors. Moderate correlations were seen for the submeter readings which also help in feature selection.

Descriptive statistics indicated significant variability in global active power, guiding the future application of Box-Cox transformation for variance stabilization.

Additionally, the dataset was resampled to monthly frequency to simplify seasonal trend analysis and reduce noise in the minute-level data.

References

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