

Forecasting Building Energy Demand Using Time-Series Models

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Goal of the Experiment

- The goal of this experiment is to predict future building energy consumption based on past electricity usage data. The idea is to use historical power consumption measurements and apply a simple time-series forecasting model in order to estimate how much energy will be consumed in the near future.
- The experiment is focused on understanding how well classical time-series models, such as ARIMA, can be used for energy demand forecasting.
The system takes historical data as input and produces numerical forecasts of energy consumption as output.

Inputs and Functionality

- The main input to the experiment is historical household electricity consumption data collected over several years. The raw data contains minute-level measurements, which are first cleaned and then aggregated to hourly values.
- The model is trained on past energy consumption data and then used to predict future energy demand for the test period.

Expected Outputs

- Hourly energy demand forecasts
 - Numerical prediction values for future time steps
- A visual comparison between actual and predicted energy consumption

Evaluation Metrics

The success of the experiment is measured using standard regression error metrics:

- **Mean Absolute Error (MAE)**, which measures the average difference between predicted and actual energy values
- **Root Mean Squared Error (RMSE)**, which gives higher penalty to larger prediction errors

These metrics allow us to evaluate how accurate the forecasting model is.

Observed results:

- $MAE \approx 0.81$
- $RMSE \approx 0.93$

Dataset Description

- The experiment uses the *Individual Household Electric Power Consumption* dataset from the UCI Machine Learning Repository. The dataset contains electricity consumption measurements from a single household collected between 2006 and 2010. It includes more than two million records with one-minute sampling resolution. For this experiment, only the **Global Active Power** feature is used. The data is cleaned, missing values are removed, and the time series is resampled to hourly resolution before training the forecasting model.

Summary

- This experiment demonstrates a simple and practical approach to forecasting building energy demand using time-series models. The results show that even a basic ARIMA model can produce reasonable forecasts and serve as a baseline for more advanced methods.