Project 4: Measure Energy Consumption

PHASE-5 PROJECT SUBMISSION

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Objective:

The objective of this project is to create an automated system that measures energy consumption, analyzes the data, and provides visualizations for informed decision-making. This solution aims to enhance efficiency, accuracy, and ease of understanding in managing energy consumption across various sectors.

In this phase we concentrate on analyzing and visualizing the preprocessed data that we got from the previous phase.

Problem Statement:

Manual recording of energy consumption in houses may leads to minor errors or require time and human resource.Instead, a automated system like a software to monitor and measure day to day energy consumption in modern houses helps a lot.

Datasets Used:

All datasets are derived from kaggle link given in the project module

1.pjm_hourly_est.csv
2.PJM_Load_hourly.csv
3.PJME_hourly.csv
4.PJMW_hourly.csv
5.NI_hourly.csv
6.FE_hourly.csv
7.AEP_hourly.csv
8.COMED_hourly.csv
9.DEOK_hourly.csv
10.DOM_hourly.csv
11.DUQ_hourly.csv
12.EKPC_hourly.csv

Data preprocessing:

1.Data Inspection:

Begin by loading your dataset and taking a close look at its structure. Use functions like head(), info(), and describe() in Python's Pandas library to get a preliminary understanding of the data.

2.Handling Missing Data:

Identify the missing rows. Remove rows with missing values if they are relatively small in number and won't significantly impact the analysis. Impute missing values using methods such as mean, median, mode, or more sophisticated imputation techniques, like k-nearest neighbors or regression.

3.Handling Duplicates:

Check for and remove duplicate records, if any, as they can distort your analysis.

Visualization Techniques:

For visualizing the data we use basic level graphics plotting library Matplotlib,Seaborn for accessing various types of plotting and correlation heatmaps.

Design Thinking:

Proposed Energy Consumption Prediction Methodology:

Energy consumption prediction in residential building is extremely important; it assists the manager to preserve energy and to avoid wastage. we have proposed a methodology based on a deep extreme learning machine (DELM) for energy consumption prediction in residential buildings. We have divided the proposed method into four main layers, namely data acquisition, preprocessing, prediction, and performance evaluation. In the data acquisition layer, we have discussed the detailed data used in the experimental work. In the preprocessing layer, the moving average has been used to remove abnormalities from the data. In the prediction layer, the deep extreme learning machine (DELM) has been proposed to enhance the accuracy of energy consumption results. In the performance evaluation layer, MAE, RMSE, and MAPE performance measures have been used to measure the performance of prediction algorithms.

Innovative Techniques:

Deep Extreme Learning Machine (DELM):

The extreme learning machine (ELM) technique is a very famous technique and it has been used in different fields for energy consumption prediction. The conventional artificial neural network based algorithm requires more training samples, slower learning times, and may lead to the over-fitting of a learning model . The idea of ELM was first specified by Reference . The ELM is used widely in various areas for classification and regression purposes because an ELM learns very quickly and it is computationally efficient. The ELM model comprises the input layer, a single hidden layer, and an output layer. The structural model of an ELM is shown below, where p represents input layer nodes, q represents hidden layer nodes, and r indicates output layer nodes. We have planned to implement this technique in our project.

The python files for data preprocessing and visualization is been added to the github repository which we have shared.The required csv file is also provided in the github repository.