

Project 4: Measure energy consumption

Phase 1: Problem Definition and Design Thinking

Problem Definition

The problem at hand is to create an automated system that measures energy consumption, analysis 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

Design Thinking

To successfully solve this problem, we need to carefully plan our approach. Here's a step-by-step design thinking process for this project:

1. Data Source

Selecting the right dataset is crucial for creating an automated system that measures energy consumption, analysis the data, and provides visualizations for informed decision-making .

We can obtain this dataset from various sources such as PJM's website, BP statistical reviews of world energy and SHIFT data portal or platforms like kaggle .

2. Data Preprocessing

The data collected is analysed and pre-processed before it is used for model training and testing. Start by handling missing values, normalising numerical features and encoding categorical variables.

The more advanced methods presented were Multiple Imputation (MI) and Maximum Likelihood Estimate (MLE) . The Multiple Imputation method substitutes the missing data by gradually supplanting the missing data for every iteration made.

Maximum Likelihood Estimate conducts substitution through assumption made by initially identifying the parameters and boundaries based on the distribution of the data.

The imputation would then be made based on the assumed parameters. This method of imputation was employed by Probabilistic Principal Component Analysis (PPCA).

Clean outliers, address imbalances in the target variable (energy consumption), and split the dataset into training and testing sets. Ensure the preprocessing steps align with the requirements of the automated systems you plan to us.

3. Feature Extraction

Not all features are equally extracted for predicting automated system of energy consumption.

We should extract the most Relevant features to improve model accuracy and reduce complexity.

Techniques like feature importance Analysis and correlation analysis can be extracted to enhance the automated system of energy consumption measurement.

4. Model Development

This research has utilised Microsoft Azure Machine Learning Studio, which is a web service solution for the development of prediction model.

Starting from data analysis until performance evaluation, AzureML has been successfully employed for the implementation of energy demand forecasting.

Other than that, parsing data for experiment was simply done by joining of modules. Additionally, the platform also supports script packages and algorithms written in external programming language, particularly R programming.

5.Visualization

Visualization provides a unique perspective on the dataset.

Tables are very powerful when you are dealing with a relatively small number of data points.

They show labels and amounts in the most structured and organized fashion and reveal their full potential when combined with the ability to sort and filter the data.

6.Automation

The digital transition that drives the new industrial revolution is largely driven by the application of intelligence and data.

The deployment of new services in edge and cloud computing, virtualization, and software-defined networks requires a better understanding of consumption patterns aimed at more efficient and sustainable models and a reduction in carbon footprints.

Datasets also need to be created to analyze how to diagnose systems and sort out new ways of optimization.