Machine Learning Project Proposal
Title: Electricity Consumption For Household Appliances

Shivansh Mittal
shivansh20128@iiitd.ac.in

Rishabh Sharma
rishabh20236@iiitd.ac.in

Tushar Suredia
tushar20254@iiitd.ac.in

Niharika Singh
niharika21545@iiitd.ac.in

1. Motivation

In today's world, increasing energy consumption and its impact on the environment demand innovative solutions. Traditional methods of tracking household electricity usage lack granularity, failing to provide insights into specific appliance consumption patterns. This often leads to inefficient energy utilization and higher bills. Our project aims to address these challenges through advanced machine-learning techniques. By leveraging submeter readings and regression models, we can accurately predict and categorize electricity consumption by individual appliances. This empowers homeowners with precise insights, enabling them to optimize energy usage, reduce costs, and contribute to a more sustainable future.

2. Related Work

This problem has been already been approached in various manners:

1. Prediction of energy consumption by a passive solar building using neural networks [1] by S. A. Kalogirou and M. Bojic. The input parameters used for each pattern were a set of easily measurable values of season, insulation,masonry thickness and time of day.

2. Linear Regression model to forecast electricity consumption in New Zealand [2] by Z. Mohamed and P. Bodger. The model is based on multiple linear regression analysis, considering economic and demographic variables such as income level, race, employment, location, homeownership, and level of education.

3. Using support vector regression and ant colony optimization to predict power load [3] by D. Niu, Y. Wang and D. D. Wu. Based on SVRs have also been used together with other techniques to obtain better results in terms of prediction and avoid training with a large data set

3. Timeline

A Tentative 12 week timeline :
Week 1-2: Data Collection (including Scraping).
Week 3: Pre-processing and Data Visualization.
Week 4: Feature Extraction.
Week 5: Feature Analysis and Selection, Correlation analysis, outlier detection.
Week 6: Linear Regression, Support Vector Regression.
Week 7: Decision Trees, Random Forest.
Week 8: K- Nearest Neighbours.
Week 9: Analysis and validating the model.
Week 10: Hyperparameter Tuning, Check for model Overfitting and Underfitting.
Week 11: Interpretation the result and report writing
Week 12: Buffer.

4. Individual Tasks

Tasks	Team Member/s
Data Collection	Shivansh
Pre-processing and Data Visualization	Niharika and Rishabh
Feature Extraction	Tushar
Analysis of Features(Selection, correlation, heatmaps)	Rishabh and Tushar
Linear Regression and Support Vector Regression	Shivansh and Niharika
Decision Trees, Random Forest	Rishabh and Niharika
K-Nearest Neighbours	Tushar
Hyperparameter tuning, Check for Overlitting and Underfitting of models	Niharika and Shivansh
Best Model Selection and Report Writing	All

5. Final Outcome

Our project aims to harness the power of diverse machine-learning techniques to create an adept model for predicting household electricity consumption. By employing submeter readings from distinct appliances, our model endeavors to dissect energy usage patterns accurately, granting homeowners unprecedented insights into their consumption behaviors.

Upon culmination, we anticipate achieving a refined, high-performing model that maximizes prediction accuracy and provides a clear framework for identifying energy-hungry appliances and optimizing their usage. This outcome holds the potential to revolutionize energy management practices, offering individuals the means to curb wasteful consumption, trim expenses, and contribute to a greener environment. Furthermore, our model's versatility extends its applications beyond households, finding utility in sectors such as smart grid management and energy-efficient urban planning. Ultimately, this endeavor aspires to empower individuals and communities to make informed decisions, fostering a sustainable future and mitigating the ecological footprint of electricity consumption.

6. References

1 Artificial neural networks for the prediction of the energy consumption of a passive solar building by S. A. Kalogirou and M. Bojic

2 Forecasting electricity consumption in New Zealand using economic and demographic variables by Z. Mohamed and P. Bodger

3 Power load forecasting using support vector machine and ant colony optimization by D. Niu, Y. Wang and D. D. Wu