CS 271: TOPICS IN MACHINE LEARNING
PROJECT PROPOSAL

SMOKE DETECTION USING DATA OBTAINED FROM SENSOR FUSION

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I. ABSTRACT

The smoke detector is a device used to detect the presence of smoke caused by a fire. Traditionally, smoke detectors use either ionization or photoelectric sensors. Smoke detectors are prone to false alarms triggered by factors such as overcooked food, steam or dust build-up. They are also prone to sensor failure. Previous research on smoke detection involves image classification, however this also has low accuracy. The dataset used for this project consists of data collected by multiple sensors, including humidity/temperature sensors, gas sensors and air pressure sensors. By using ML techniques on the data obtained from sensor fusion, we can increase accuracy and decrease the occurrence of false positives. This could also potentially reduce the expenses of the fire department.

II. DATA

The dataset used in this project can be found at [1]. The data was collected by Stefan Blattmann using multiple sensors and then combining the data obtained from those sensors using linear regression-based sensor fusion. Blattmann used various scenarios for data collection such as normal indoor, normal outdoor, indoor wood fire, indoor gas fire, outdoor wood and gas grill, and so on. The data consists of 12 features and the corresponding labels. The labels indicate whether there was an actual fire in a sample or not. There are more than 50000 samples in the dataset.

During the project, we will use various feature engineering techniques such as imputation and scaling. We will also be using Principal Component Analysis to determine the features which are more significant in decision-making, and subsequently removing the features that are not important. These techniques will help in making our model more optimized.

III. TECHNIQUES AND RESULT ANALYSIS

The machine learning techniques that we will be using during the project can be divided into two categories: Classic Machine Learning techniques and Modern Machine Learning techniques. In classical machine learning, we will be using Support Vector Machines (SVMs), Logistic Regression, K Nearest Neighbor, Random Forest Classifier,

and Naive Bayes. Artificial Neural Networks (ANNs) will be used as a part of modern machine learning techniques. The results obtained from these models will be compared on the basis of following metrics: Accuracy, Precision, Recall, F1 Score, and area under the ROC curve. At the conclusion of the project, we will use Manhattan Distance based approach to rank the models.

References

[1] S. Blattmann, "Real-time Smoke Detection with AI-based Sensor Fusion," 03 08 2022. [Online]. Available: https://www.hackster.io/stefanblattmann/real-time-smoke-detection-with-ai-based-sensor-fusion-1086e6.