SMOKE DETECTION WITH SENSORS

USING MACHINE LEARNING

**Batch 2019**

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023-19-0049 Aftab Ahmed

023-19-0163 Ali Raza Younis Moughal

023-19-0125 Ammar Ali

Instructor: Dr. Faheem Akhtar

**Sukkur IBA University**

**Department of Computer Science**

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# Introduction:

**Every year, fire cause a huge loss everywhere. It damages the infrastructure of buildings which in turn causes great human losses. Therefore, the prevention of death by fire is a necessity. So, we are going to work on dataset of smoke detection for training a model for smoke detection. In machine learning, people are working on smoke detection domain. There are various methods that were used to detect. Smoke detection with detecting images from videos and applying algorithm to detect smoke but there were many drawbacks for that like visualization of images that can be somehow blurred and difficult to decide whether fire alarm should be called or not. That’s why, the system that contains trained model for smoke detection that will sense the smoke and output will be decided by system.**

# Problem Statement:

Smoke detector is one of the easiest and low costs. Most industries use it because it works fatly to protect and is most effective This system can be of great in domestic as well as industrial settings to detect smoke and alert people of an impending fire since smoke is a precursor for fire, instead of relying on heat/temperature sensors which sound alarm when the fire has already started.

# Dataset Discussion:

Collection of training data is performed with the help of IOT devices since the goal is to develop a AI based smoke detector device.  
Many different environments and fire sources have to be sampled to ensure a good dataset for training. A short list of different scenarios which are captured:

* Normal indoor
* Normal outdoor
* Indoor wood fire, firefighter training area
* Indoor gas fire, firefighter training area
* Outdoor wood, coal, and gas grill
* Outdoor high humidity
* Etc.

The dataset is nearly 60.000 readings long. The sample rate is 1Hz for all sensors. To keep track of the data, a UTC timestamp is added to every sensor reading.

# Experimental Evaluation:

## Methodology:

Before training the model, data pre-processing plays important role, so we will clean all the data by removing outliers and highly corelated features. Data will also be visualized with box and histogram plots. Outlier can be removed also with the help of visualization by understanding boxplots. After preprocessing, the model will be trained that will detect smoke. We will use multiple techniques like bagging and bootstrapping for training model. logistic regression, Naive Bayes, SVM, Decision tree and so on algorithms will be implemented for train data set. The best models will be selected for deployment after considers best metric of models.

## Test Results:

Firstly, the dataset was pre-processed with multiple technique. We visualized that there were some null values. We removed all the null values because this was not affecting the quality of dataset. We removed two columns id and UTC because ID was just used for numbering the rows and UTC was used for timestamps that was not more important for training. In visualization of box plots, we analyze that there were not any outliers. The data was not balanced the ratio was around 30 and 70 percentage so we applied the SMOTE technique for data imbalanced. There were four columns that were highly correlated above 90 so, those columns were deleted.

Finally, we applied some models for training dataset including ensemble techniques. All those gave the better accuracy. The accuracy table is shown below

* Logistic Regression => 0.99
* Decision tree => 0.94
* SVM => .99
* Linear Regression =0.98
* ANN => 0.99
* Gradient Boosting => 0.99

# Major Outcomes:

The Outcomes for out project are:

* Trained Model for Smoke Detection.
* Web Interface for Model Deployment.

# Conclusion:

Smoke detection algorithms that extract attributes from sensors and those values will be forwarded to trained model for predicting whether alarm should be beeped or should not be beeped. It will be most effective and works well to protect because the majority of industries will utilize it. Since smoke is a precursor to fire, this system can be very useful in home and industrial settings to detect smoke and warn people of an imminent fire rather than depending on heat/temperature sensors that only sound the alarm when the smoke will­­­ be detected.