Development of Machine Learning & Edge IoT Based Non-destructive Food Quality Monitoring System using Raspberry Pi

Link:
https://www.researchgate.net/publication/345991985_Development_of_Machine_Learning_Edge_IoT_Based_Non-destructive_Food_Quality_Monitoring_System_using_Raspberry_Pi\

Summary
This paper focuses on integrating a cost effective, user friendly and more adaptive edge IoT based food spoilage detection system where the researchers used several gas sensors for detecting alcohol, hydrogen, benzine, LPG etc. and Raspberry Pi with machine learning algorithm. The authors divided three food levels and observed tomato and banana for several days. The entire detection process is notified through a smartphone based alert system using a WiFi module after fetching data from the machine trained database.

Methodology

1. First of all, they collected tomatoes and bananas and observed them for several days, at the same time they collected pics for several stages of getting rotten.
2. Then, using Principle Component Analysis (PCA), Support Vector Machine (SVM) they analyzed the entire process.
3. After going through observation, the analyzed reports are sent to smartphones as an alert that clearly indicates whether the food is fresh or not.

Components

- Raspberry Pi 2 Model B
- LCD screen
- MQ 2, MQ 3, MQ 9, HTU21D gas sensors
- ESP8266 WiFi module

Equations
List of equations are given below:

- Euclidean metric,

$$d(x; c) = \sqrt{[}\ (xi\text{-}ci)2$$

- RBF kernel,

$$K(\mathbf{x}, \mathbf{x}') = \exp\left(-\frac{\|\mathbf{x} - \mathbf{x}'\|^2}{2\sigma^2}\right)$$

Findings
After handling missing data, data clustering, data virtualization using PCA, the analytics are calculated while using some algorithms. The accuracy rates of food spoil detection are 99.1% and 99.9% using Logistic Regression and Linear SVC respectively.

Novelty
In this paper, they have used several machine learning algorithms and gas sensors for achieving higher accuracy rate.

Algorithm Used
Four types of machine learning algorithm is used here:

- Logistic Regression
- Linear SVC
- rbf SVM Classifier
- Random Forest

Analysis
In the analysis phase, after implementing four types ML algorithms, they have found different accuracy rates from which we can choose the highest percentage used algorithm for detecting food quality and spoilage.

Research Gap
In this research, they used various methods of machine learning and different sensors, therefore the approach is not that much cost effective.

Problems Faced
Pictures of different stages of tomato and banana are not provided here for better visual observation.

Future Work
In the future, if it can use a cost effective approach, then surely the research can have a game chaining research project while making it more user friendly for industrial IoT devices.