- **Food Spoilage Detection Using Convolutional Neural Networks and K Means Clustering**
  (Link: https://ieeexplore.ieee.org/document/8979114)

Summary

This research paper encompasses food spoilage detection by observing the color change in spoiled food. Since most of the spoiled foods change color and appearance at the time, therefore, using artificial intelligence along with image processing with Convolutional Neural Network, k cluster algorithm (a machine learning algorithm) and Hue Saturation Value (HSV) can detect the spoilage percentage of food even it is a vegetable or fruit. This system is developed for reducing food poisoning issues as well as to help the colorblind people to identify whether food is safe to eat or spoiled as they can not differ within colors.

Methodology

First of all, after collecting pictures of fresh and rotten foods, then these photos are being processed through image processing (using CNN and k cluster algorithm) and Hue Saturation Value can detect the percentage of different colors. After that, researchers can come to a conclusion by analyzing the final highest color percentage and using HSV values that can detect the spoiled food percentage.

Findings

If Convolutional Neural Network along with k means clustering and HSV values are combined together for detecting food spoilage, then it is easier for us to find whether our food is fresh or not. Moreover, this will help colorblind people to detect spoiled food using this prototype.

Novelty

The innovative part of this paper is that they combined CNN and k means clustering algorithms with Hue Saturation Value (HSV).

Algorithm Used

Here, machine learning algorithms like k means clustering algorithm and Convolutional Neural Network is used for the entire observation.

Analysis

Here, they have analyzed some pictures of spoiled and unspoiled bananas, masoor lentils and unspoiled bread. They detected color codes from different areas of food skin using k-means clustering and found the spoil percentage by analyzing the highest percentage color code.

Research Gap

They only provide three types of food's k-means clustering here.

Future Work
In future work, they can use Gaussian elimination method for noise elimination from the collected dataset and they can use histogram equalization for enhancing picture size.