Food Quality Inspection and Grading Using Efficient Image Segmentation and Machine Learning-Based System

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Summary

In recent years, inspecting quality of food is extremely important for ensuring a good product, at the same time detecting rotten foods so that spoiled food can not contaminate fresh foods. Therefore, in this paper, for ensuring food quality inspection, the authours used image processing techniques with k means clustering and added Gaussian elimination method for removing noise from collected photos. Then in order to enhance the size of noise less photo, they used here histogram equalization and photos are being segmented using k means clustering and some other algorithms. From there, the researchers can identify which food is spoiled.

Methodology

Im this paper, first of all, they collected variety of datasets of foods. Then using Gaussian elimination, they remove noise from the photoes and then the size of these photos are being emhanced by equalizing the histogram. K means clustering is used here for breaking a photo into several segments to detect disease or other signs of spoiled food. After that, photos are classified using support vector machine (SVM) and KNN.

Equations

- Standard deviation using Gaussian function is,

$$\mathbf{G}(\mathbf{x}) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{(x^2/2\sigma^2)},$$

$$\sigma = \sqrt{\frac{\sum_i \left(X_i - \overline{X}\right)^2}{n-1}},$$

- The detection of sensitive negative results,

$$\text{sensitivity} = \frac{\text{TP}}{(\text{TP} + \text{FN})}.$$

- Analyzing specificity using TP/TN,

$$\text{specificity} = \frac{\text{TN}}{(\text{TN} + \text{FP})}.$$

- Analyzing accuracy using TP/TN,

$$\text{accuracy} = \frac{\text{TN} + \text{TP}}{(\text{TN} + \text{TP} + \text{FN} + \text{FP})}.$$

Findings
In this paper, they found a clear image dataset since they used Gaussian elimination method and histogram equalization. Moreover, by doing mathematical calcuation, they found the accuracy, sensitivity and specificity while inspecting a food quality.

Novelty
The novelty of this paper is, the authors implemented Gaussian elimination method along with histogram equalization for reducing noise and increasing image size respectively for image dataset.

Algorithm Used
They have used here k means clustering which is basically a machine learning algorithm.

Analysis
In the analysis segment, they analyzed pictures using image processing and then all these pictures are categorized using KNN (a classification algorithm that can detect an object using the closest training example).

Research Gap
The authors did not include any smartphone based system which people can use easily inside or outside of the cold storage.

Problems Faced
This paper doesn't provide any idea about which components are used during the research.

Future Work
If the researchers can integrate this system by using smartphones and if we can use this technology inside or outside of a cold storage, then there is a vast area for conducting more researches.