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Freshness Detection of Coconut via K-Means

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Abstract: ***Coconut is an essential food source in south Indian cuisine. Food stuff will be picked carefully. So this research is conducted to identify the freshness of the coconut, which is blameless. The identification can be achieved by features like, size, shape, color and texture of coconut image. These features of the image are extracted by Gray-Level Co-Occurrence Matrix (GLCM) and K-means is huddled the image via features. Entirely 361 images are captured and construct the image dataset. These images are grouped into three groups and obtained 97% accuracy.***
Keywords: GLCM, K-means, coconut image.

I. INTRODUCTION

An images is worth of thousand words. Human eyes are easily recognize the information through images instead of explaining with more details. Thus, computer vision is accompanied by machine learning algorithms to recognize the object quicker than human impeccably. Coconut is one of the most used stuff in our food especially in south India. So the freshness of coconut identification is needed one. This research focuses to identify the freshness of coconut. At first, researcher collects the images and process the images. GLCM features are obtained and these features clustered by K-means.

Number of research conducted previously. But most of them focused on ripening of coconut to pluck because of difficulties in climbing the tree. There related research work conducted before is reviewed and quote as follows. Aashna ahuwalia et al, [1] reviewed the research paper related to vegetable identification by image processing methods and feature of images such as color, shape and texture are used for classification. Hridkamol Biswas et al, developed an automatic recognition system to classify the vegetables using size color shape and weight [2]. Om Patil, et al, implemented Tensor Flow with the use of openCV as the main library database to identify the vegetables. Experiments proved that accuracy with 99% of identifying vegetables.

Remaining of this paper is structured as follows. The construction of image dataset and description are given in section 2. Clustering of coconut images by K-Means and result analysis are visibly explained in section 3 and 4 respectively. Section 5 concludes the paper with findings and future developments.

II. DATA SOURCE

Totally 361 images are collected to verify the coconut freshness. These images are collected from Pillaithoppu village which is one of the famous place to grow coconut in Kaniyakumari District, Tamil Nadu, India. This image dataset consists of three stage of coconuts. Coconuts take one year to fully ripen. The color of the coconut husk is good indication of ripeness. Immature coconuts are mostly filled with coconut water and bright green in color. The husk slowly turns into brown as known as fruits are mature. At peak maturity, when the coconut meat has hardened. The outer husk is solid brown throughout. Sample images of each stage is depicted in the Figure 1, 2 and 3. Also sample images in dataset is displayed in Figure 4. Next section describes the clustering by K-means in detail.

Figure 1: Immature coconut image

Figure 2: Mature coconut image

Figure 3: Peak mature coconut image

Figure 4: Sample dataset

III. COCONUT IMAGE CLUSTERING

This section portrays the clustering of coconut images using K-means algorithms. This research involves the following ladders to cluster the images. They are Capture image, Subtract the background, Extract the feature and Cluster the image. Collecting the images is explained in previous section. Then, remaining steps for single image are clearly depicted in Figure 5, 6,7 and 8. K-means clustering plays an important role in grouping the coconut images in the research. Before clustering the images, extraction of features are done by GLCM color feature. Gray Level Concurrence Matrix is used for texture features. In the GLCM number of rows and columns are same as number of gray levels of that image. GLCM is used for number of applications in image processing. Images in database are resized and convert both images into Grayscale. Then the Converted Grayscale images are transformed to binary image. In binary image, count the number of pixels concealed by the images by using GLCM feature.

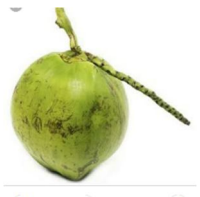

Figure 5: Original image

Figure 6: After removal of background

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Figure 7: Gray image

Figure 8: Segmented image

The color may be bright green with brown spots and total brown. K-means is the unsupervised learning algorithm also size and texture of coconut is different by their stage. K-means is applied to the features to group the coconut images. The above methods are repeated for all the images in the database. As a final point, K-means clustering is applied on images [4]. The steps in k-means are as follows:

A. Specify number of clusters K.
B. Initialize centroids by first shuffling the dataset and then randomly selecting K data points for the centroids without replacement.
C. Keep iterating until there is no change to the centroids.

The execution of K-means in MATLAB and result are enlightened in next section.

IV. RESULT ANALYSIS

The built-in K-Means is exploited MATLAB. The number of clusters are defined as three. The 361 images are grouped into three groups such as in mature, mature and peak mature. 61 images are immature, 150 images are mature and 150 images are peak mature in the dataset. After execution of K-Means in MATLAB, 361 images are split into 61 images, 150 images and 150 images to respective groups as shown in Table 1. This announces that k-means reached 97% accuracy perfectly.

Table 2: Experiment analysis of K-means on images

Group of coconut	No. of images	No. of images Clustered	Accuracy (%)
Immature	61	61	100
Mature	150	147	98
Peak mature	150	139	93
Overall Accuracy			97

K-Means is clustered the images perfectly because the images are distinct by features exclusively color. The color is unique for each group. Conversely, researcher magnificently completed this research with result finding. Next section clinches this article with possible tracks of future enhancements.

V. CONCLUSION

Finally we conclude this article in this section with the major findings of this research. The main goal of this research is to identify the freshness of the coconut by the images using its features. K-means clustering algorithm employed on the features to group the coconut image according to its category. There are three district clusters obtained by K-means and better accuracy is reached. But this research can be further implemented with more number of images by other algorithms and Deep learning methods also.

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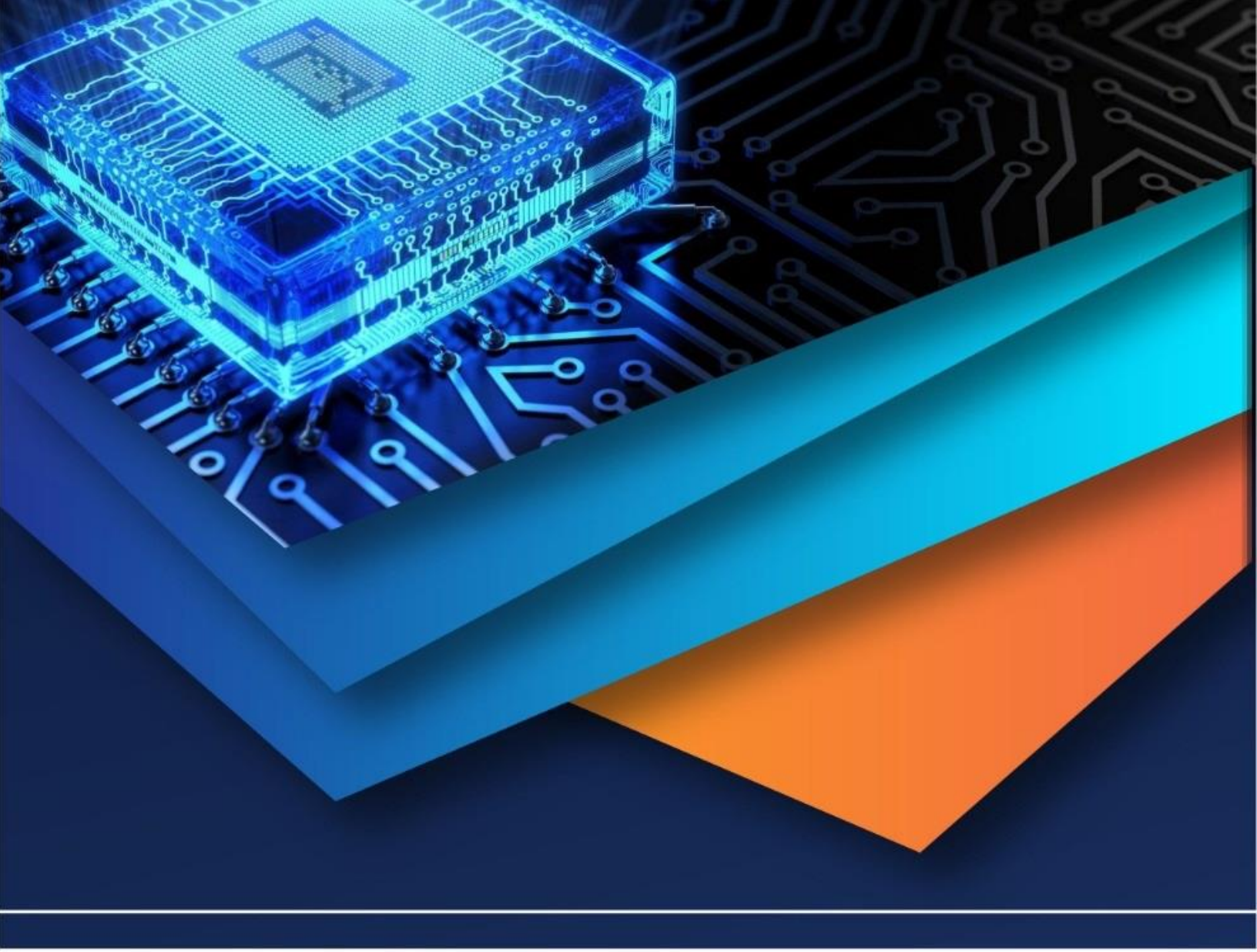

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