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Detection and Identification of Artificially Ripened Fruits using MATLAB

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ABSTRACT: In this paper, an efficient image processing technique is used to detect the artificially ripened bananas. Banana is an important fruit crop across the world. Nowadays to ripe the bananas, traders use many artificial methods (using chemicals). One of the artificial methods used is adding of calcium carbide. CaC2 contains the traces of arsenic and phosphorous which is the carcinogenic agent. The threshold based segmentation is used to segment the image from the bunch of bananas and some discriminatory features are extracted in frequency domain using Haar filter. Features are selected up to the third level of decomposition in wavelet domain and analysed of discriminatory behaviour. The variation in the features of the images is related to the difference between artificially ripened and naturally ripened bananas. These statistical features are then analysed and used for identification of artificially ripened sample in these samples using support vector machine classifier. The experimental results indicate that the proposed method is efficient for identification of artificially ripened bananas.

KEYWORDS: MATLAB.

I. INTRODUCTION

The fruits liberate ethylene gas augmented with respiration rate1 during the process of ripening. It is difficult to handle the ripe fruits as they are squashy and flimsy and they usually cannot endure the rigors during transport. Hence, these fruits are harvested in a fully mature state which is hard and green. Little quantity of ethylene stimulates the ripening process near consumption zones in a controlled environment of temperature and humidity. They include mango, guava, fig, apricot, banana, kiwi, apple, plum, pear and passion fruit. The other categories of fruits are non-climacteric fruits. They are harvested only when they are completely ripened. They do not react to ethylene treatment as they emit a tiny amount of ethylene. They include orange, grapes, litchi, watermelon, and blackberry.

II. LITERATURE REVIEW

In [1] this paper device gets an input image of mango under test and compares the features (histogram values) with a naturally ripened one and detects fruits which are ripened artificially. This method makes usage of the Smartphone which runs android application that is installed in it and the image processing is executed to detect the artificially ripened fruits. The proposed system has an efficiency of 91% in the identification of the fruits ripened.

In [2] this paper demonstration version of fruit sorting system and it is implemented on Raspberry Pi development board. This paper proposed and appraised the frame for the determination of the ripeness of tomato, estimation of size and shape and detection of defects of tomato. This work presents the novel incorporated technique for grading tomatoes based on their ripeness. The proposed approach used the concept of color detection algorithm for classifying tomato in three classes and K-mean clustering algorithm for detecting the defects in tomato and classifying them in defected class. The result analysis is able to accurately determine the ripeness of tomato. The modularity and distributed nature of approach makes the system easy to be upgraded in the future in order to increase quality standard.

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In [3] the thermal imaging is used for observing and fault diagnosis in electrical equipment. They used thermal camera for images of electrical equipment in experiments of no identical conditions, after that contacting with noise demonising, for image processing the segmentation and feature extraction is used, and then finally the analysis of image is generalized by using algorithms of artificial intelligence and check whether there is fault or not. In this the threshold segmentation technology is most widely used as compared to the detection edge segmentation or the segmentation method based on region. In electrical equipment's image they detect the abnormal heating condition. In feature extraction they extricate the images which were considered as fault, features those indicates the important characteristics and ancient. Ancient characteristics referan image characteristic which is perfectly not weak and does not depend on environment conditions. In Intelligent fault diagnosis methods they used neural network methods.

In [4] they used an Electronic based nose system, which recruit an array of in exorbitant trading tin-oxide fragrance sensors, have been used to analyse ripeness state of banana fruit. To define seven different regions in multisensory space according to the ripeness state of bananas an investigatory techniques and principal component analysis were used, to estimate the banana-skin colors from classification. In equipment of electronic-nose, the signals generated by sensors are organized such a pattern-recognition engine that permits system to analyse multiplex aroma. Neural Network has been used extensively to perform pattern-recognition. Today back-propagation-trained multilayer perceptron (MLP) paradigm is the more accepted pattern-recognition step in aroma inspection. Although, there is problem in aroma classification, because in some instance the Fuzzy ARTMAP paradigm outperforms MLP. Optimistic technique is another learning vector quantization (LVQ) technique; it is supervised technique which is based on (SOM) self organizing paradigm.

In [5] a thermal imaging technique is used for (PCB) Printed Circuit Board and their analysis is done using MATLAB. They have been taken a series of 20 thermal images which are stored in form of .png. These images are of the identical PCB in various conditions of thermal load. Particularly each image corresponds electrical operation. To aid the different characteristics of image analysis they also develop a tool based on MATLAB. Maximum area of peak temperature and the peak temperature variables are used for analysis those corresponds the regions with heat dissipation. MATLAB based tool is used to analyse all the images which are related to PCB and on the basis of that they also drawn useful conclusion accurately in much lesser time. On the basis of MATLAB the Graphical User Interface (GUI) is used for designer to choose censorious image to see temperature jump in between two images which are appreciably various temperature profiles. They used clustering based segmentation methods to select the region of interest should be permitted. For processing of thermal image of PCB's the standard methodologies of image processing are uses like color-based segmentation, histogram thresholding technique, image production difference, image into video conversion and histogram comparisons.

III.A SURVEY ON EXISTING METHODS IN PRACTICE FOR RIPENING OF FRUITS

There is no quicker and simple methods for uniform ripening of fruits available in the fruit industry which causes a major setback. The existing methods of ripening have their own pros and cons. There are numerous straightforward technologies are available nowadays for accurate ripening. The duration for ripening differs for different fruits under customary climatic conditions so as to make it edible. They include 1. Mango ripening in an air tight rice container. This is a natural process of ripening but not applicable on large scale. 2. Smoking inside smoke chambers using acetylene gas 3. The ripening means includes sheet of paddy husk or wheat straw. 4. The unripe fruits but attained full growth are dipped in 0.1 per cent ether solution13 and wiped dry and distributed over a newspaper or clean cloth without touching each other 5. In an air tight room, a vessel containing five litters of water is mixed with 10 ml of ether and 2 gm. of sodium hydroxide pills13 and placed near the fruits which acts asripening chamber. 6. Fruit ripening using calcium carbide

The artificial ripening agent includes the water dissolved calcium carbide which emits acetylene. When the fruits ripened with the above artificial ripening agent are consumed it affects the entire nervous system of a human as it reduces the oxygen supply to brain. Hence Prevention of Food Adulteration (PoFA) has forced harsh rules to abandon it. Similarly fruit ripening using Arsenic and phosphorus are poisonous and revelation may cause rigorous health vulnerabilities. Hence from this survey it is identified that ethylene gas of exact concentration under controlled temperature and pressure can be used for ripening process which is considered as a safe process. 3. Ripening Process

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Using Ethylene Gas The natural hormone Ethylene does not induce any side effects to the human community when consumed in large quantities over long periods1. This de-colouring hormone is capable of converting the green coloured chlorophyll in the fruits to yellow colour which indicates the carotene under optimal ripening conditions2.

The optimal conditions are listed in Table 1.

Sl. No.	Physical Parameters	Optimal Range
1.	Temperature	18 °C to 25°C
2.	Relative humidity	90 to 95%
3.	Ethylene concentration	10 to 100 ppm
4.	Period of handling	depends on fruit type and stage of maturity - 24 to 74 hours
5.	Air flow	adequate to guarantee circulation of ethylene
6.	Aeration	Adequate air exchange is necessary in order to avoid accumulation of O_2 which diminishes the result of C_2H_4.

The exposure to ethylene depends on price, expediency and security factors. It is safer to use diluted ethylene gas mixture rather than using concentrated ethylene. Pure ethylene is explosive and flammable in nature at 3% concentration. An airtight room kept at a constant temperature is used to place the fruits to be ripened.

Optimal ripening temperatures for a variety of fruits are given in Table 2.

Sl. No.	Name of the Fruit	Ethylene Concentration (ppm)	Ethylene exposure time (hrs)	Ripening temperature °C	Storage Temperature °C
1.	Avocado	10-100	12-48	15-18	4.4-13
2.	Banana	100-150	24	15-18	13-14
3.	Honey dew melon	100-150	18-24	20-25	7-10
4.	Kiwifruit	10-100	12-24	0-20	0.5-0
5.	Mango	100-150	12-24	20-22	13-14
6.	Orange degreening	1-10	24-72	20-22	5-9
7.	Stone fruit	10-100	12-72	13-25	-0.5-0

Fruits are exposed to ethylene in two ways. In trickle method, ethylene gas is dripped into room for the whole day to uphold a concentration of 10 ul per litre. Room is ventilated after that day to avoid 1% concentration of excess CO2 , since it would impede ripening. Fruits are packed in aerated bags which are facilitated by forced air circulation at controlled temperature when they are placed in a room that is poorly sealed. To ensure a uniform continuous flow of ethylene through the room, a small fan could be used. This type of forced-air ripening method affords further uniform temperature and ethylene concentration all through the ripening room. There is another safer method of ripening. Instead of using pure ethylene, ethylene produced by passing ethanol over a bed of activated alumina could be used for ripening. Care should be taken to ventilate the ripening rooms daily so as to ensure that Carbon Dioxide (CO2) levels do not exceed 1%

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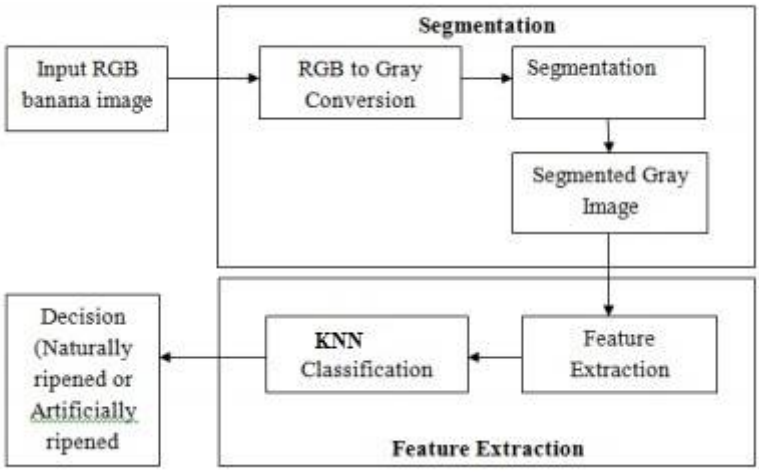
IV.THE PROPOSED METHOD

The primary objective of this work is to develop a fruit ripening quality monitoring system using fruit image analysis by colour image processing. According to the brightness value of the image pixels, the ripening characteristic parameters are picked up from the images. SVM classifier is used to classify between artificially ripened and naturally ripened bananas. Experiments performed indicate that the proposed method gives high accuracy using SVM classifier.

V. PRPPOSED METHODOLOGY

The image processing based method to differentiate between naturally and artificially ripened fruits involve feature extraction from segmented gray image of bananas followed by feature analysis of the coefficients of wavelet transform. To extract the identical area from banana bunches, a uniform portion of the image was segmented from the whole image. From this segmented gray scale image of bananas, different imaging features are extracted in spatial and in wavelet domain. These features are analysed to find the discriminatory behaviour between the different categories of bananas. Fig. 1 represents the flow of proposed method to differentiate between two categories of banana samples (artificially ripened bananas and naturally ripened bananas) using image processing.



2.1. Segmentation:

Image segmentation is an important process in many computer vision and image processing applications. It divides an image into a number of discrete regions such that the pixels have high similarity in each region and high contrast between regions. Properties like grey-level, colour, intensity, texture, depth or motion help to recognize similar regions and similarity of such properties, is used to construct groups of regions having a specific meaning. Image segmentation based on thresholding is one of the oldest and powerful technique, since the threshold value divides the pixels in such a way that pixels having intensity value less than threshold belongs to one class while pixels whose intensity value is greater than threshold belongs to another class

2.2. Feature extraction in spatial domain

The proposed method is to find difference between the categories of bananas i.e. natural and artificially ripened bananas. Statistical and texture features are extracted from segmented grey image of the banana sample. The extracted features are Mean, Variance, Standard Deviation, Contrast, Correlation, Energy, Homogeneity and the features obtained from grey-level co-occurrence(GLCM) matrix. Brief descriptions of these features are as follows:

2.2.1. Statistical features:

These include mean, variance and standard deviation. Statistical features of image in spatial domain are defined as the measure of variation in the intensity values of pixel in an image. Mean is defined as average of intensity of pixels in an

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image. Standard deviation of an image is defined as the measure of how spread out intensity values of pixels and variance is defined as the average of the squared deviations from the mean.

2.3. Grey-level Co-Occurrence matrix (GLCM):

An image is composed of pixels each with intensity (a specific grey level) and the Grey level co-occurrence matrix (GLCM) depicts how often different combinations of grey levels co-occur in an image. Texture feature calculations use the contents of the GLCM to give a measure of the variation in intensity at the pixel of interest.

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