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Defect detection in Mango fruit using Image Processing

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ABSTRACT

Image processing technology has been widely used in the agricultural field. Most of it is applied to the robot that can be utilized for picking fruit and for inspection vehicle. Defect detection is a major challenge for the computer vision to achieve near-human levels of recognition. The fruits and vegetable defect detection are useful in the supermarkets and can be utilized in computer vision for the automatic sorting of fruits from a set, consisting of different kind of fruits. The objective of this work is to develop an automated tool, which can be capable of identifying and classifying mango fruits based on shape, size and colour features by digital image analysis. However, defect detection by a human is labour-intensive and time-consuming. The proposed methodology is useful in supermarkets for automatic sorting of fruits from a set of different kinds of fruits. This system minimizes error and also speeds up the time of processing. The objective of this work is to present a novel method to detect surface defects of fruit using RGB images. The proposed method uses pre-processing, segmentation, edge-detection and feature extraction to classify the fruit as defected or fresh. MATLAB has been used as the programming tool for the identification and classification of fruits using Image Processing toolbox. The proposed method can be used to detect the visible defects, stems, size and shape of mangoes.

Keywords— *Mango Fruit, Image Processing*

1. INTRODUCTION

In recent years, many types of research have been done on fruit quality detection by using computer vision technology, and a lot of significant results have been obtained. There are many research reports, but so far they are in the experimental stage, and the analysis method is far from practical application. Particularly in defect detection, the current approach used to deal with very slow, cannot be used in actual online work. In processing the digital image, various phases are to be followed to extract the required information from the digital image. The phases of image processing are Pre-processing, Segmentation, Feature Extraction and Classification.

For deciding the overall acceptance quality for customers, the uniformity in size, shape and other quality parameters of fruits are required. Labour shortages and a lack of overall consistency in the process resulted in a search for automated solutions. The important aspects for the inspection of fresh fruits are colour, size and number of defects. The defect or damage usually occurs in fruits due to various factors such as rotting, bruising, scab, fungal growth, injury, disease etc. Proper care should be taken after the post-harvesting of the fruits. These defects must be removed to prevent cross-contamination and reduce subsequent processing cost. The primary objective of this work is to design an algorithm that can identify the defect and classify the fruit based on digital image analysis. A generalized block diagram of identification and classification of mango fruits is shown in figure 1.

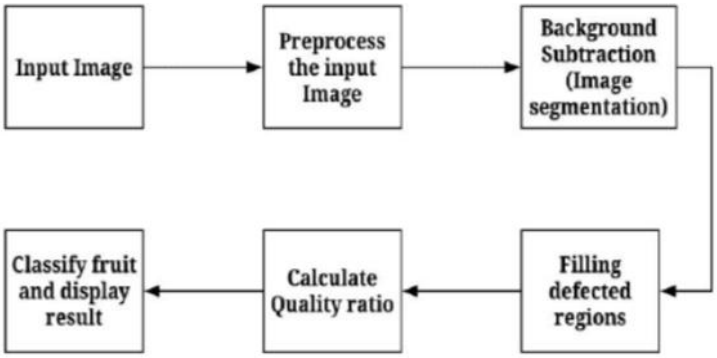

Fig. 1: Generalized block diagram

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2. PROBLEM IDENTIFICATION

To enhance the quality and quantity of agriculture product, there is a need to adopt new technology. Mango classification requires early and cost-effective solutions. Image processing approach is a non-invasive technique which provides consistent, reasonably accurate, less time consuming and cost-effective solution for farmers to manage fertilizers and pesticides. Some important factors and issues which are needed to be considered while the development of identification and classification method for mango fruit is listed below:

(a) Pre-processing: The images obtained during the image acquisition phase may not be appropriate for the identification and classification purpose. The captured image is an RGB image (true-colour image) and the captured image contains noise and noise produces some blurring, to remove the noise we perform pre-processing activities.

(b) Background subtraction: Background subtraction (segmentation) serves two purposes. The first purpose is to remove most of the background pixels for the determination of the coarse regions of the fruit. The second purpose is to determine whether pixels in the fruit have intensities less as compared to the intensities of pixels in the background. If so, reverse, increase the intensities of pixels in the fruit as compared to the intensities of pixels in the background. A foreground object (fruit) will be created which reduces the amount of data to be processed. This will improve the performance of the classifier.

(c) Feature Extraction: The area of fruit in the binary image is calculated which is the number of pixels in the white area total. Then, the total is divided by the pixel value (x*y) of the whole image, by which the area of the fruit relative to the image can be obtained.

(d) Classification of the fruit: After feature extraction, the defect detection is performed based on surface defect such as scars, spots, etc. The defected fruit is identified by creating a boundary of contours of a defective part on filtered fruit image and the contours are filled with white pixels to finds its area for the basis of judgement. After which the condition will be applied. If the ratio is greater than the set threshold value then the fruit defects otherwise, the fruit is fresh.

3. PROPOSED METHODOLOGY

Theoretically, the proposed algorithm involves three types of processing:

(a) Low-level processing: In low-level processing input image/dataset is pre-processed. Pre-processing includes RGB to grey conversion, image binarization, and image filtering.

(b) Intermediate-level processing: Intermediate level processing involves background subtraction, identification of defected region and filtering.

(c) High-level processing: Classification of mango fruit has been performed in high-level processing.

4. ALGORITHM

Step 1: Input the fruit dataset image to check the fruit.
Step 2: Pre-process the original image RGB by converting it into a grayscale image and binary image by thresholding.
Step 3: Filter the image to remove noise.
Step 4: Subtract the background from the pre-processed image.
Step 5: Perform edge detection and fill the defected parts.
Step 6: Calculate area and quality ratio of fruit image.
Step 7: Apply the condition and display the result.

5. CONCLUSION AND FUTURE SCOPE

Due to the growing demand for quality mango fruit, automatic and reliable identification and classification mechanism to handle the bulk of data are implemented. Algorithms were developed to identify and classify the mango fruit, based on single view fruit images and the mango fruits were categorized into two classes based on the quality ratio. If the value of the quality ratio is greater than the set threshold value, the fruit is rotten. On the contrary, if the value of the quality ratio is less than the set threshold value, the fruit is good. Hence using the proposed algorithm, one can able to sort the mango fruits based on the quality which is essential for value addition of fruits. Hence, using the proposed algorithm, sorting of fruits can be done based on quality. The system will have a good prospect of application in fruit size detecting and grading areas. The colour, perimeter, roundness, and percentage of defect features can be utilized in the future to enhance the accuracy of the algorithm.

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