

FRUIT MATURITY DETECTION

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Abstract: The project entitled as **FRUIT MATURITY DETECTION** is one of the android application for detecting the maturity of the fruit. The assessment of fruit quality is important for the cultivator and the consumer. In an existing system the maturity of the fruit is identified by many maturity detection methods, for example, usage of infrared rays or measuring the sugar concentration in fruits. The main drawback in the existing system is high cost and the method used may cause damage to fruits. Another method is detecting the maturity through its smell. But several immature fruits have no smell or bitter smell. It is therefore considered that sweet smell can be used for detecting the fruits maturity. In the proposed system a clustering algorithm is used for effective grading of the fruit by using parameters like color on the fruit's surface, weight of the fruit in grams, and size of the fruit. The grading analysis is done by capturing four different images of fruit with the help of mobile phone's rear camera, provided that the camera is digital with minimum 2.0 megapixels resolution for crystal clear images. The main purpose is to detect the defects in the outer skin of the fruit and categorize the fruit in various grading classes like average, good, moderate. Clustering algorithm offers effective grading with accurate, reliable, consistent and quantitative information apart from handling large volumes, which may not be achieved by employing human graders. The project is built using Java 7.1 as front end and SQLite 2 as back end.

Keywords: Defect Identification, Maturity Detection

1. Introduction

Fruits like mango is one of the world's favorite tropical fruits with increasing production trends every year. Fruits like mango is the most important fruit of India and is known as king of fruit. The Fruits like mango is cultivating in the largest area i.e. 4312 thousand hectares, and the production is around 15.03 million tons, contributing 40.48% of the total world production of Fruits like mango. India exports Fruits like mango to over 40 countries worldwide. Its physical appearance affects its value in the market, so, it is important to observe proper handling of fruits after harvesting. In general, the color of the fruit indicates its maturity and the presence of defects. In this work, an algorithm is proposed to automatically identify defect and maturity of Fruits like mango fruit using image processing. This framework can be applied in various areas like manufacturing companies, where Fruits like mango juices are produced and supermarket.

In recent years, many types of research have been done on fruit quality detection by using computer vision technology, and many 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 the defect identification and maturity detection,

This proposed work is an attempt to implement an extensively designed project based on the topics covered. The project involves a proposed problems and solutions with MATLAB (Matrix Laboratory) programming. Section 1 includes a brief description plans, motivation, the necessity of defect identification and maturity detection of Fruits like mango and purpose of this project. In Section 2, some related works are discussed. In Section 3, the problems are discussed which arise during Fruits like mango image analysis. Section 4 explains the materials and methods involved in the completion of the proposed work. In Section 5, Experimental results of proposed

the current approach used to deal with very slow, cannot be used in actual online work. Therefore, it is of importance to study the defect detection method suitable for production.

The process of grading of Fruits like mangoes relies on its physical characteristics. This process is presently done using manual labor and is substantially dependent on the human visual system. Fruit categorizations in agriculture have changed from traditional grading by humans to automatic classification over the past 20 years. Many companies are moving to automated classification in many crops such as grading on peaches and oranges [1]. The purpose of the study was to implement image-processing algorithms that can help in automating the process of Fruits like mango defect and maturity detection.

Demand from the consumer for quality produces, the consistent behavior of machines in compare with humans, the insufficiency of labor and attempt to reduce labor costs are the primary motivations of proposed system. The primary objective of this work is to design an algorithm that can identify defect and maturity detection of Fruits like mango fruits based on shape and size features by digital image analysis. In more detail, the research objectives are stated as follows. To develop an algorithm for image processing to identify defect and maturity detection of Fruits like mango fruits, and test and verify the analysis of image processing with experimental results.

work are discussed. In Section 6, conclusion and scope of future work are made. References are included in Section 7.

2. Related Work

The review of literature is accomplished very carefully and keenly towards the proper definition of the problem. Different methodologies are being investigated to propose and implement the present work. The reviewed literature has been classified into primary heads for the sake of the comprehensive analysis study such a classification shall help to study literature as per their context. Some of the

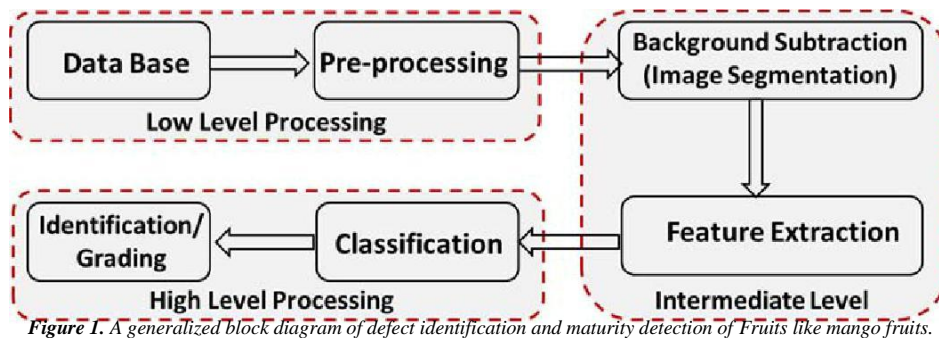
most important implementation of image processing in agricultural products is:

- (1) The image processing method for classification of orange by ripeness is developed. In this work, the proper degree of maturity is determined and based on that orange have been classified by histogram and morphological analysis. It uses standard CODEX benchmark, in that quality level of the commercial types of specified orange [2].
- (2) A fusion approach is implemented for multiclass fruit and vegetable classification task in the distribution center and supermarket. A novel unified approach has been introduced, to combine many features and classifier. This method requires less training of data than another method that combines features individually and fed separately to classification algorithm [3].
- (3) Using just one image feature to secure the class separability might not be sufficient, so it is necessary to extract and combine those features which are useful for the fruit and vegetable recognition problem. The result of the system depends upon the image segmentation method, so efficient image segmentation must be used. In the literature, available classifiers work on two classes only, but in the classification problem author considered more than two categories, so it is a major issue to use a binary classifier in a multiclass scenario [4].
- (4) An image processing based hybrid algorithm has been implemented for automatic identification and classification of fruits. The hybrid method relies on the techniques of Fourier descriptors (FD), spatial domain analysis (SDA) and artificial neural network (ANN) [5].
- (5) Machine vision has been introduced in a variety of industrial applications for fruit processing, allowing the automation of tasks performed so far by human operators. Such an important task is the detection of defects present on fruit peel which helps to grade or to classify fruit quality. In this paper, a hybrid algorithm, which is based on split and merger approach, is proposed for an image segmentation that can be used in fruit defect detection [7].
- (6) Variable lighting condition, occlusions and clustering are some of the important issues needed to be addressed for accurate detection and localization of fruit in orchard environment. This paper summarizes various techniques and their advantages and disadvantages in detecting fruit in plant or tree canopies. The paper also summarizes the sensors and systems developed and used by researchers to localize fruit as well as the potential and limitations of those systems [8].
- (7) Image processing is an efficient tool for analysis in various fields and applications in agriculture. Today's very advanced and automated industries used more accurate method for different inspection processes of agriculture object. This task is known as robotics task. In Indian agriculture industry, many kinds of activities are done like quality inspection, sorting, assembly, painting, packaging. Above mentioned activities are done manually. By using Digital Image processing tasks done conveniently and efficiently. Using Digital image processing many kinds of task fulfills like object Shape, size, color detection, texture extraction, firmness of purpose, aroma, maturity, etc. In this paper, various algorithms of shape detection are explained, and conclusions are provided for best algorithm even merits and demerits of each algorithm or method are described [9].
- (8) Seasonal fruits, like Fruits like mango, are harvested from gardens or farms in batches; the Fruits like mangoes present in each batch are not uniformly matured, therefore, sorting of Fruits like mangoes into different groups is necessary for transporting them to various locations. With this background, this paper proposes a machine-vision-based system for classification of Fruits like mangoes by predicting maturity level and aimed to replace the manual sorting system. The prediction of maturity level has been performed from the video signal collected by the Charge Coupled Device (CCD)

camera placed on the top of the conveyor belt carrying Fruits like mangoes. Extracted image frames from the video signal have been corrected and processed to extract various features, which were found to be more relevant for the prediction of maturity level [1].

- (10) This paper focuses on the automatic detection of the pomegranate fruits in an orchard. The image is segmented based on the color feature using k-means clustering algorithm. The K-Means algorithm produces accurate segmentation results only when applied to images defined by similar regions on texture and color. Segmentation begins by clustering the pixels based on their color and spatial features. The clustered blocks are then merged to a particular number of regions. Thus it provides a solution for image retrieval. Thus this paper proposed the simulation results that have been attained using the algorithm [10].

The literature survey gives a keen insight into the various



Some important factors and issues, which are needed to be considered while development of defect identification and maturity detection of Fruits like mango fruits using image analysis is listed below:

3.1. Background Subtraction

It is necessary to extract Fruits like mango from the cluttered



Figure 2. Variation of occlusion.

3.2. Feature Extraction

Shape – Region and boundary are two types of shape

studies done in the field of defect identification and maturity detection of Fruits like mango fruit. The study focused mainly on different methods and applications of Fruits like mango fruit defect identification and maturity detection system. A variety of methods has been suggested by the researchers to improve the performance of the scheme. This literature survey has provided useful insight into different techniques that can be utilized to plan design and development of the proposed method.

3. Problem Identification

To enhance the quality and quantity of the agriculture product, there is a need to adopt the new technology. Image processing approach is a non-invasive technique, which provides consistent, reasonably accurate, less time consuming and cost effective solution. A generalized block diagram of defect identification and maturity detection of Fruits like mango fruits is shown in “Figure 1”.

environment, so subtraction of background is essential for proper identification and classification of Fruits like mango fruits. Background subtraction also reduces the scene complexities such as shading, light variation, background clutter. “Figure 2” shows due to the severe occlusion; it is impossible to detect the Fruits like mangos even manually correctly.

description feature. Region-based features include grid-based and moment approaches, whereas finite element models, rectilinear shape, polygonal approximation and Fourier-based

shape descriptors are boundary-based shape features.

Color - Color value and degree of color distribution are measured based on R, G, and B color component ratio. Example: Color may be different for example; Orange ranges from being green to yellow, to patchy and brown.

Size - Size may be large, medium or small. It is measured from the maximum length or area or calculated volume from several images.

3.3. Classifier

In classification process different feature such as geometric and, non-geometric features need to be classified. So, it is necessary to address the issue of proper selection of classifier.

5. Result and Discussion

The proposed work is an extension of the recently published article [13]. The proposed algorithm is an attempt to make a simple and efficient tool for defect identification and maturity detection of Fruits like mango fruits using image processing.

6. Conclusion and Future Scope

Due to the growing demand of quality Fruits like mango fruit, automatic and reliable defect identification and maturity detection mechanism to handle the bulk of data are implemented. Algorithms were developed to identify defect and maturity the Fruits like mango fruit, based on single view images and the Fruits like mango fruits were categorized into 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 proposed algorithm, one can able to sort the Fruits like mango fruits quality which is essential for value addition of fruits. In future, color, perimeter, roundness, and percent defect feature can be utilized to enhance the accuracy of the algorithm.

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