

# Fruit Quality Inspection using Image Processing

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## ABSTRACT

*The recent application and development of image analysis in quality evaluation of products in the field of agricultural and food. Images are the important source of data and information in the agricultural sciences. The basic concepts and technologies associated with computer vision system and Automatic vision based technology, tool used in image analysis and automated sorting and grading is highlighted.*

*In India the ever-increasing population, losses in handling and processing and the increased expectation of food products of high quality and safety standards, there is a need for the growth of and objective and accurate, fast quality determination of food and agricultural products. Computer vision is a rapid, economic, consistent and objective inspection technique, which has expanded into many diverse industries. The process consist of speed and accuracy satisfy ever increasing production and quality requirements, hence aiding in the development of totally automated processes. The non-destructive method of inspection has found applications in the agricultural and food industry, including the inspection of quality and grading of fruit and vegetable.*

**Keywords:** *Image Processing, Fruit Analysis, Fruit Quality, Color, Shape and Size.*

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## INTRODUCTION

In today's world, we can see every of the system is getting automated and manual interference in the system becomes non-economical solution as well as an time consuming task. In case of fruits, its very much sensitive product as its food item and hygiene becomes the most important parameter while handling it. Through this project, we are going to put the automated fruit quality sensing, detection and acceptance or rejection of the product for further use or discarding purpose. This automated system is designed to overcome the problems of manual techniques, here the hardware model is designed using conveyor system.

In agri department science, images are the important source of data and information. To reproduce and report such data, photography was the only method used in recent years. It is difficult to process or quantify the photographic data mathematically. The image processing technology circumvent these problems based on the advances in computers and microelectronics associated with traditional photography. To improve images from microscopic to the telescopic visual range and offers a scope for their analysis. Several applications of image processing technology have been developed for the agricultural operations. These applications involve implementation of the camera based hardware systems or color scanners for inputting the images. The computer based image processing is undergoing rapid evolution with ever changing computing systems. The dedicated imaging systems available in the market, where the user can press a few keys and get the results, are not very versatile and more important, they have a high price tag on them. The aim of image processing and computer vision techniques in the food and farming industry.

## LITERATURE REVIEW

The study done by several researchers in the area of image categorization, fruit and vegetable classification, fruits recognition, fruit disease identification using images. Fruit and vegetable classification and fruit disease identification can be seen as an instance of image categorization. Most of the researches in the field of fruit recognition or fruit disease detection have considered color and texture properties for the categorization. Their work of fruit recognition is done with the fruits located on trees, but we restrict our self to the classification of fruits and vegetables amongst the several kinds of fruits and vegetables.

In this paper [1] to inspect and control quality, one must be able to measure quality-related attributes.

In this paper [2] due to the high moisture content in fruits and vegetables, water dominates X-ray absorption.

In this paper [3] the color grading is a crucial step in the processing of fruits and vegetables that directly affects profitability, because the quality of agricultural products is often associated with their color.

### 1. Assessment of Fruits

The quality inspection and grading of fruits and vegetables. It offers the potential to automatic and manual grading practices and thus to standardize techniques and eliminate tedious inspection tasks. [9] reported that the automatic inspection of produce using machine vision not only results in labour savings, but can also improve quality inspection objectivity. e.g. Apple, Oranges, etc.

#### 1.1. Apples

The study of apples using computer vision has attracted much interest and can reflect the progress of computer vision technology for fruit inspection. Computer vision has been used for such tasks as shape classification, defects detection, quality grading and variety classification. Paulus and Schrevens [14] developed an image-processing algorithm based on Fourier expansion to characterize objectively the apple shape so as to identify different phenotypes. In this research it was shown that four images per apple were needed to quantify the average shape of a randomly chosen apple. The segmentation defect of „Golden Delicious“ apples using machine vision. The segment defects, each pixel of an apple image was compared with a global model of healthy fruits and discriminants function sorted the apple as accepted or rejected[8,17].

#### 1.2. Oranges

Computer vision has been applied to the classification of oranges by reference to their visual characteristics. Ruiz et al. [16] They are three image analysis methods to solve the problem of long stems attached to mechanically harvested oranges. The techniques include colour segmentation based on linear discriminants analysis, contour curvature analysis and a thinning process, which involves iterating until the stem becomes a skeleton.

#### 1.3. Strawberries

Strawberry size, shape and fruit quality are dependent on a number of pre- and postharvest factors, hence variation occurs, necessitating the need for sorting.[12] investigated the use of computer vision to sorting fresh strawberries, based on shape and size .

### Quality Defined

The composite of those characteristics that differentiate individual units of a product, and have significance in determining the degree of acceptability of that unit to the user .It's a term which denotes a degree of excellence, a high standard or value. Instrumental methods of measuring appearance(size, shape), color in fruits and vegetables.

### Color

It may be determined using nondestructive methods founded on visual or physical measurements. These methods are based on evaluation of either the light reflected from the surface of a product or transmitted through it. There are three components necessary to the perception of color— 1) a source of light, 2) an object that modifies light by reflection or transmission and 3) the eye/brain combination of an observer .

## Appearance

Appearance factors other than color include the size, the shape, the wholeness, the pattern, the presence of defects, gloss, and consistency. Most appearance factors may be measured easily. Size may be determined either by dimensions, weight, or volume, and there is usually a good correlation between size and weight. Shape is actually a ratio of different dimensions to each other, for example the length/width dimensions may describe carrot shape. To determined either a visual or instrumental evaluation on the surface of a fruit or vegetable.

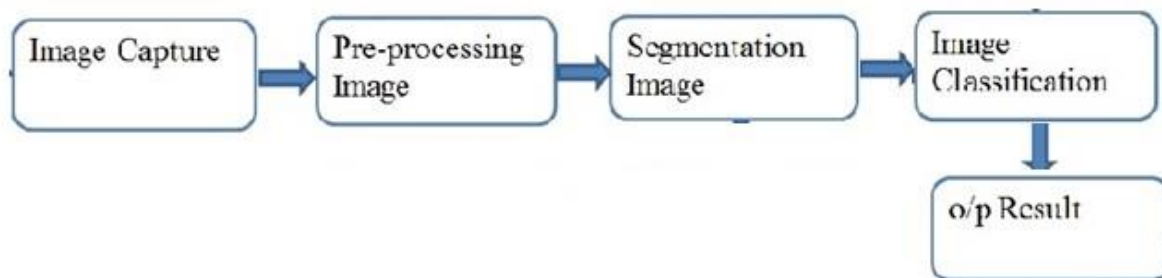
## Digital Image Processing

The digital image processing generally refers to processing of a two-dimensional picture by a digital computer. It is an array of real numbers represented by a finite number of bits. The principle advantage of Digital Image Processing methods is its versatility, repeat-ability and the preservation of original data precision. The various Image Processing steps used in project are,

1. Image Acquisition
2. Image pre-processing
3. Image Segmentation
4. Image Classification

### 1. Image Capture

First step of the image processing is explained below which is nothing but image capturing. Image capturing is done with the help of camera or scanner and we have used here VGA camera of 5mega pixels for this project. Technical details of the image capturing and data transfer are explained below. This block involves capturing an image. To Improving the lighting conditions in the room e.g. Apple, etc.



**Fig-1:** Image processing steps

### 2. Pre-processing image

Now after the capturing of the image, pre-processing is the next step of the digital image processing. Pre-processing is used for the conversion of the colour captured in the image for the system point of view from Binary to Gray code for further data processing.

### 3. Image Segmentation

Image segmentation is used for the segmentation of the colour to identify the colour difference in the fruits. So we are segmenting the data for the understanding of the system about the classification of the colours of fruits, as given below. the segmentation should stop when the objects of interest in an application has been isolated. The comparing image processing of pixel range ratio ( $a > 200$ ,  $a > 500$ ,  $a < 1000$ ).

### 4. Image Classification

Classification for the image is the nest step and used for the classification of the colour of the fruit depends on the data given by image segmentation part, on the basis of which further fruit colour is classified. Quality of fruit

detection method using classified is one of the most often used methods of information extraction. Image classification is the labeling of a pixel or a group of pixels based on its Binary to Grey value.

### Advantages and Disadvantages

The digital image analysis technology to generate precise descriptive data on pictorial information have contributed to its more widespread and increased use. Quality control in combination with the increasing automation in all fields of production has led to the increased demand for automatic and objective evaluation of different products. In agreement it found that a computer vision system with an automatic handling mechanism could perform inspections objectively and reduce tedious human involvement [11].

A human grader inspection and grading of produce is often a labour intensive, tedious, repetitive and subjective task [13]. In addition to its costs, this method is variable and decisions are not always consistent between inspectors or from day to day [17,7]. The computer vision inspection of food products to be cost effective, efficient and consistent. The computer vision has been used widely in agricultural and horticulture to automate many labour intensive process [16]. Computer vision is seen as an easy and quick way to acquire data that would be otherwise difficult to obtain manually [10]. Gerrard et al., [12] recognized that machine image technology provides a rapid, alternative means for measuring quality consistently. Another benefit of machine vision systems is the nondestructive and un-disturbing manner in which information is attained making inspection unique with the potential to assist humans involving visually intensive work [18]. Also if the research or operation is being conducted in dim or night conditions artificial lighting is needed.

### CONCLUSION

The paper reviews the given systems have been used increasingly in industry for inspection and quality evaluation purposes as they can provide rapid, economic, hygienic, consistent and objective assessment. The recently developed in automatic vision and computer vision for the agricultural and food industry. However the accuracy and quality requirements needed in this highly competitive and changing industry.

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