A Computer vision system to quality analysis of fruit for comparative analysis

Hassan Sardar

Research Scholar, Computer Science & Engineering

CMJ University

Shillong, Meghalaya, India

Department of computer science, Punjabi University

Baba Jogipeer Neighbourhood Campus Ralla Mansa, Punjab, India

E-mail: urshassu@yahoo.co.in

Abstract- **Computer** *vision systems are largely employed for automatically controlling or analyzing processes or activities in many industries like automotive, electronics, food & beverages, pharmaceutical, textile, one of the most popular applications of machine vision is to inspect qualities of produced goods based on form, color and presence of defects. A computer vision algorithm is a well defined list of steps for quality analysis of a spherical shape of a particular fruit. There so may application areas in computer science and engineering. One major purpose of this research paper to design a new updated algorithm to implemented in the MATLAB software in the application of food engineering , food science and food marketing so that enhance agriculture field with help of computer technology. I proposed an algorithm to quality analysis of fruit with the help of soft computing (i.e. image segmentation) & statically method using image processing. Different fruit images may have similar or identical color, size and shape values. Main aim of the research is to develop a new and efficient algorithm for identify the quality of fruits.*

Keyword: Visual examination, computer vision system, fruit color, pixel value, image analysis,

1. INTRODUCTION

Computer vision is concerned with modelling and replicating human vision using computer software and hardware. It combines knowledge in computer science, electrical engineering, mathematics, physiology, biology, and cognitive science. It needs knowledge from all these fields in order to understand and simulate the operation of the human vision system.

Biological images contain a wealth of objects and patterns, which may convey information about underlying mechanism in biology. Image processing and analysis provides a means to extract and quantify objects and patterns in image data and obtain answers to meaningful biological questions. It offers two advantages over traditional more manual methods of analysis [1]:

1) Human vision, while highly sensitive, can be easily biased by pre-conceived notions of objects and concepts; automated image analysis provides an unbiased approach to extracting information from image data and testing hypotheses.

2) Once an image-analysis routine is devised, it can be applied to a large number of microscopy images, facilitating the collection of large amounts of data for statistical analysis.

Non-destructive visual inspection for texture and/or color abnormalities has application on a variety of surfaces e.g. wood, steel, wafer, ceramics, and even non-flat objects such as fruits and aircraft surfaces, and is highly demanded by industry in order to replace the subjective and repetitive process of manual inspection. There are numerous reported works in the past two decades during which computer vision based inspection has become one of the most important application areas. This paper focuses on the recent developments in vision based surface inspection using image processing techniques, particularly those that are based on texture analysis methods. The visual inspection process often involves texture and/or color analysis and pattern classification (decision making) [2].

1.1 COMPUTER GRAPHICS:

Computer graphics are graphics created using computers and, more generally, the representation and manipulation of image data by a computer with help from specialized software and hardware. The development of computer graphics has made computers easier to interact with, and better for understanding and interpreting many types of data.

The term computer graphics refers to several different things [3]:

1. The representation and manipulation of image data by a computer
2. The various technologies used to create and manipulate images
3. The sub-field of computer science which studies methods for digitally synthesizing and manipulating visual content,

Figure 1. Show chart of color intensity of pixels (i.e. 256 x 256 dimensions)
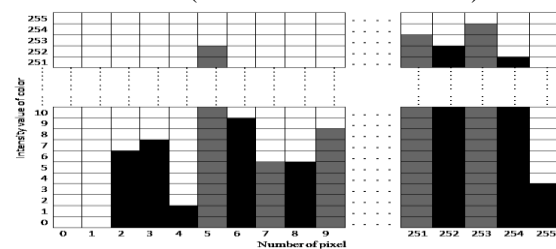
1.2 IMAGES TYPE:

The MATLAB consist of data matrix associated with colormap matrix. There are four types of images, which

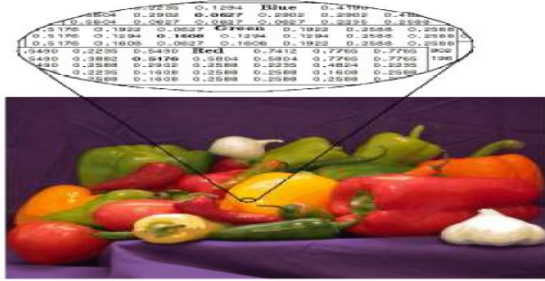are intensity images, binary images, indexed images and RGB images [4].
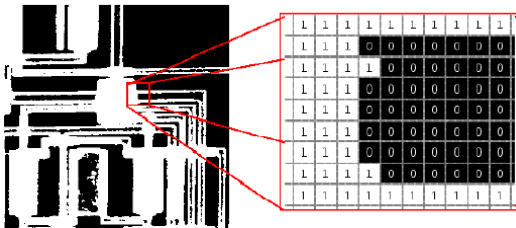

Figure 2 Shows the Intensity image.
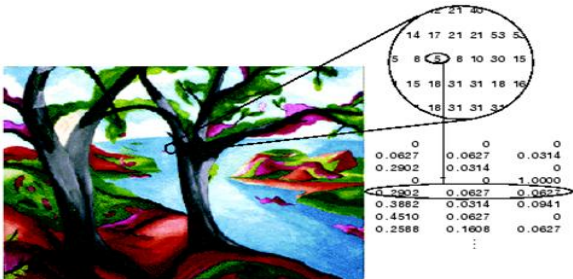

Figure 3 Shows the Binary image.

Figure4 shows the RGB image.

Figure 5: Show RGB color cube for a uint8 image.

RGB components in an image are proportional to the amount of light incident on the scene represented by the image. In order to eliminate the influence of illumination intensity, so called Chromaticity coordinates.An image is collection of different objects and all these object of image are collection of number of pixel further which have different intensity values of objects in the area of images. Numerically each pixel i.e. represent as ON & OFF pixels (which also help to measure size of fruit), if pixel value is zero i.e. is OFF (inactive) pixel and if pixel value 1to 255 i.e. ON (active) pixel, format pixel represent 1 bit which value can be 0 to 255 color intensity. According to above said a single pixel has 256 different quantities in color Red Green & Blue (RGB) and also in grayscale colored.
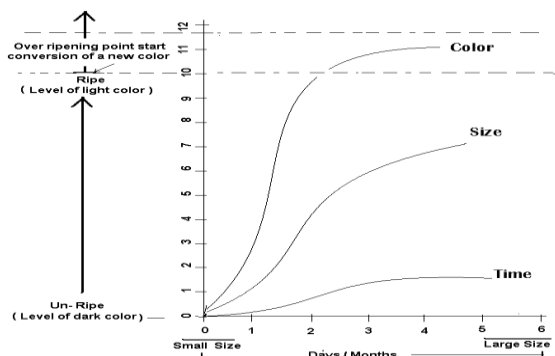

Figure 6: Show Changes in color, size and time.

In figure 6 represent the color level, size and Timining diagram which represents change in color conversion slightly start from level of dark to level of light color. During the same time period size of fruit also increase from small to large in a standard size after day-by-day movement and in months of a year.

Digital image processing focuses on following:

1. Improvement of pictorial information for human interpretation.
2. Proce
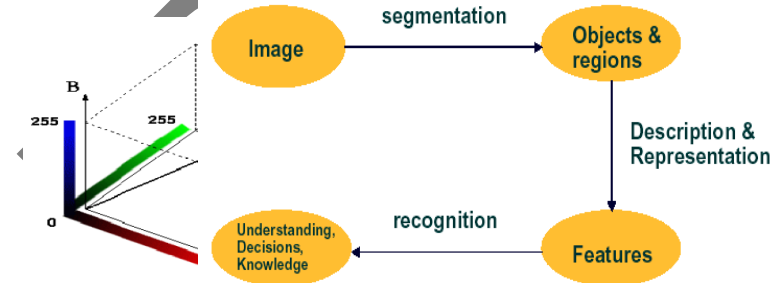
ssing
of image data for storage and transmission
3. Representation for autonomous machine perception
4. Processing images for measurement of the features and structures present

Figure 7: show Process flow of image segmentation

Image segmentation is to partition an image into meaningful regions with respect to a particular application. Object recognition is the task of finding a given object in an image. Segmentation algorithms generally are based on one of 2 basis properties of intensity values [5]:-

Discontinuity: to partition an image based on sharp changes in intensity (such as edges).

Similarity: to partition an image into regions those are similar according to a set of predefined criteria.
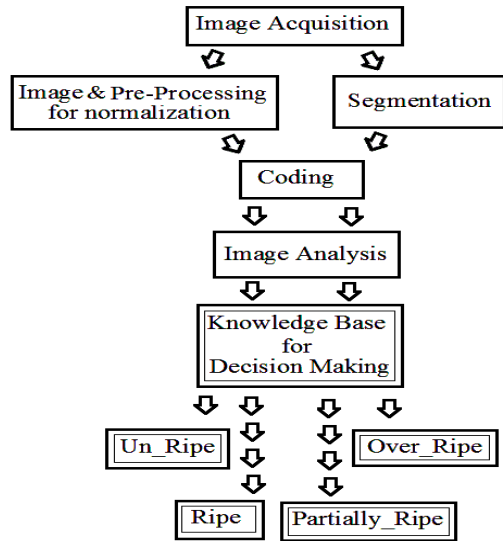
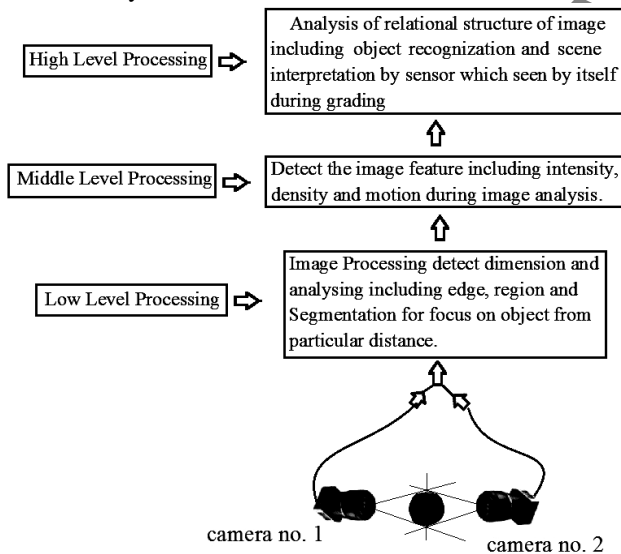**Figure 8**: Show activities in hierarchical flow of the system.

Figure 9: Show three level image processing with two cameras.

Images capture by camera no. 1 & 2

Figure 10: show 45th image by both camera

In the above sphere image is capture in two parts which are captured by camera no. 1 & camera no. 2 which helps to analysis color quality, quantities and intensity values of different pixel in these images which can further calculate the combined image value of a guava fruit

2 Objectives

The scopes of objective are to develop a complete system to undergo color detection before quality analysis and grading of the fruits by digital image. The whole system will be undergoes real time analysis as possible.The goal will be achieved through the attainment of following objectives.

1. To identify quality of fruits.
2. Development of a new & updated algorithm for quality analysis of fruits.
3. To compare the speed of identification for checking the quality of fruits with manual method.
4. To compile the research work in the form of Phd. thesis based on the results obtained.

3 Literature survey:

The mean color values of the fruit can be computed after the user crop the area of fruit in the fruit image. The system will compute the mean values for each of the red, green and blue (RGB) component of the cropped fruit area by manipulating and computing on the 3D matrices that stored all of the fruit pixels. Next the RGB values for each fruit pixel computed by using the mean function provided in MATLAB [6].

Soft computing is an emerging area of inter-disciplinary research, it refers to a collection of computational techniques which study, model and analyses complex phenomena. As many textile engineering problems are inherently complex in nature, soft computing techniques have often provided optimum solutions to these cases. Although soft computing has several facets, it mainly revolves around three techniques including artificial neural network, fuzzy logic and genetic algorithms [6]**.**

4. Research Methodology

4.1 INTRODUCTION

During analyzing for point or spot color measure, a mostly hardware solution is fine. So there main three types cameras can be used in computer vision machine application are following:

1. 3CCD. 2. Tri-Linear.3. Bayer pattern.

A complete computer system which supports graphical user interface (GUI) with latest good configuration is acceptable. For the image acquisition system that camera can be used which play an important role in the technology and methodology for implementation [7, 8] which also include as:

4.2 IMAGE PROCESSING & PRE-PROCESSING:

Image processing and pre processing involving changing the nature of an image and also filters typically, which are required to correct acquisition artefacts. Image processing is also acts for examine images for the purposes of identify objects and judging. For example Adobe Photoshop Element 8.0, paint and also can use color feature of MS- Word 2007/2010 for preprocessing in which we select only required object and remove extra portion of image so that can easily comparable with the all image of same category.
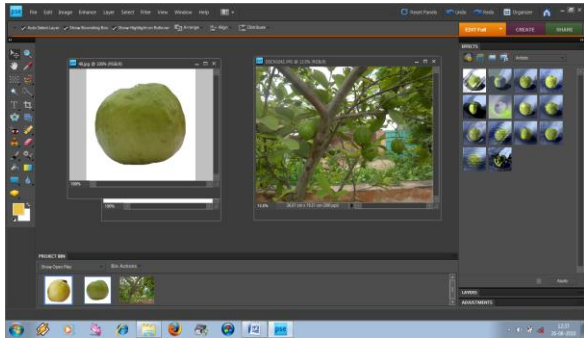
Figure 11: Show image processing and pre-processing system

4.3 Proposed Algorithm to analysis quality of fruit.

Prerequisite: [50 Reference Images], [camera], [computer system]

Step1:- i) Load 50 reference images of fruit.

ii) Pass all 50 reference images through color array to calculate image value by intensity value in the continuous series with help of step deviation method.

Step2:- i) Take new image of guava fruit.

ii) Pass it through color array to calculate image value by intensity value in the continuous series with help of step deviation method.

The following formula is used.

$$\text{Image Value} = \frac{f_1 * d_1 + f_2 * d_2 + f_3 * d_3 + \ldots\ldots + f_{32} * d_{32}}{f_1 + f_2 + f_3 + \ldots\ldots + f_{32}} * c$$

Where f_i = no. of pixels that belong to color intensity of pixels Class interval (32 spells)

d_i = step deviation of range between color intensity of pixels class interval

c = length of Class interval in color intensity of pixels

If image value match lie between 1 to 33 image.

Then

Result is un-ripe

Else if

Image value match lie between 34 to 40 images.

Then

Result is partially ripe

Else if

Image value match lie between 41to 45 images.

Then

Result is ripe

Else if

Image value matches with 46 and 50 image.

Then

Result is over ripe

Step3:- Repeat the Step 2 for next new image.

Step4:- Exit.

Example for implementation of purposed algorithm using 5x5 dimension (25 pixels) image of different color quantity & intensity and following formula:

$$\text{Image Value} = \frac{f_1 * d_1 + f_2 * d_2 + f_3 * d_3 + \ldots\ldots + f_{32} * d_{32}}{f_1 + f_2 + f_3 + \ldots\ldots + f_{32}} * c$$

Pixel & intensity value of Color b/w segments as follow:	f_i	m_i	$d_i = \dfrac{m_i}{c}$ $c = 8$	$f_i d_i$
01-07		4	0.5	
08-15		11.5	1.4375	
16-23		19.5	2.4375	
24-31	1	27.5	3.4375	3.4375
32-39		35.5	4.4375	
40-47	1	43.5	5.4375	5.4375
48-55		51.5	6.4375	
56-63		59.5	7.4375	
64-71		67.5	8.4375	
72-79		75.5	9.4375	
80-87	1	83.5	10.4375	10.4375
88-95		91.5	11.4375	
96-103		99.5	12.4375	
104-111		107.5	13.4375	
112-119		115.5	14.4375	
120-127		123.5	15.4375	
128-135		131.5	16.4375	
136-143		139.5	17.4375	
144-151		147.5	18.4375	
152-159	1	155.5	19.4375	19.4375
160-167		163.5	20.4375	
168-175		171.5	21.4375	
176-183	2	179.5	22.4375	44.875
184-191	2	187.5	23.4375	46.875
192-199		195.5	24.4375	
200-207	1	203.5	25.4375	25.4375
208-215		211.5	26.4375	
216-223		219.5	27.4375	
224-231		227.5	28.4375	
232-239		235.5	29.4375	
240-247		243.5	30.4375	
248-255		251.5	31.4375	
Total	**9**			**130.5**

A　$\text{Image Value} = \dfrac{f_1 * d_1 + f_2 * d_2 + f_3 * d_3 + \ldots\ldots + f_{32} * d_{32}}{f_1 + f_2 + f_3 + \ldots\ldots + f_{32}} * c$

$$= \frac{130.5}{9} * 8 = 116$$

Suppose sample image value is match with image value of reference image (bench mark as database) between any levels using proposed algorithm then result will be considered. Which is very useful in large database for same type category of a particular fruit?

5 RESULT DISCUSSION:

The proposed work is related to RGB color quantities which is analysis a digital images of a guava fruit using the help of computer vision system, human vision system and image acquisition system to measure quality standard level, intensity value and color recognition of visual

surface of different size of guava fruit from the digital images of same dimension that may be un-ripe, partially ripe, ripe or fully ripe (ready to eat) and also be a over ripe fruit (bad fruit). Further in this research work correct electronic nose and other resource can be used which can take big advantage in Agriculture business of food industry and food marketing.

Figure 12 show the following different sizes and shape of 50 references guava images.
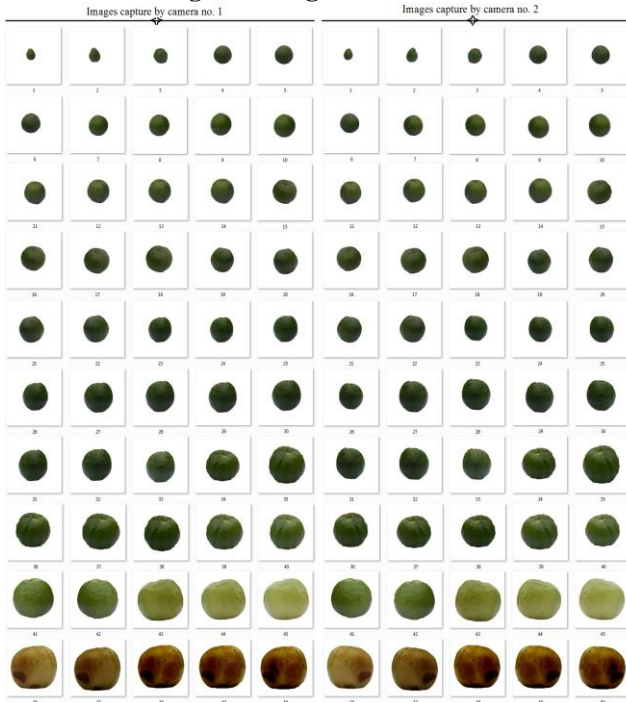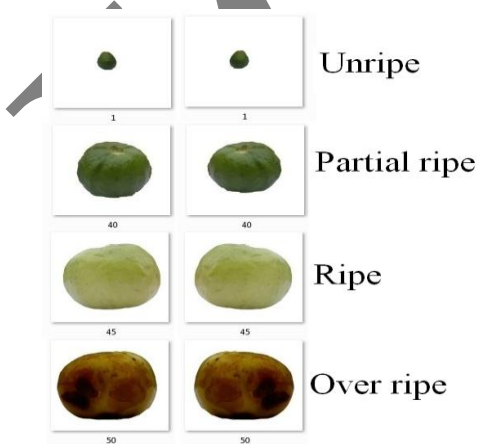

Figure 13 show the result sample after implementation

6 CONCLUSION:

   The proposed method reviewed & updated algorithm can implement using MATLAB. There are different 50 images were used as database of different size and shape, The proposed algorithm after implementation tells us about guava fruit i.e. un-ripe, partial ripe, ripe and over rip, further categorized fruit can be used to make different

products. This research can well work & also can implement in large scale industries where guava are used to make products as per customer and consumer demands.

7 FUTURE SCOPE:

 The proposed hassu algorithm can also be used for different size and shape of eatable fruits of different categoery, which may be possible have different own constraint according their attribute and parameters.

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