A Novel Approach to Detect Quality of Apple using Image Processing

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Abstract-*For a long time, checking quality of fruits and detecting their grade are done manually. Though this method is easy but the main disadvantage is that it consumes too much time for checking. There is also chance of error in this system. In our new technique, we are going to present a new system which can be used for checking quality of fruits and detecting their grade using image processing. This system is based on histogram processing and edge detection of the images of fruits. We have used three edge detection technique – Prewitt, Sobel and Roberts. It is simple process and can be used in the farmhouses where large no of fruits are checked every day. Apart from this, gradation of the fruits is also possible in this method and it takes less manpower. Using post processing technique, we can develop this system to identify the damaged area of fruit.*

Keywords-Histogram processing, Prewitt Edge Detection, Sobel Edge Detection, Roberts Edge Detection, Quality Checking

I. INTRODUCTION

There are many techniques used to check quality of the agricultural products by image processing. I Kavdir et al. has used Fuzzy logic as a decision making support to grade fruits [1]. Quality features like color, size and defects of fruits were measured through different equipment. Rosli et al. proposed a method that utilizes digital fuzzy image processing, content predicated analysis, and statistical analysis to determine the grade of mango [2]. Z. May et al. works on detection of ripeness of oil palm fruit. He used a new system of automatic grading system for oil palm fruit is developed using the RGB color model and artificial fuzzy logic using a computer and a CCD camera to analyze and recognize images [3]. Y Zhang et al. presented a novel classification method based on a multi-class kernel support vector machine with the required goal of accurate and fast classification of fruits [4]. M. Khojastehnazhand et al. described an efficient algorithm for sorting lemon fruits based on color and size and implemented in visual basic environment. According to their method, Images of fruits are captured by the digital camera are transferred to the computer through the video capture card and then images were digitized, and stored in the computer in RGB color space. A program was developed to capture and record the surface images of the fruits [5]. Alok Mishra et al presented a quality detection technique of fruits by canny edge detection method and K Means clustering technique [6]. S. S. Telang et al used both software as well as hardware to detect the quality of fruits more efficiently [7]. J P Gupta et al. presented a segmentation technique of fruit based on color features with K-mean clustering unsupervised algorithm [8]. D-J-Lee et al. implemented a color mapping technique to evaluate the quality of agricultural products like tomato. Color is used to determine the length of time the tomatoes can be transported and the type of dying process to ripen tomato. Color mapping technique converts a specified range of colors of interest in 3-D RGB color space into a smooth & continuous 1-D color space [9]. G S Gill et al launched a technique for this purpose using K Means algorithm [10]. We have also studied the review paper of S Banot et al. in this subject [11].

In our proposed technique, we have used images of good quality apples and rotten apples. After capturing the images of fruits, we have converted the color images into gray scale images. Then the gray scale images are transformed into histogram processing. The histograms of the images are analyzed and from this we can segregate the quality of the apples. In the second part of our work, we have used edge detection process. We have used three edge detection technique – Prewitt, Sobel and Roberts . No of edge is calculated from all images for processing and then decision is taken that which fruits are acceptable and which one should be rejected.

II. METHODOLOGY

Let us assume that three selected images of apples are f1(x, y), f2(x, y) and f3(x, y) respectively. f1(x, y) and f2(x, y) represent the images of good quality apples whereas f3(x, y) represents the image of rotten apple.

We know that in histogram processing the transformation function (processing technique) T is applied to an input image f(x, y) which gives the processed output image

$g(x, y) = T(f(x, y))$ ---------- (1)

The Histogram of the images $f_1(x, y)$, $f_2(x, y)$ and $f_3(x, y)$ are represented as $g_1(x, y)$, $g_2(x, y)$ and $g_3(x,y)$ respectively. So,

$g_1(x, y) = T(f_1(x, y))$ ---------- (2)

$g_2(x, y) = T(f_2(x, y))$ ---------- (3)

$g_3(x, y) = T(f_3(x, y))$ ---------- (4)

III. RESULT

We have worked on Matlab 2014 software. For our proposed work, we have selected four images of apple. Two of them is good quality apple whereas rest two are rotten or defected apple. The selected images of apples are represented in figure 1 (a-d).

Fig 1(a) Fig 1(b)

Fig 1(c) Fig 1(d)

Fig 1 (a – b) Good Quality Apples (c-d) Defected Apples

We have used Prewitt, Sobel and Roberts operator on each image of apple. The output of Prewitt edge detection is shown in Fig 2. Similarly output of Sobel and Roberts edge detection is shown in Fig 3 and Fig 4 respectively. Fig 5 represented the histogram of four apples.

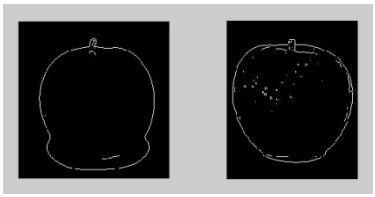

Fig 2(a) Fig 2 (b)

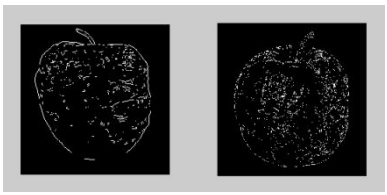

Fig 2(c) Fig 2(d)

Fig 2 (a – b) Prewitt Edge Detection of Good Quality Apples ;

Fig 2 (c – d) Prewitt Edge Detection of Defected Apples

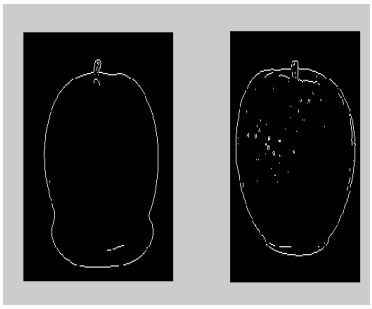

Fig 3(a) Fig 3 (b)

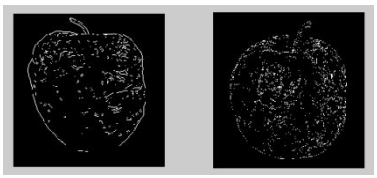

Fig 3(c) Fig 3(d)

Fig 3(a – b) Sobel Edge Detection of Good Quality Apples ;
Fig 3(c – d) Sobel Edge Detection of Defected Apples

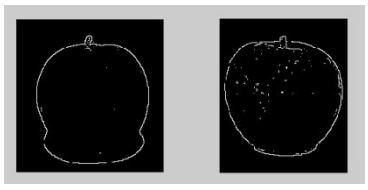

Fig 4(a) Fig 4(b)

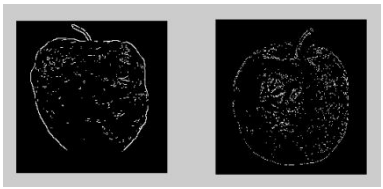

Fig 4(c) Fig 4(d)

Fig 4(a – b) Roberts Edge Detection of Good Quality Apples;

Fig 4(c – d) Roberts Edge Detection of Defected Apples

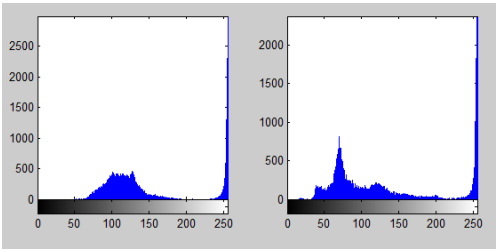

Fig 5(a) Fig 5(b)

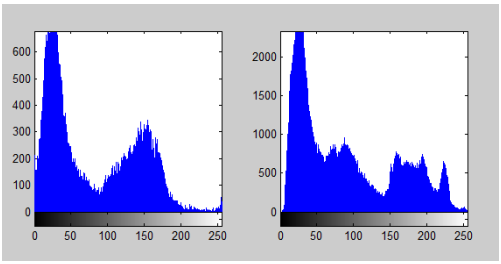

Fig 5(c) Fig 5(d)

Fig 5(a – b) Histogram of Good Quality Apples

Fig 5(c – d) Histogram of Defected Apples

IV. CONCLUSION

The above mentioned technique can be used to detect the quality of fruits by histogram and edge detection. In our experiment, we have used three edge detection technique: Prewitt, Sobel and Roberts respectively. In each case, we have observed that no of edges are too much in rotten or defected apples whereas it is too less for good quality of apples. During histogram processing, we have observed that in case of good quality apple, pixels whose values are near to zero is more than the value of pixels whose values are near to 255. In this way, we can isolate good and poor quality apples. By some post processing, we can improve the output. Artificial intelligency also gives better output which will be discussed in next part.

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