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Survey on Fruit Quality Detection Based on its Surface Colour

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ABSTRACT: Fruit import-export business covered huge market in today's world. There is demand for different fruits from different countries. Thus it is an important issue to check the quality of the fruit in order to have proper storage, transportation and their sales management. There are manual checking done at different level.

This method is proposed to identify the quality of the fruit by observing its surface color. In this method, the image of the fruit is taken extracting from its background. This image is taken using a camera with good image quality. The image is in RGB format. In order to achieve more accurate values the HSV features of the image is calculated. These values are then plotted on histogram. A BPNN (Back Propagation Neural Network) is used to train the system. The quality of the fruit is divided into two categories, good, average and bad. The system is trained to satisfy these parameters.

When the time of the prediction of the fruit, the HSV values of the fruit are calculated same way. Then these HSV values are compared with stored values according to the quality of the fruit. Thus the result is displayed according to the features matching the parameters.

KEYWORDS:fruit, quality inspection, color; image processing**,** BPNN(Back Propagation Neural Network), RGB image, HSV Values.

I. INTRODUCTION

Early detection can be performed visually by humans, however it may be nearly impossible to continuously monitor large amount of fruits without having some kind of automated system. In this context, image processing-based software capable of detecting the infestation using only the images provided by cameras. In this context, the system for automatic identification and detection of quality is proposed in the literature. This system is capable of identifying the quality of multiple fruits. Sometimes the image get loaded is taken in advance and sometimes it is taken at runtime.

This method is proposed to identify the quality of the fruit by observing its surface color. In this method, the image of the fruit is taken extracting from its background. This image is taken using a camera with good image quality. The image is in RGB format. In order to achieve more accurate values the HSV features of the image is calculated. These values are then plotted on histogram. A BPNN (Back Propagation Neural Network) is used to train the system. The quality of the fruit is divided into three categories, good, average and bad. The system is trained to satisfy these parameters.

In the studies about the effectiveness of different control strategies, normally several samples of fruits affected by different diseases have to be collected. Then these fruits are classified according to their condition. Therefore, an image processing based software capable of identifying the quality of the fruit could be very useful, especially in terms of speed, as this kind of software can process batches of images very quickly.

II. RELATED WORK

In existing system, the entire fruit quality detection work is carried out manually which is very hectic task. Farmers need to stand in a queue for a long duration in order to check there fruit quality by the market inspector and this can affect the fruit quality. As entire work is carried out manually, it is time consuming and inefficient.

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In order to verify the proposed method, experiments are conducted on fruit quality inspection. Images of apple at different status, are used to train the designed BP network. After training, the BP network is used to inspect the qualities of apple with their images. Showing that all inspecting results are correct.

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Disadvantages of Existing System:

If the image quality is not satisfies the criteria of system then it will be affect the result.

III.OBJECTIVES

1) The Objective is to maintain the qualityof fruits.
2) In this system time and cost consumption should be less.
3) Using ANN algorithm better accuracy can be achieved in quality detection.

IV. COLOR MODEL AND COLOR HISTOGRAM

A. The RGB Color Model

The RGB color model is one of widely used color models, as it is supported by commonly used tools related to color image, such as camera, scanner, etc. The RGB color model is an additive color model, which produces various colors by adding red, green, and blue light in various ways. As shown in Fig. 1, colors are represented in the RGB color model within a cubic volume defined by orthogonal Red, Green, and Blue axes. Black is at the origin of the coordinate system, and white is at the opposite corner of the cube. The diagonal connecting the black and white corners contains the range of neutral gray levels. It is very hard to extract hue and saturation information from the RGB color model.

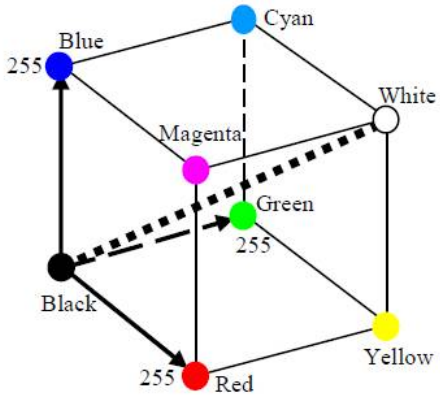

Figure 1. The RGB color model.

B. The HSV Color Model

For better identification of colour for a machine, RGB colour model is converted to the HSV colour model. In some cases, where colour identification plays integral role, the HSV colour model is often preferred over RGB colour model. RGB displays colour as a combination of primary colours whereas HSV displays as a combination of Hue, Saturation and Value.HSV have cylindrical geometry, with hue, their angular dimension, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. In

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this geometry, the central vertical axis comprises grey colours, ranging from black at lightness 0 or value 0, the bottom, to white at lightness 1 or value 1, the top. In this geometry, the additive primary and secondary colours red, yellow, green, cyan, blue and magentaand linear mixtures between adjacent pairs of them, sometimes called pure colours are arranged around the outside edge of the cylinder with saturation 1; in HSV these have value 1. In HSV, mixing these purecolours with white producing so called tints reduces saturation, while mixing them with black producing shadesleaves saturation unchanged.

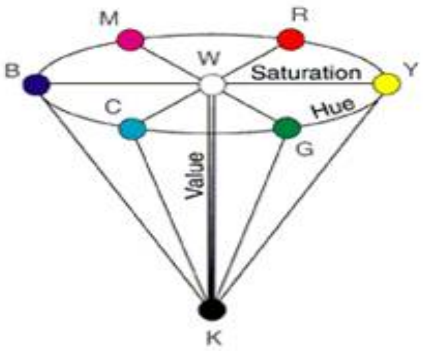

Figure 2. HSV color model

The RGB to HSV conversion can be carried out by following method.
The R, G, B values are divided by 255 to change the range from 0.255 to 0.1:

R' = R/255
G' = G/255
B' = B/255
Cmax = max(R', G', B')
Cmin = min(R', G', B')
Δ = Cmax – Cmin

Hue calculation:

$$H = \begin{cases} 60° \times \left(\frac{G'-B'}{\Delta} mod 6\right) & , Cmax = R' \\ 60° \times \left(\frac{B'-R'}{\Delta} + 2\right) & , Cmax = G' \\ 60° \times \left(\frac{R'-G'}{\Delta} + 4\right) & , Cmax = B' \end{cases}$$

Saturation calculation:

$$S = \begin{cases} 0 & , C_{max} = 0 \\ \frac{\Delta}{C_{max}} & , C_{max} \neq 0 \end{cases}$$

Value calculation: V = Cmax

C. Color Histograms

In image processing, a color histogram is the representation of the distribution of colors in an image, which is derived by counting the number of pixels of each given set of color ranges in a color space. Color histograms are useful tool in color image processing, which are defined as:

$$h_{A,B,C}[r_1, r_2, r_3] = N \bullet P\{A = r_1, B = r_2, C = r_3\},$$

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Where A, B, and Crepresent the three color channels (R, G, Bor H, S, V); *N* is the total number of pixels in the image; *P* is probability; *r1*、*r2*、*r3* are the color values. Only the histograms of H and S are used in this paper for fruit quality inspection because intensity makes no contribution to the color in the HSV color model. As an example, the normalized H and S histograms of the image.

V. FRUIT QUALITY DETECTION METHOD

A. Background Separation:

It is obvious that the histograms of H, S and V represent the whole color property of the image in Fig. 3, not the exact surface color of the banana. This may lead to incorrect inspection result. Hence, color image segmentation is used in this paper for background separation.

Figure 3. The image of an Apple

In computer vision, image segmentation is the premise and key of visual identification, and the segmentation result influence subsequent processing directly. Color is one of important features used for image segmentation. For background separation in this paper system uses the following operations as shown in figure 4. (a), (b) and (c):

Fig. 4(a). Blurring Operation

Fig. 4(b). Gray Scale Operation

Fig. 4(c). Sobel Edge Detection Operation

Figure 4. All background separation operations.

B. Fruit Quality Inspection

For inspecting the quality of fruits using their surface color, a BP neural network is used in this paper, which is one of powerful bio-inspired pattern recognitions in many researches and applications, and can accurately establish the mapping between the input and output variables.

A BP neural network has a multi-layer architecture, with one input layer, one output layer, and one or more intermediate layers. In this paper, one intermediate layer is adopted.

The number of neurons in the intermediate layer *p* depends on the numbers of neurons in the input layer and theoutput layer as follow:

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$$p = \sqrt{n+m} + a,$$

Where *n* is the number of neurons in the input layer;
*m*is thenumber of neurons in the output layer,
and*a* is a constantbetween 1 and 10. So,
*p*is lager or equal to 6, and smaller orequal to 15.

To select a suitable number for *p*, the BP network is trained with different number of *p*, ranging from 6 to 15. It gives the relationship between the error of the BP network and number of neurons in the intermediate layer. *p*is determined to be equal to 6. The designed BP network is depicted.

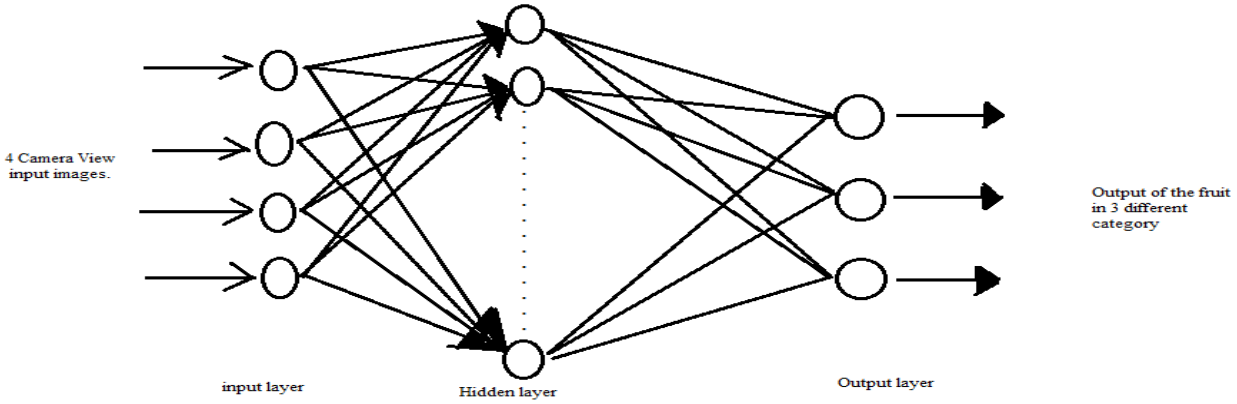

Figure 5. BPNN

VI. PROBLEM DEFINITION

To developa system for fruit quality detection based on its surface color using ANN algorithm which is gives the best result to the market in uses of less human resources.

VII. PROPSED SYSTEM MECHANISM

In order to verify the proposed method, experiments are conducted on fruit quality inspection. Images of apple at different status, are used to train the designed BP network. After training, the BP network is used to inspect the qualities of apple with their images. Showing that all inspecting results are correct.

We suppose that our model is composed of three qualities: a good quality fruit, average quality fruit and bad quality fruit. The quality of the fruit is pre-defined in ANN.

A user can get data/image input from camera as well as can load through the system memory. The all algorithm will be apply on the fruit images. If the input is new to system then it must be train by the user to the system and if not then the all the appropriate result will be shown to the user.

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VIII. SYSTEM ARCHITECTURE

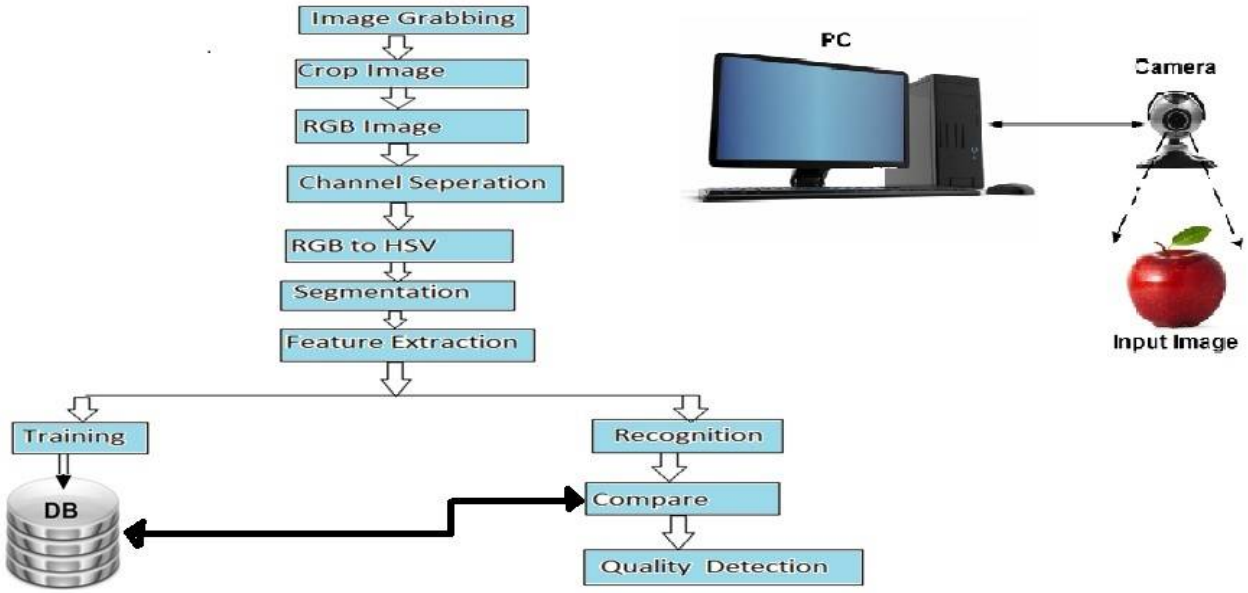

Figure 6. System Architecture

IX. RESULTS

In this section system will gives the output depending on the user input in three categories as Good, Average and Bad respectively.

In order to verify the proposed method, experiments are conducted on apple quality inspection. Images of bananas at different status, some of them given in Fig. 7, are used to train the designed BP network. After training, the BP network is used to inspect the qualities of apple with their images. Some of experiment results are tabulated in Table 1, showing that all inspecting results are correct.

Fig. 7(a): Quality Level Value 1

Fig. 7(b): Quality Level Value 2

Fig. 7(c): Quality Level Value 3

Figure 7: Three different apple qualities.

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SOME EXPERIMENT RESULTS:

This tableshows the comparison between human eye result and system result which determined using ANN algorithm.

No		1	2	3
Images				
BP Network Output	Good Part	62.333333333333336%	30.40495867768595%	3.487179487179487%
	Average Part	37.17948717948718%	68.8099173553719%	5. 214923966942149%
	Bad Part	1.487179487179487%	2.785123966942149%	92. 7179487553719%
Actual Quality Level		1	2	3
Measured Quality Level		1	2	3

TABLE I. SOME EXPERIMENT RESULTS

X. CONCLUSION

Fast fruit quality inspection method is useful and important. In this paper, a fruit quality inspection method is proposed using the surface color of fruits as inspection parameter, which is both nondestructive and non-invasive. After a color image of fruits is taken, it is changed from the RGB color model to the HSV color model. The image is then background separation is done using blurring, gray scale and sobeledge detection operation. For convenience, simplified histograms of hue H and saturation S and value V of fruits' surface color are calculated and input into a designed BP neural network with three layers. The output of the BP network is the quality inspection results of the fruits. Quality inspection experiments of apple are conducted to verify the proposed method with satisfied results. It is shown that the proposed method is feasible and reliable.

REFERENCES

[1] Yizhong Wang, Yanhua Cui, George Q. Huang, Ping Zhang, Shaohui Chen, "Study on Fruit Quality Inspection Based on Its Surface Color in Produce Logistics", in International Conference on Manufacturing Automation,2010.
[2] Alberto Martin and SabriTosunoglu, "IMAGE PROCESSING TECHNIQUES FOR MACHINE VISION ", in Florida International University Department of Mechanical Engineering 10555 West Flagler Street Miami, Florida 33174.
[3] Yu-Hsiang Wang,"Tutorial: Image Segmentation", in Graduate Institute of Communication Engineering National Taiwan University, Taipei, Taiwan, ROC.
[4] Anil K. Jain, Jianchang Mao, K. M. Mohiuddin "Artificial Neural Networks: A Tutorial", in March 1996.
[5] N. R. Pal and S. K. Pal, "A review on image segmentation techniques,"Pattern Recognition, vol. 26, no. 9, pp. 1227-1294, 1993.
[6] Sung-Hyuk Cha, "Comprehensive Survey on Distance/Similarity Measures between Probability Density Functions ",in Computer Science Department, Pace University, 861 Bedford rd, Pleasantville, NY 10570 USA.
[7] Shiv Ram Dubey, Pushkar Dixit, Nishant Singh, Jay Prakash Gupta, "Infected Fruit Part Detection using K-Means Clustering Segmentation Technique", in Dept. of Inform. Tech., Dr. M.P.S Group of Institutions College of Business Studies, Agra, India, Dept. of Comp. Engg. & Applications, Poornima Group of Colleges, Jaipur, India, Systems Engineer in Infosys Limited, Bangalore, India.
[8] Y. M. Geng, "Forecast Model Based on BP Neural Network," Journal of Guang Dong Communications Polytechnic, vol. 6, pp. 46-48, 2007.

BIOGRAPHY

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