Identification of quality index of fruit/vegetable using Image Processing

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ABSTRACT

The recent application and development of image analysis in the 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, a tool used in image analysis and automated sorting and grading are highlighted. The proposed system starts the process by capturing the fruit or vegetable image. Then, the image is transmitted to the processing level where the fruit features like color, shape, and size of fruit samples are extracted. After that by using artificial neural network fruit images are going through the training and testing. In this proposed paper neural network is used to detect shape, size, and color of fruit and with the combination of these three features, the results obtained are very promising.

Keywords: Camera, Filtering, ANN Technique, Geometric Feature Extraction, Canny Edge Detector, etc.

1. INTRODUCTION

The increasing quality awareness among consumers has increased the need for enhanced quality monitoring of agricultural and food products. Quality assessment of fruits and vegetables is done based on the analysis of external features like color, size, shape, texture and presence of damage. As consumers are mostly influenced to choose or reject a particular fruit by its color, it is the most important attribute for assessing the quality of fruits. The traditional labor intensive manual inspection process which is subjective in nature is gradually being replaced by computer vision techniques. The application of computer vision in agriculture has increased considerably in recent years due to the fact that it provides substantial amounts of information about the nature and attributes of the produce, reduces costs, maintains consistent quality standards and delivers useful information at real time. The computer vision system is a novel technology consisting of the following steps: image acquisition, image pre-processing and image interpretation to facilitate the objective and nondestructive evaluation of quality characteristics in agricultural land food products. The computer vision is particularly used more in automatic inspection of fruits and vegetables, since it is more reliable and objective than human inspection.

2. LITERATURE SURVEY

Nowadays, overseas commerce has increased drastically in many countries. Plenty fruits are imported from the other nations such as oranges, apples etc. Manual identification of defected fruit is very time consuming. This work presents a novel defect segmentation of fruits based on color features with K-means clustering unsupervised algorithm. We used color images of fruits for defect segmentation. Defect segmentation is carried out into two stages. At first, the pixels are clustered based on their color and spatial features, where the clustering process is accomplished. Then the clustered blocks are merged to a specific number of regions. Using this two-step procedure, it is possible to increase the computational efficiency avoiding feature extraction for every pixel in
the image of fruits. Although the color is not commonly used for defect segmentation, it produces a high discriminative power for different regions of image. This approach thus provides a feasible robust solution for defect segmentation of fruits. We have taken apple as a case study and evaluated the proposed approach using defected apples. The experimental results clarify the effectiveness of proposed approach to improve the defect segmentation quality in aspects of precision and computational time. The simulation results reveal that the proposed approach is promising. A framework for the defect segmentation of fruits using images is proposed and evaluated in this paper. The proposed approach used K-means clustering technique for segmenting defects with three or four clusters. We have used defected apples for the experimental observations and evaluated the introduced method considering apples as a case study. Experimental results suggest that the proposed approach is able to accurately segment the defected area of fruits present in the image. K-means based defect segmentation approach is also segment defected area with the stem and calyx of the fruits. The future work includes automatic determination of number of clusters required to segment the defects more accurately.

3. PROJECT OVERVIEW

4. PROPOSED SYSTEM

The proposed system starts the process by capturing the fruit or vegetable image. Then, the image is transmitted to the processing level where the fruit features like color, shape and size of fruit samples are extracted. After that by using artificial neural network fruit images are going through the training and testing. In this proposed paper neural network is used to detect shape, size and color of fruit and with the combination of these three features the results obtained are very promising.

Figure: Block diagram of the proposed system
5. METHODOLOGY

1) IMAGE ACQUISITION

An image is analyzed as it is clicked. Then the user is given tools to discard that he considers noise. The image acquisition is done using a digital camera and it is loaded and saved using MIL software. MIL works with images captured from any type of colour (RGB) or monochrome source (Gray). MIL supports the saving and loading of images. It supports file formats such as TIF (TIFF), JPG (JPEG), BMP (bitmap), as well as raw format. Here the input image got is an RGB image.

2) PREPROCESSING

Basically, the images which are obtained during image acquisition may not be directly suitable for identification and classification purposes because of some factors, such as noise, weather conditions, and poor resolution of images and unwanted background etc. We tried to adopt the established techniques and study their performances.

The steps involved in pre-processing are

A. Input image
B. Background subtraction
C. Converting RGB to gray
D. Converting gray to binary
E. Filtering

All the steps mentioned above is easily and efficiently done by using basic commands MATLAB toolbox.

2.1 RGB Image

RGB is one of the formats of colour images. Here the input image is represented by three matrices of sizes regarding the image format. The three matrices in each image correspond to the colours red, green and blue and also says that of how much of each of these colours a certain pixel should use.

2.2 Background Subtraction

Background subtraction is a process of extracting foreground objects in a particular scene of an image. A foreground object is defined as an object of attention which helps in reducing the amount of data to be processed.
2.3 Gray Image

Gray scale images have one colour which is a shade of gray in various ranges in between. Monochrome image is another name of gray image. This denotes the presence of only one (mono) colour (chrome). To convert any colour image to a gray scale representation of its luminance, we must obtain the values of its red, green, and blue (RGB) primaries in linear intensity encoding, by gamma expansion.

2.4 Binary Image

A Binary Image is a digital image which has two assigned pixel values. Typically the two colors used for a binary image are black and white. The gray image of Fruits is converted to binary image this means that each pixel is stored as a single bit (0 or 1). Binary images used in digital image processing as masks or as the result of some frequent operations such as segmentation, thresholding, and dithering.

3) FILTERING

The purpose of filtering is to smooth the image. This is done to reduce noise and improve the visual quality of the image. Often, smoothing is referred to as filtering. Here filtering is carried out by median filter since it is very useful in detecting edges. The best known order-statistics filter is the median filter, which replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel. The original value of the pixel is included in the computation of the median. Median filters are quite popular because, for certain types of random noise they provide excellent noise reduction capabilities, with considerably less blurring than linear smoothing filters of similar size. The median value is not affected by the actual value of the noise cells. The Median filter is particularly good at removing isolated random noise, as in this example [4][5][6]. It also preserves edges and line features better than the Low Pass / Average filter, but does produce some blurring.

3.1 Median Filter

The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the “window”, which slides, entry by entry, over the entire signal. For 1D signal, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as “box” or “cross” patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically.

4) SEGMENTATION

The purpose of image segmentation is to divide an image into meaningful regions with respect to a particular application. The segmentation is based on measurements taken from the image, may be grey level, colour, texture, depth or motion. Here edge-based segmentation is properly suitable. As edge detection is a fundamental step in image processing, it is necessary to point out the true edges to get the best results from the matching process. That is why it is important to choose edge detectors that fit best to the application. In this way canny edge detector is chosen.

4.1 Canny Edge Detector

Canny edge detection algorithm is also known as the optimal edge detector. Canny's intentions were to enhance the many edge detectors in the image. 1) The first criterion should have low error rate and filter out unwanted information while the useful information preserve. 2) The second criterion is to keep the lower variation as possible between the Original image and the processed
image. 3) Third criterion removes multiple responses to an edge. Based on these criteria, the canny edge detector first smoothes the image to eliminate noise. It then finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks along these regions and suppresses any pixel that is not at the maximum using non-maximum suppression. The gradient array is now further reduced by hysteresis to remove streaking and thinning the edge.[7]. Here fig1.6 shows the edge detection of good and bad Fruits using canny edge detector.

5) FEATURE EXTRACTION

Feature extraction is defined as grouping the input data objects into a set of features. The features extracted carefully will help to extract the relevant information from the input data in order to perform the feature matching. Using this we can reduce the representation input size instead of the full size input. Here clustering process has been used to extract features form good and bad fruits.

5.1 Boundary Extraction

As it is a coloured input it needs to be converted to grayscale by function “rgb2gray (image)” and the syntax is:I=rgb2gray(RGB).which converts the true colour image RGB to the gray scale intensity image I, and then the image is converted to binary before it is used for further processing in which image consists of only two colours namely black and white.

5.2 Geometric features extraction

This starts with the extracted boundary of the sample. The function used to trace the features is “regionprops”. The main features extracted are Area, Major axis and Minor axis.

5.3 Colour, shape, and size features extraction

In this red, green and yellow colours are used for classification as there is a difference between the fruit’s skin based on these colors. Hence these colours are helpful for sorting out the fruits. The red and green component is calculated by counting pixel values corresponding to the red and green colours and yellow component is calculated by first converting the RGB image to CMY by using the function. Separating one kind of sample from another, classification method is used. In this case, one kind of fruit is separated from the other set of fruits by using neural network. Extracting the size of the fruit is called grading. Size is an important criterion related to the market value of the fruit. Hence grading the fruit is important for the farmers before they sell their products.

6) 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.

6. RESULTS AND DISCUSSION

Our main objective was to reduce the effort that an average farmer takes to find the difference between a good fruit and a damaged one. In this project we have done it successfully. And finally the prototype was done successfully. Here we have taken three different samples of lemon for experiment. And the results are described below:
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8. REFERENCES


