iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** I **Month of publication:** January 2022

DOI: https://doi.org/10.22214/ijraset.2022.39909

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue I Jan 2022- Available at www.ijraset.com

Identifying the Quality of Tomatoes in Image Processing

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Abstract: ***In agricultural and horticulture. Image processing is one of the widely used application. in this paper automated quality identification using some image processing techniques is there that can be done using some image features which help in quality detection of vegetables like shape, color and size. tomatoes are in high demand because the world population consumes them daily. This research is to improve tomato production and fruit quality through fruit measurement methods, which have a low impact factor on fruit and plant during measurements. As there is high demand for quality fruits in the market fruit grading process is considered as very important. Fruit grading by a human may cause inefficient and it may also leads to some error. Researchers have developed numerous algorithms for quality grading and sorting of fruits. color is most important features for indentifying disease and maturity of the fruit. Here a sorting process is introduced where the image of the fruit is captured and analyzed using image processing techniques and the defected fruit is discarding by this process. the main aim of this paper is to do the quality check of the fruits within a short span of time.***
Keywords: Fruit grading, Tomato quality, image processing, segmentation, classification

I. INTRODUCTION

Automation of the quality identification process is expected to reduce labor cost, improve the efficiency and accuracy of the sorting process. According to data coming from the Mexican Ministry of Agriculture, horticulture constitutes 18% of Mexico's agricultural production and half of its agricultural exports. Due to the highly labor-intensive nature of horticulture and horticultural processing, these fields generate more than 20% of the total labor-days within the Mexican agricultural sector. Moreover, the horticultural sector has flourished under globalization, diversifying exports to the US market and increasing the scale of production. Tomatoes find numerous uses in both fresh and processed forms. Processed products include ketchup, sauces, pastes and juice. The most important parameters are size, shape, and texture. Maturity on the basis of image processing is very much useful to find out the fruit quality and reduce the manual grading. An image, which having a three basic color component such as red component, green component, and blue component. Maturity based grading considers only the red component and green component. Most of the fruits will have its red color in their maturity stage. Then, it will separate red component from other remaining components based on the features and also it will have the higher contrast. First step is to collect the real data base images by using digital camera. The collected RGB images are pre-processed. Pre-processing is the process used to improve the quality of image in such a way that it increases the chances to attain success of further processes. It is the conversion of original image to a better understandable level in spectral quality for feature extraction. Next step is segmentation. It is the process by which pixels are grouped into segments according to their spectral similarity. After segmentation, features are extracted from that image. Classifier is used to classify the grading of fruits. Sorting of fruits and vegetables is one in every of the foremost necessary processes in fruits production, whereas this method is usually performed manually in most of the countries including India.

II. PROBLEM DEFINITION

Tomato is healthiest vegetable as a diet food. So tomato consumers demand better quality tomatoes. The criteria for evaluating a tomato's external appearance include distribution of color on the surface. Generally it can be identified by human expert but through eyes, It has resulted in a serious problem because misjudgment occurs frequently due to recurring fluctuations in quality identification criteria. This issue motivate intensive research work to implement flexible and effective systems to sort fruits . Anuradha Gawande et al. [1] proposed a method to identify infected region from the input images and classify the infected patterns as per their level of infection aka low, average, medium, high, extreme high and fully infected fruits according to external surface. However, it processes only one image at a time rather than a bunch which is the major limitation of the system. Md. Rokunuzzaman et al. [2] considered only the defects on the tomato head as the basis for grading and for sorting neural network technique was applied. Some important parameters like color, size, and texture were not considered and for sorting a pre defined data base was required for comparison. P. Vimala Devi et al. [3] presented a review of various methods of fruit sorting and defect detection using machine vision technique. Cheng-Jin Du et al. [4] published a review of the application of image processing techniques to different types of food products. It showed that various processing techniques have different degrees of success in different fields. CCD, MRI, Ultrasound, CT and ET sensor techniques are used for image acquisition of food.

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A. Steps and Methods

Steps of disease identification algorithm are shown in above figure 1.

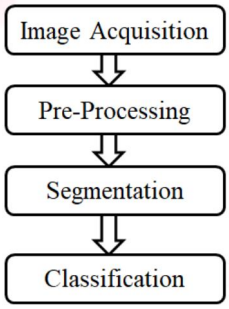


Figure 1.Identification algorithm

In first step Image is acquired and pre-processing steps are used for removing noise. Image is segmented to separate background and foreground. Classification is used to identified tomato is “disease” or “healthy”.

B. Sample Collection

For research we have to collect the samples of tomatoes from the market. Then by vision it can separated healthy or unhealthy.

1) *Image Acquisition and Pre-processing:* The image of tomatoes is captured in high definition camera. To get better result, it is necessary to increase brightness or shining of input image that called as contrast image. To remove noises a simple median filter is applied. After image pre-processing generated image is contrast image.
2) *Image Segmentation:* Image segmentation is nothing but the image is divided into the homogeneous regions when it is joined. Information in color images is large than gray image. Color information can be used to enhance image analysis and improve segmentation results compared to gray-scale-based approaches. Image segmentation is nothing but the collect the important information from real input image. Image segmentation is one of the most difficult low-level image analysis tasks. To recognize different objects or instances of the same object in an image, different sets of local parameters are needed due to changes in local image properties such as brightness and contrast. Image segmentation is nothing but partitioning an image in to some similar features. Segmentation is done using different methods like k-means clustering, converting RGB to HSI model etc.

a) Segmentation using Spot Detection: RGB image is converted to HSI model for HSI stands for Hue, Saturation and Intensity. Using spot detection infected part of tomato can be founded. When human view a color object it is describe by its hue, saturation and brightness.

b) K-means Clustering: The k-means clustering is used for classification of object based on set of features into k number of classes. The algorithm for K –means Clustering [2]:

- Pick center of K cluster, either randomly or based on some heuristic.
- Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster canter.
- Again compute the cluster centers by averaging all of the pixels in the cluster. Repeat steps 2 and 3 until convergence is attained. The infected tomato shows the symptoms of the disease by changing the color of the tomato.

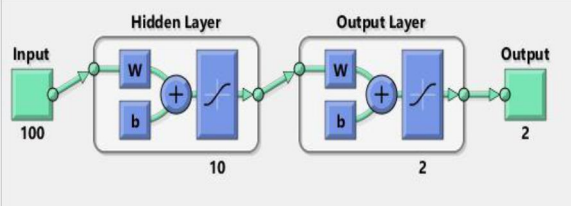
c) Classification: Classification is a general process related to categorization. Image classification refers to the task of extracting information classes from image. There are two types of classification: supervised and unsupervised. Here we used that is tomato is diseased or healthy represented as 1 and 0.

d) SVM (Support Vector Machine): SVM is work in high-dimensional spaces seeking an optimal hyper-plane to separate the categories. SVM database contains equal images of infected and non-infected.SVM is used for decision making. It is suitable to work with high dimensional data. But it can work only with two classes.

e) ANN (Artificial Neural Network): ANN has been applied to a variety of data-classification and pattern recognition task and classification tool. ANN contains three layers first is input layer which is input of data, second layer is hidden layer which contain some hidden layer of neural network and last layer is output layer which contain target data. Using ANN, quality identification of tomato is successfully performed. The artificial neuron that receives the signal can process it and then signal artificial neurons connected to it. Here are some results of ANN shown in below figure 2.

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III. CONCLUSIONS

The proposed paper is on the basis of size. It will result in a smart system which will sort the tomatoes based on the grading done. Recent developments in agricultural technology have led to the demand for a new era of automated, noninvasive methods that leave the crop intact and do not interfere with its natural growth. Image processing technique has been proved as faithful system for agriculture domain. It can be used more conveniently for the quality identification of tomato crop based on color that is measured by accuracy in terms of color. For Color based quality identification of tomato, other segmentation techniques and classifiers like neural network, support vector machine, and fuzzy logic should use to evaluate for this problem statement. So here conclude that SVM gives batter accurate result then ANN. In Future, try to get better accurate result using hybrid classification technique.

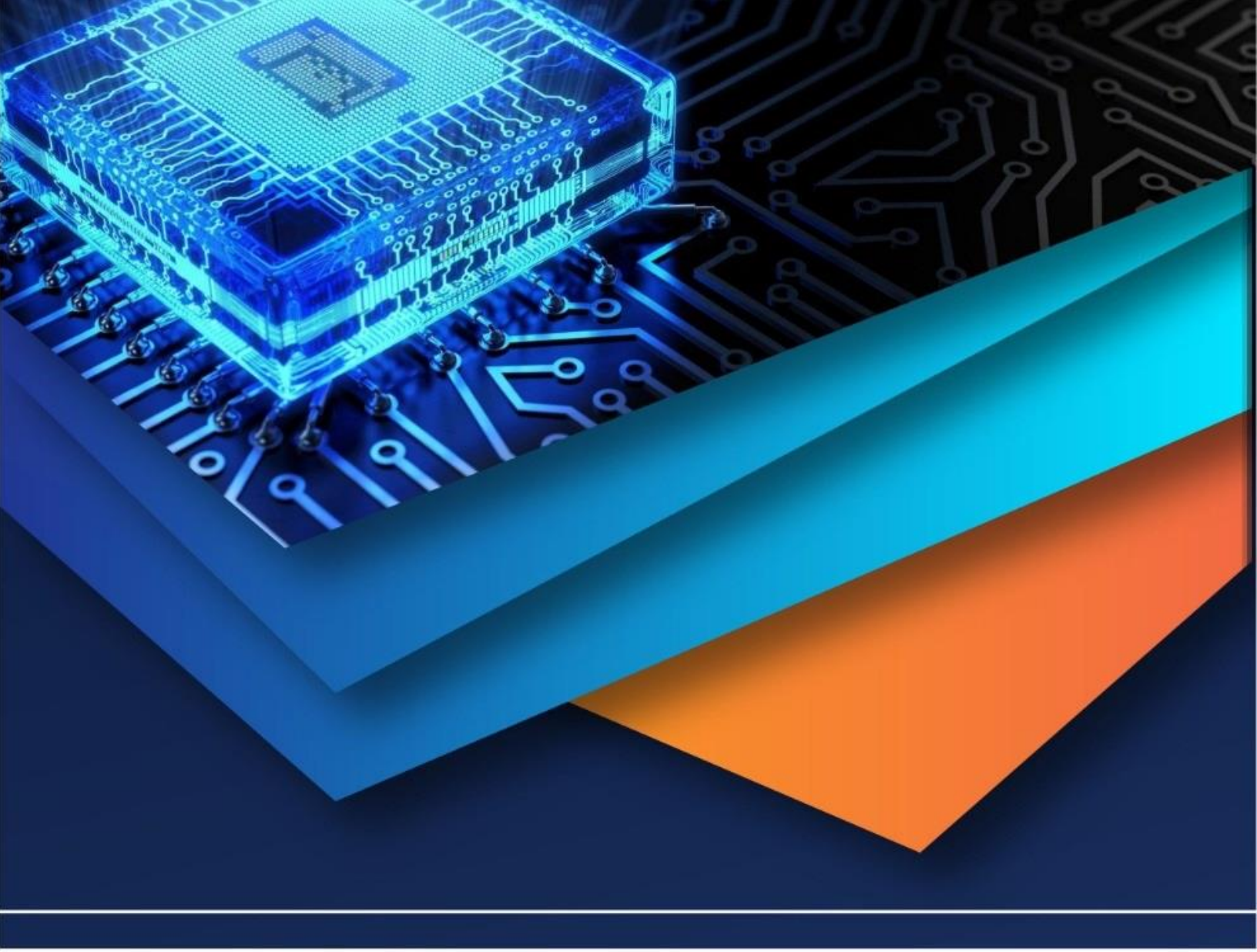
IV. ACKNOWLEDGMENT

The complexity of certain low efficient subsystems is overcome by this standard methodology. This method involves significant way of gradation of fruits and helps in the speed of the process. The critical emphasis involves in the registering the quality check of large quantity of fruits with a small span of time and to process the production of the fruits on a larger scale.

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