Automatic detection of fruit diseases: A Review

[1]Rupam Thakur,[2]Priyanka Mehta

[1] M.Tech.Research Scholar,[2]Head of Department
[1] Department of Computer Science and Engineering,
[1]Universal Group of Institutions, Lalru, Punjab, India

***Abstract*: Automatic detection of fruit diseases is of great significance to automatically detect the symptoms of diseases as early as they appear on the growing fruits. The various types of diseases on fruits determine the quality, quantity, and stability of yield. The main goal is to monitor diseases on fruits and suggest better solution for healthy yield and productivity with the help of Artificial Neural Network concept. System uses two image databases, one for training of already stored infected area image and other for execution of query images.**

I. INTRODUCTION

In system designed to monitor fruits of harvest, it is necessary to create an effective methods for detecting these fruits as well as the predictability of kind and quality. These systems substantially rely on studying fruits shape and discussing images of fruits on trees by focusing on several geometric factors such as density, color, edges and rotation of fruit in addition to the amount of properties such as height, width, thickness, and the possibility of presence spots on the fruit. Recognition system is a 'grand challenge' for the computer vision to achieve near human levels of recognition. The fruits and vegetables classification is useful in the super markets where prices for fruits purchased by a customer can be determined automatically. Fruits and vegetables classification can also be used in computer vision for the automatic sorting of fruits from a set, consisting of different kinds of fruit. Recognizing different kind of vegetables and fruits is a recurrent task in the supermarkets, where the cashier must be able to identify not only the species of a particular fruit or vegetable (i.e., banana, apple, pear) but also identify its variety (i.e., Golden Delicious, Jon gold, Fuji), for the determination of its price. This problem has been solved by using barcodes for packaged products but most of the time consumers want to pick their product, which cannot be packaged, so it must be weighted. Assignment of codes for each kind of fruit and vegetable is a common Solution to this problem; but this approach has some problems such as the memorization, which may be a reason for errors in pricing.

Early detection of disease and crop health can facilitate the control of fruit diseases through proper management approaches such as vector control through fungicide applications, disease-specific chemical applications and pesticide applications; and improved productivity. The classical approach for detection and identification of fruit diseases is based on the naked eye observation by experts. In some of the developing countries, consultation with experts is a time consuming and costly affair due to the distant locations of their availability. The diseases in fruits not only reduce the yield but also deteriorate of the variety and its withdrawal from the cultivation. Fruit diseases appear as spots on the fruits and if not treated on time, cause the severe loss. Excessive uses of pesticide for fruit diseases treatment increases the danger of toxic residue level on agricultural products and has been identified as a major contributor to the groundwater contamination. Pesticides are also among the highest components in the production cost their use must be minimized. Therefore, we have tried to give such an approach which can detect the diseases in the fruits as soon as they produce their symptoms on the fruits such that proper management treat can be applied.

The studies of fruit or plant can be determined by observable patterns of specific plant and it is critical to monitor health and detect disease within a plant. Through proper management strategies such as pesticides, fungicides and chemical applications one can facilitates control of diseases which interns improve quality. There are various techniques available such as spectroscopic and imaging technology, applied to achieve superior plant disease control and management. With smart farming today's farmer can use decision tools and automation techniques which seamlessly integrate product, knowledge and services for better productivity, grading and surplus yield.

II. RELATED WORK

Kutiba Nanaa et al. [1] present a new method for detecting mango fruits from images. The main contribution is to employ the elliptical mango shape in detection method. Method is based on preprocessing operators on image includes converting to gray image, finding edges, calculating distances to edges, opening morphology and converting to binary color image. To take advantage of the elliptical shape of mango fruit, they employ Randomized Hough Transform to find oval shapes in input image. Back propagation Neural Network is used to classify the mango fruit from the proposed oval shapes. Three layers form the proposed neural network. Input layer consist of 450 neurons used to forward values of the cropped oval shape image, One hidden layer includes 50 neurons, and output layer include a unique neuron classify the input cropped image as a mango image in the case of the output greater than 0.5 . Experimental results show that mango detection rate up to 96.26% in the case of clear appearance of mango while it reported as 90% in the study involved detecting ripped mango.

Han li et al. [2]In this study, a novel method termed 'extended spectral angle mapping (ESAM)' was proposed to detect citrus greening disease (Huang long bingor HLB), which is a very destructive disease of citrus. Firstly, the Savitzky–Golay smoothing filter was used to remove spectral noise within the data. A mask for tree canopy was built using support vector machine, to separate the tree canopies from the background. Pure end members of the masked dataset for healthy and HLB infected tree canopies were extracted using vertex component analysis. By utilizing the derived pure end members, spectral angle mapping was

applied to differentiate between healthy and citrus greening disease infected areas in the image. Finally, most false positive detections were filtered out using red-edge position. An experiment was carried out using Silage acquired by an airborne HS imaging system, and a multispectral image.

Gabriel et al. [3] this work proposes a pattern recognition method to automatically distinguish stem and calyx ends and detect damaged berries. First, blueberries were imaged under standard conditions to extract color and geometrical features. Second, five algorithms were tested to select the best features to be used in the subsequent evaluation of classification algorithms and cross-validation. The best classifiers were Support Vector Machine and Linear Discriminant Analysis.

Shiv Ram Dubey et al. [4] in this paper, an adaptive approach for the identification of fruit diseases is proposed and experimentally validated. The image processing based proposed approach is composed of the following main steps; in the first step K-Means clustering technique is used for the defect segmentation, in the second step some state of the art features are extracted from the segmented image, and finally images are classified into one of the classes by using a Multi-class Support Vector Machine. They had considered diseases of apple as a test case and evaluated our approach for three types of apple diseases namely apple scab, apple blotch and apple rot. Their experimental results express that the proposed solution can significantly support accurate detection and automatic identification of fruit diseases.

Jagadeesh Devdas Pujari et al. [5] In this paper, lesion areas affected by anthracnose are segmented using segmentation techniques, graded based on percentage of affected area and neural network classifier is used to classify normal and anthracnose affected on fruits. They have considered three types of fruit namely mango, grape and pomegranate for our work. The developed processing scheme consists of two phases. In the first phase, segmentation techniques namely thresholding, region growing, K-means clustering and watershed are employed for separating anthracnose affected lesion areas from normal area. Then these affected areas are graded by calculating the percentage of affected area. In the second phase texture features are extracted using Run length Matrix. These features are then used for classification purpose using ANN classifier.

Juan Gómez-Sanchis et al. [6] this work has proposed a system for early detection of two kinds of fungi that belong to the Penicillium genus in citrus fruits.The goal is to avoid or at least reduce associated economic losses. These defects are only detectable by using UV light, which is dangerous but they cannot be detected in a visual inspection or in usual RGB computer vision system that uses visible illumination. The proposal has been based on a hyper spectral computer vision system that allows a greater capability of discrimination. However, as the number of features increases to a great extent, all of them cannot be directly used in a classifier, and feature selection procedures needed; in this work, we have used the MRMR method that has reduced the number of features considerably.

Rajesh.Yakkundimath et al. [7] this paper presented a reduced feature set based approach for recognition and classification on images of fruits into normal and affected. The RGB (Red Green Blue) color features are reduced from 18 to 2 and GLCM (Gray-level Co-occurrence Matrix) texture features are reduced from 30 to 2. The reduced feature set comprises of 4 features namely, green mean, saturation mean, red GLCM sum mean and green GLCM sum mean. A feedback from classifier, performance is used in reducing the features. The average accuracy of 89.15% for normal type and 88.58% for affected type is obtained using 2 color features. The average accuracy of 93.15% for normal type and 89.50% for affected type is obtained using 2 texture features .The average accuracies have increased to 96.85% for normal type and 93.89% for affected type when the reduced color and texture features are combined. The work finds application in developing a machine vision system in agriculture and horticulture fields.

An and Singh Jalal et al. [8] in this paper, an image processing-based apple fruit disease classification approach is introduced and validated. The proposed approach is comprised of the four steps. K-means clustering-based defect segmentation method is used in the first step for a region of interest extraction. In the second step, state-of-the-art color-, texture- and shape-based features are drawn from the segmented apple diseases. The different types of features are combined to form the more distinctive feature in the third step. In the last step, the training and classification are done using a MSVM. Three kinds of apple diseases, including apple blotch, apple rot, and apple scab as well as normal apples are considered as the case study for the experimentation in this paper. The experiments and results point out the significance and distinctiveness of the proposed method for apple disease classification problem. Based on the classification results, they have concluded that the normal apples are easily distinguishable as compared to the infected apples and the combinations of the color-, texture- and shape-based features outperform the state-of-the-art color, texture and shape features standalone with less contribution from shape feature.

Shiv Ram Dubey et al. [9] this paper introduced and evaluated an approach to recognize the fruit and vegetable from the images. The described framework operates in three steps, background subtraction, feature extraction and training and classification. Background subtraction is performed using K-means clustering-based segmentation technique. They extracted some state-of-art color and texture features from the foreground image and fused them together. The fusion of color and texture information makes the resultant feature more discriminative than color and texture feature individually. This paper uses a MSVM forth training and classification. This paper also compared the performance fused features for SVM and nearest neighbor classifier and indicates that support vector machine is better choice for training and classification.

III. METHODOLOGY

The main purpose is to supervised the diseases on fruit and suggest alternate solution for healthy yield and good productivity. Image acquisition is consistently the initial condition for the work flow series of image processing because as processing is possible only with the help of an image. For image segmentation, K-Means clustering technique is used. Feature vectors such as

image color, morphology, texture and structure of hole are applied for extracting features of each image and for diagnosis of disease morphology gives accurate result. SURF algorithm used as locator and descriptor for extracting the features.

A. Image Acquisition

Image acquisition in image processing can be broadly defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through whatever processes need to occur afterward. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed and is the result of whatever hardware was used to generate it, which can be very important in some fields to have a consistent baseline from which to work. One of the ultimate goals of this process is to have a source of input that operates within such controlled and measured guidelines that the same image can, if necessary, be nearly perfectly reproduced under the same conditions so anomalous factors are easier to locate and eliminate.

B. *Image Segmentation*

Segmentation partitions an image into distinct regions containing each pixel with similar attributes. To be meaningful and useful for image analysis and interpretation, the regions should strongly relate to depicted objects or features of interest. Meaningful segmentation is the first step from low-level image processing transforming a gray scale or color image into one or more other images to high-level image description in terms of features, objects, and scenes. The success of image analysis depends on reliability of segmentation, but an accurate partitioning of an image is generally a very challenging problem.

C. Feature Extraction

Four feature vectors are considered namely color, texture, morphology and structure of hole of the fruits. For describing huge data set sometime enormous resources are required. Algorithm used for extracting the features is as follow: SURF (Speed up Robust Feature) algorithm is applied for extracting the features. SURF algorithm used as local descriptor and blob detector.

D. Blob Analysis

Blob detection methods are aimed at detecting regions in digital images that differ in properties, such as brightness or color, compared to surrounding regions. Region of an image in which some properties are approximately constant can be called as Blob. The basic scenario of the Blob Analysis solution consists of the successive stages:

1. Extraction: It is first step of image thresholding technique which detects a region corresponding to single object or objects.
2. Refinement: In refinement step, Region transformation techniques are used.
3. Analysis: It is final step for refined region to access calculate the result. If the region shows multiple objects then divide it into separate blobs for inspection.

E. *Pattern Matching*

Pattern matching is the act of checking a given sequence of tokens for the presence of the constituents of some pattern. In proposed system, artificial neural network concept is applied for pattern matching which intern classifies disease.

IV. CONCLUSION

In Fruit Detection System we had analyzed that the proposed technique based on fuzzification in which fuzzy curves and fuzzy surfaces which can rapidly find the feature for pattern recognition system. Fuzzy surfaces remove those features that are based on other significant features. It had proved for providing good results in feature extraction. K-mean clustering algorithm had proved to be the one of the best techniques for segmentation. SVM had proved to be best for classification as it maps input data with high dimensional feature space through linear or non-linear mapping techniques. When the quality of image is low or the resolution of image is low Intent Search Technique had proved to be best for improving the quality of image.

REFERENCE

[1] Nanaa, Kutiba, Mohamed Rizon, Abd Rahman, Mohd Nordin, Yakubu Ibrahim, Abd Aziz, and Azim Zaliha. "Detecting mango fruits by using randomized Hough transform and back propagation neural network." In *Information Visualization (IV), 2014 18th International Conference on*, pp. 388-391. IEEE, 2014.

[2] Li, Han, Won Suk Lee, Ku Wang, Reza Ehsani, and Chenghai Yang. "'Extended spectral angle mapping (ESAM)'for citrus greening disease detection using airborne hyper spectral imaging." *Precision agriculture* 15, no. 2 (2014): 162-183.

[3] Leiva-Valenzuela, Gabriel A., and José Miguel Aguilera. "Automatic detection of orientation and diseases in blueberries using image analysis to improve their postharvest storage quality." *Food Control* 33, no. 1 (2013): 166-173.

[4] Dubey, Shiv Ram, and Anand Singh Jalal. "Adapted approach for fruit disease identification using images." *arXiv preprint arXiv:1405.4930* (2014).

[5] Pujari, Jagadeesh Devdas, Rajesh Yakkundimath, and Abdulmunaf Syedhusain Byadgi. "Grading and classification of anthracnose fungal disease of fruits based on statistical texture features." *International Journal of Advanced Science and Technology* 52, no. 1 (2013): 121-132.
[6] Gómez-Sanchis, Juan, José D. Martín-Guerrero, Emilio Soria-Olivas, Marcelino Martinez-Sober, Rafael Magdalena-Benedito, and José Blasco. "Detecting rottenness caused by Penicillium genus fungi in citrus fruits using machine learning techniques." *Expert Systems with Applications* 39, no. 1 (2012): 780-785.
[7] Rajesh Yakkundimath, Pujari. And A. S. Byadgi. "Reduced color and texture features based identification and classification of affected and normal fruits' images." *International Journal of Agricultural and Food Science* 3, no. 3 (2013): 119-127.
[8] Anand Singh Jalal, dubey "Apple disease classification using color, texture and shape features from images." *Signal, Image and Video Processing* (2015): 1-8.
[9] Dubey, Shiv Ram, and Anand Singh Jalal. "Fruit and vegetable recognition by fusing color and texture features of the image using machine learning. *"International Journal of Applied Pattern Recognition* 2, no. 2 (2015): 160-181.