Bayesian Classifier Based Advanced Fruits Disease Detection

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Abstract: **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. 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 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. 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. The core area of this work is to increase the automatic detection of fruit disease. The results indicate that proposed method is substantial and it can specifically support a relatively accurate analysis of fruit diseases.**

Keywords: ANN, Naïve bayes classification, Fruit diseases, K-means clustering.

I. INTRODUCTION

In systems designed to monitor fruits of harvest, it is important to create 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. The fruits and vegetables classification is useful in the super markets where prices for fruits purchased by a customer can be determined automatically. 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 fruits and vegetables it is common Solution to this problem; but this approach has some problems such as the memorization, which may be a reason for errors in pricing.

Therefore, we have tried to give such an approach which can detect the disease in the fruit 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. 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. In the present world, Fungi are the main causative agent for agriculture crop loss as compared to insects and weeds.

Fungi causes up to 100 % crop loss, weeds caused up to 32% crop loss, animal pest caused upto15-18% crop loss. It causes infection in field crop, harvested crops and leads to the variety of damage with characteristics features such as odour, change in flavor, loss in nutrients and germ layer destruction. It finally results in the reduction of quality and quantity of crops.

Infection and loss are higher in the humid tropics than in cold temperate regions. Various fungicides are used to eliminate the disease/ infection of fungus. Pesticide can be sprayed as pre-harvest such as copper hydroxide, mancozeb, and copper sulfate products (these are routinely used from flowering through to harvest). This treatment was employed to those fruits and crops which are shipped to overseas market. There are billions of dollars worth loss due to crop losses occur by various causative agents such as microorganisms (bacteria and fungi). There are various measures employed to control the plant disease. At present various pathogens adapt according to pesticide and chemicals employed to control the various diseases caused by pathogens. So, now there is continual need to develop safer and more effective ways to control the disease or to reduce the infection. In this condition, biotechnology shows great promise. The National Center for Food and Agricultural Policy (NCFAP) reported that genetically enhanced crops (some engineered for disease resistance and others for insect resistance). Biotechnological methods for disease control are entirely dependent on basic research into the molecular mechanisms of disease resistance. Among the various components of disease management strategies, use of resistant variety is one of the most important components. Several mango varieties have been documented for susceptibility to anthracnose but none of them known with significant resistance to the disease.

II. REALTED WORK

Kutiba Nanaa et al. [1] present a new method for detecting mango fruits from images. 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.

Shiv Ram Dubey et al. [2] this paper introduced and evaluated an approach to recognize the fruit and vegetable from the images. The described framework operates in three steps i.e. 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 for the training and classification.

García-Ibarra et al. [3] reported that ACLSV infection affected the germination of the apricot seeds however, it was confirmed that ACLSV was not seed transmitted .The virus is thus transmitted by grafting of infected planting material, mechanical inoculations and unclean horticultural practices.

Liu et al. [4] revealed that in top worked apple orchards, 41.7- 88.55% of trees were infected with top work disease resulting in a tree mortality of 15.2-70.0%. Infected trees grew normally in the first 1-2 years, but fibrous and main roots started to die gradually, shoot growth was limited and fruits were small. The existence of three latent viruses ASPV, ACLSV and ASGV in the infected trees was confirmed.

Xiang and Zhou [5] reported 53.06% mortality of top worked apple trees infected with decline disease caused by ACLSV /ASGV /ASPV. The leaves of infected trees were small, light yellow colored and abscission occurred early. These viruses infect many commercial apple cultivars with an infection rate of up to 80- 100% and cause yield loss of up to 40%.

Singh R.P [6] demonstrated that the adding 0.65 to 0.70% sodium sulfite in extraction buffer minimized the pigmentation of nucleic acid extracts and improved RT-PCR detection of viruses from potato tubers and stone fruits. It was also observed that the resultant nucleic acid extracts were suitable for both duplex and multiplex RT-PCR. 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.

Kulkarni et al. [7] suggested that development of resistant varieties is the most appropriate approach to control the disease. In order to develop more efficient and safer methods of disease control, it is first important to study the genes which are involved in various stages of pathogenesis.

III. METHODLOGY

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.

Algorithm

Step 1: Accept image from database
(Color, Morphology, Texture, Structure of Hole)

Step 2: Extraction of Feature Vectors

$E(n) = [C(n) + M(n) + T(n) + H(n)$

C = Color
M = Morphology
T = Texture
H = Structure of Hole
E = Extraction of features
n = No. of images

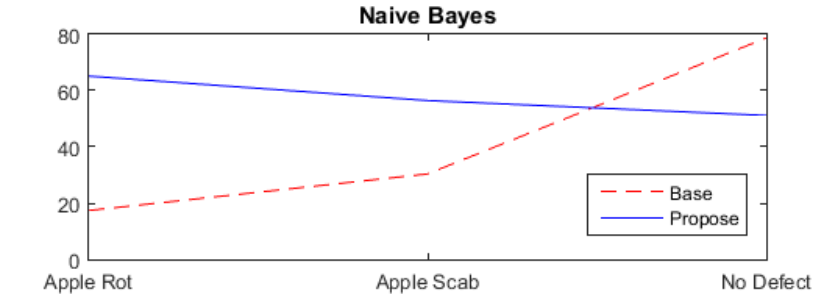
Step 3: Calculating ROI:
Let E (n) be set of Extracted Images and
If <Fruit Detected>
Then
E (n)
Else
Reject

Step 4: Pattern Matching
Let T be set Trained Database
If<E (n) = = T>
Then
Classification
Detection
Else

Go To Step (2)

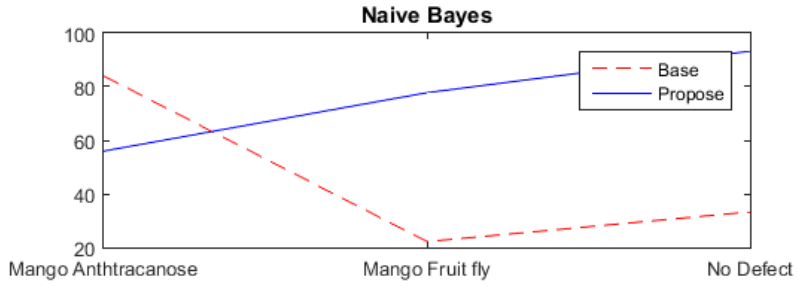
Step 5: Stop.

IV. RESULTS



	Apple Rot	Apple Scab	No defect
1	15	0	8
2	2	13	8
3	11	5	17

Fig 1. Confusion matrix for diseases in Apple using Naïve Bayes. (The upper graph with X is redundant)



	Mango Anthracanose	Mango Fruit	No defect
1	14	11	0
2	1	7	1
3	0	1	14

Fig 2. Confusion matrix for diseases in Mango using Naïve Bayes. (The upper graph with X is redundant)

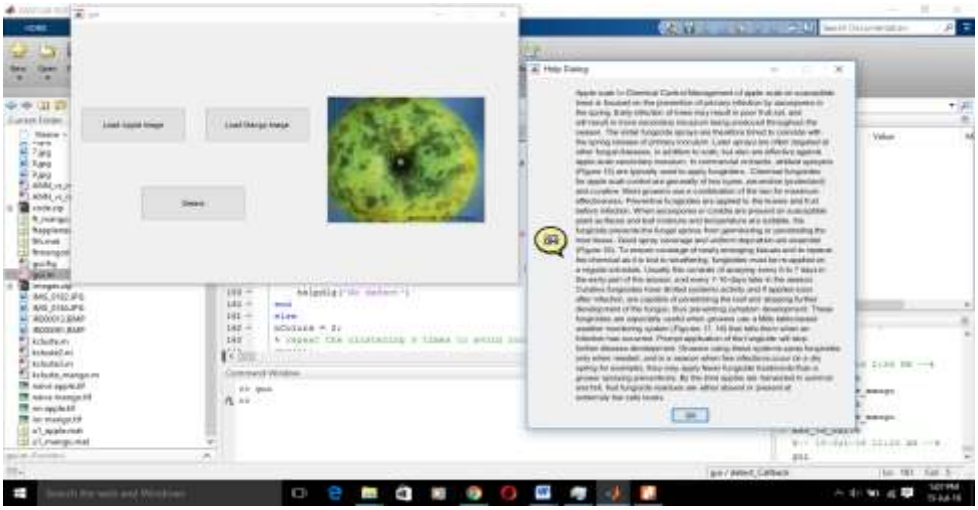


Fig 3. GUI screenshot for apple disease detection

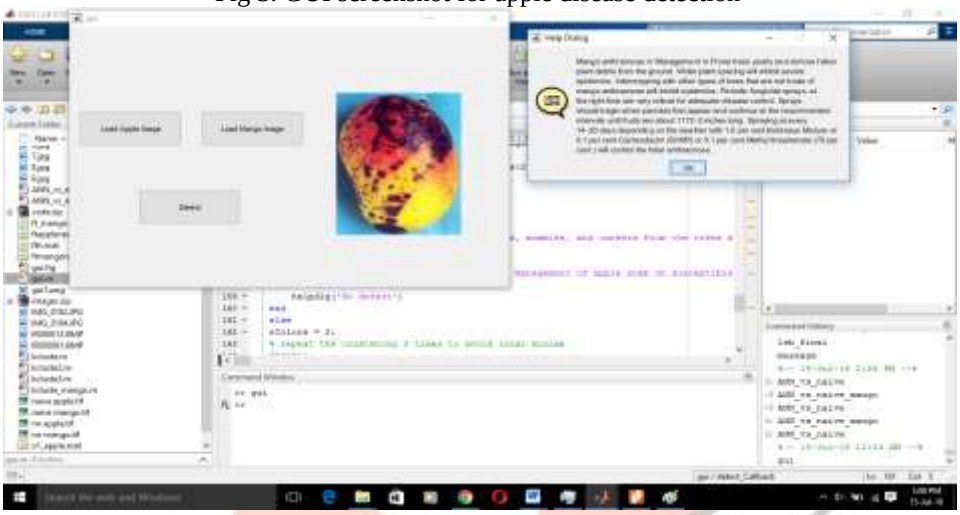


Fig 4.6. GUI screenshot for mango disease detection

The accurate detection and classification of the plant disease is very important for the successful cultivation of crop and this can be done using image processing. The use of artificial intelligence method for classification of disease in apple and mango can be efficiently used. We have used Naïve Bayes classifier as a new method which has performed better than the ANN method.

V. CONCLUSION

This paper discussed various techniques to segment the disease part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The core area of this work is to increase the automatic detection of fruit disease. The results indicate that proposed method is substantial and it can specifically support a relatively accurate analysis of fruit diseases. Also, the Naïve Bayes classifier is more precise and relatively faster in terms of implementation. When these fruit diseases are detected, then appropriate treatment are accordingly recommended. The future work however may involve the better data set creation to improve the training part. This is because the current dataset may not be a proper one for training the classifier and hence there has to be proper way of imaging the fruit for training as well as testing.

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