Multi Classifier Based Disease Recognization on Cotton Leaves

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Abstract— Diagnosis of plant disease is a task of identifying the disease in the leaf or fruit or vegetable. About 42 percent of the world's agriculture harvest is destroyed yearly by disease and pest. However, losses of harvest can be minimized and specific treatments can be applied if plant diseases are correctly identified early. Manual identification of disease in the plant is not only time consuming but also does not give accurate result. So, providing fast, automatic and accurate solution using image processing techniques can be a good realistic significance. Automatic identification of diseases using image processing techniques can be done by using five methods like Image Acquisition, Image Pre-processing, image segmentation, Feature extraction and classification using multiple classification algorithms. This paper shows the result of research conducted on detection of diseases on cotton leaves found in Khandesh region with the help of different classifiers such as Neural Network and Naive Bayes classifier and their combinations.

Key words: Neural Network, Naive Bayes Classifier, SVM, Image Processing, Cotton Disease

I. INTRODUCTION

India is an agricultural country. Agriculture sector provides livelihood to percent of the total population of country. Many of the industries are depend on agriculture sector for their raw-material and production for example sugar factory, cotton and jute textile industries, food industries, pharmaceutical industry or many more. Industries need good quality of material. So that Research sector are trying to increase the productivity and quality of agriculture. The main reason behind the decrease in the quality of the agricultural product is plant diseases. Disease is an impairment of health or a condition of abnormal functioning. Plant diseases are caused by bacteria, viruses and fungi. The plant diseases may occur because of careful diagnosis and handling at right time to protect the plant from heavy losses. Disease can be found in different parts of the plant like fruit, leaves, vegetable, and stem. Farmers require constant monitoring of experts which might be prohibitively expensive and time consuming. Depending on the applications, many systems have been proposed to solve or at least to reduce the problems, by making use of image processing and some automatic classification tools.[8]

In this work we focus the cotton leaves with Alterneria leaf spot ,Bacteria Blight leaf spot , Coresepora leaf and leaf curl diseases of Khandesh region in Maharashtra.

Structuring of remaining paper is as follows. Section II provides overview methodology which is used for plant disease detection. Section III focuses on recent research trends in plant disease detection. Furthermore, Section IV concludes the paper.

II. RELATED WORK

Over the past years, different Disease detection techniques have been proposed.

Tejal et. al [1] Propose a system for disease identification and grading. They done their work on pomegranate leaf and fruit and detect bacterial blight disease. To remove the shadow, which causes during image acquisition, morphology technique has been used as pre-processing. For segmentation K-means clustering method has been used. After segmentation AT (Total Area of leaf or fruit) and AD (Total disease area) are calculated. Using AT and AD PI (percent-infection) is calculated, Using PI grade of the disease is determined. For disease identification they consider two characteristics as for the leaf they checked diseased spot on leaf is bordered by yellow margin if yes then it signifies that leaf is infected by bacterial blight and for the fruit first black spots are identified and if crack passing through that black spot it signifies that fruit is infected by bacterial blight. By using proposed system they achieve precise, accurate and acceptable result. Revathi and Hemalatha [2] give a Homogeneous pixel counting technique for cotton disease detection (HPCCDD). By using canny and sobel edge detection homogenous techniques segmentation is done while proposed HPCCDD algorithm has been used for analysis and classification. By using proposed algorithm 98.1% accuracy has been achieved. Gavhale et. al [3] proposed a method for citrus leaf disease detection. In pre-processing step image enhancement and color space conversion have been done. In feature extraction method GLCM texture feature and color texture feature are extracted while for classification SVM classifier has been used. Monika et. al [4] Give a system for disease detection and fruit grading. For feature extraction three feature vectors have been used, namely, color, texture and morphology in which morphology give better result. For the classification artificial neural network has been used. For the fruit grading two methods are used spread of disease and automated calculation of mango weight. In spread of disease method percent infection is calculated by using K–means clustering and in second method by using number of pixel weight is calculated and as per the weight quality of the fruit is decided.

III. EXISTING SYSTEM

Existing system is based on parallel combination of two kinds of classifiers: a neural network classifier that uses texture, color and shape features to discriminate between the damages and symptoms, and an SVM classifier that uses texture and shape features. This study focuses on six classes including the damages of three pest insects (Leaf miners, Thrips and Tuta absoluta) and symptoms of three fungal diseases (Early blight, Late blight and Powdery mildew), which are among the major challenges of the vegetables crops in Souss Massa region.

IV. PROPOSED WORK

In our proposed system we had focused on diseases of the Cotton plants that are cultivated in the region of Khandesh , Maharashtra. Cotton is produced on large scale in khandesh region. We will tried to find out diseases on the Cotton leaves with the help of Image Processing Technique. This system will works on the detection of four types of disease such as Alterneria leaf spot, Bacteria Blight leaf spot, Coresepora leaf spot and leaf curl disease. To classify these diseases different classifiers are used such as Neural Network Classifier and Naive Bayes Classifier and there combinations. Figure shows the proposed architecture.

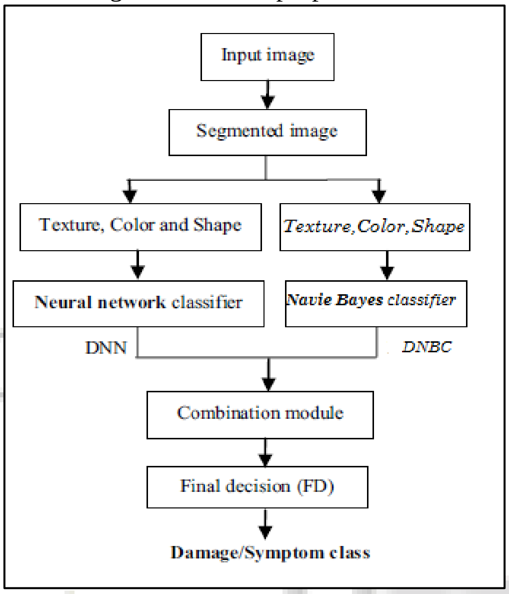


Fig. 1: proposed architecture

A. Neural Network

The classifier is trained first. Then the resulting rule set is used to classify unseen data. Classifier algorithm has many features like:

Speed - NN is significantly faster than ID3 (it is faster in several orders of magnitude)

Memory - NN is more memory efficient than ID3

Size of decision Trees – NN gets smaller decision trees.

Ruleset - NN can give ruleset as an output for complex decision tree.

Missing values – NN algorithm can respond on missing values by _?‘

Overfitting problem - NN solves overfitting problem through

1) Reduce error pruning technique.

Pseudo code NN

Input: Example, Target Attribute, Attribute

Output: Classified Instances

In pseudo code the algorithm looks like this:

- Check for the base case
- Construct a DT using training data
- Find the attribute with the highest info gain (A_Best)
- A_Best is assigned with Entropy minimization
- Partition S into S1,S2,S3...
- according to the value of A_Best
- Repeat the steps for S1, S2, S3
- For each ti є D, apply the DT

2) Base cases are the following:

- All the examples from the training set belong to the same class (a tree leaf labeled with that class is returned).
- The training set is empty (returns a tree leaf called failure).
- The attribute list is empty (returns a leaf labeled with the most frequent class or the disjuction of all the classes).

B. Naive Bayes Classifier

It gains popularity because it offers the attractive features and powerful machinery to tackle the problem of classification i.e., we need to know which belongs to which group and promising empirical performance. The Naïve Bayes is based on statistical learning theory. Naïve Bayes’s better generalization performance is based on the principle of Structural Risk Minimization (SRM).

The concept of SRM is to maximize the margin of class separation. The Naïve Bayes was defined for two-class problem and it looked for optimal hyper-plane, which maximized the distance, the margin, between the nearest examples of both classes, named Naïve Bayes.

At present Naïve Bayes is popular classification & prediction tool used for pattern recognition and other classification purposes. The standard Naïve Bayes classifier takes the set of input data and predicts to classify them in one of the only two distinct classes. Naïve Bayes classifier is trained by a given set of training data and a model is prepared to classify test data based upon this model. For multiclass classification problem, we decompose multiclass problem into multiple binary class problems, and we design suitable combined multiple binary Naïve Bayes classifiers. Most traditional classification models are based on the empirical risk minimization principle. Naïve Bayes implements the structural risk minimization principle which seeks to minimize the training error and a confidence interval term. A number of applications showed that Naïve Bayes hold the better classification ability in dealing with small sample, nonlinearity and high dimensionality pattern recognition. Naïve Bayes are based on the concept of decision planes that define decision boundaries. A decision plane is one that separates between a set of objects having different class memberships. The classifier that separates a set of objects into their respective classes with a line. Classification tasks, are not that simple, and even more complex structures are needed in order to make an optimal separation, i.e., correctly classify new objects (test cases) on the basis of the examples that are available (train cases).

All the information from above processes is given to multiclass SVM . The Multiclass SVM is used for cotton leaf spot disease classification. The cotton leaf color is segmented corresponding to number of weight vectors. Information from segmented images both diseased and non-diseased pixels are used for training in support vector machine for cotton leaf disease segmentation.

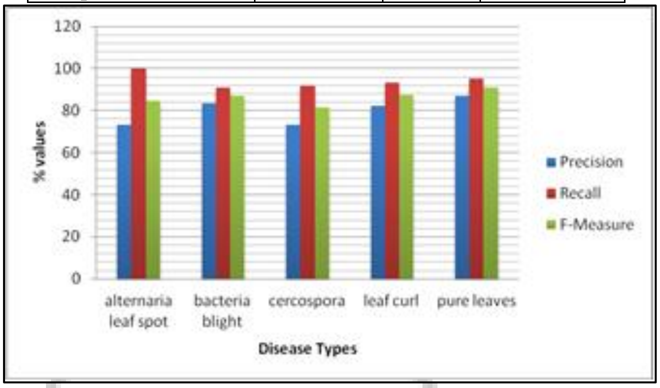
V. RESULT

The proposed system is tested on the image dataset which contains 81 images with 5 classes. The particular class contains the number of images with their feature extraction. Feature can be extracted or calculated at the time of image inserted in dataset. After disease detection precision, recall and F-measure is calculated for individual classifier and for the combination of both the classifier.

A. Performance for single Neural Network

Table 1: Performance for Neural Network

Neural Network	Precision	Recall	F-Measure
alternaria leaf spot	73.33	100	84.61
bacteria blight	83.33	90.91	86.95
Cercospora	73.33	91.67	81.48
leaf curl	82.35	93.33	87.5
pure leaves	86.95	95.24	90.90

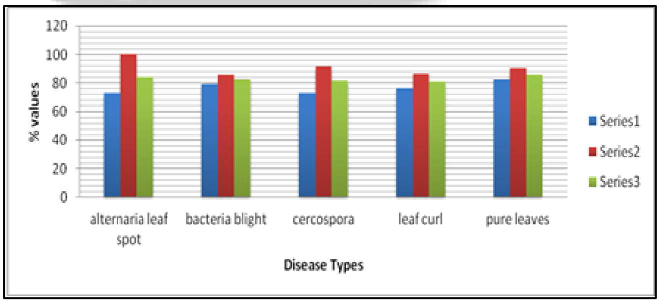


Graph 1:Neural Network

B. Performance for single Naive Bayes Classifier

NBC	Precision	Recall	F-Measure
Alterneria leaf spot	73.33	100	84.61
Bacteria blight	79.16	86.36	82.60
Cercospora leaf	73.33	91.66	81.48
Leaf Curl	76.47	86.66	81.25
Pure Leaves	82.60	90.47	86.36

Table 2:Performance of NBC



Graph 2: Naive Bayes Classifier

C. Performance for combination of NN and NBC

NBC+NN	Precision	Recall	F-Measure
alternaria leaf spot	84.61	100	91.66
bacteria blight	87.5	95.45	91.30
cercospora	85.71	100	92.30
leaf curl	82.35	93.33	87.5
Pure leaf	91.30	100	95.45

Table 3: Performance of NN+NBC

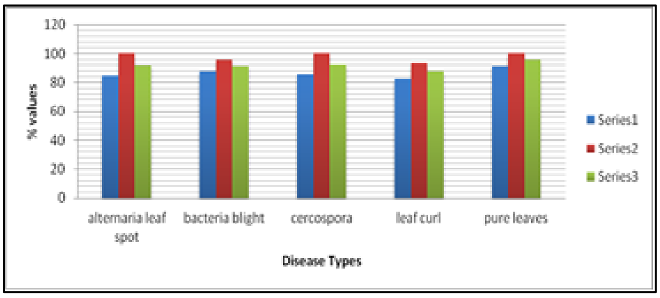


Chart 3: NN+NBC

To study the effectiveness of our proposed approach, we compare it with the previous approaches that adopt single classifier.

The results obtained are compared and analyzed for design in gproposed approach that gives the highest rate of recognition in comparison with the previous approaches.

Approches	Classification Method	Accuracy
Al Bashish et al[1]	Neural Network	74.40%
Camargo et al [2]	SVM	82.93%
Wang et al [3]	Neural Network	79.27%
Proposed System	NBC	83.26%

Table 4: Comparison with Existing System

Table 4 shows the accuracy per class of the proposed approach compared to the three existing approaches. The figure clearly shows that classification through Neural Network and Naive Bayes Classifier shows more accuracy than the existing one i.e.86.28% and 83.26% respectively. But it is seen that the combination of these two classifiers gives better result i.e. 91.65% which is the highest accuracy shown in graph.

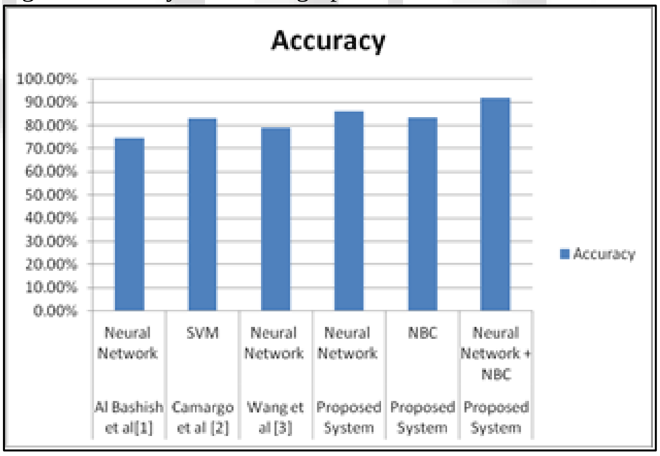


Chart 4: Accuracy of Proposed System

Based on the comparison, in this study, between our approach and the existing approaches, it can be concluded that the results of the proposed approach are significant and encouraging, which indicate that the combination of classifiers(KNN+NBC) improves the recognition rate of the damages and symptoms.

VI. CONCLUSIONS

Plant Disease detection is very momentous and efficient research field. The paper purpose is to present an outline of established method for plant disease detection and study of recent growth. Experiment result shows that the techniques for detection of plant diseases using Neural network and Naïve Bayes for parallel classification and K-means clustering for segmentation generates better results in terms of detection accuracy. All these techniques are used to analyses the healthy and diseased cotton plants leaves. As per the results it is clear that these proposed disease detection techniques have an ability to detect cotton plant diseases with efficient manner.

In future research it would be interesting to apply proposed system algorithms on various different types of leaves. Also proposed system can be tested on large dataset to get the idea about efficiency in terms of processing speed and communication cost for system.

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