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IMAGE PROCESSING FOR PLANT LEAF DISEASE RECOGNITION USING RBF AND SOM.

Abrham Debasu Mengistu
Faculty of Computing, Bahir Dar institute of Technology, Bahir Dar University, Bahir Dar, Ethiopia.
Email: abrhamd@bdu.edu.et

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Abstract

Plant disease recognition based on image processing provides quickly and more reliable diagnosis and control of plant diseases. We extract 15 features (four morphology, five GLCM and six color features) were identified from the image of four kinds of plant i.e maize, mango, banana and avocado. We were used and compare ANN and SOM together with RBF (self organizing map and radial basis function) to identify the plant leaf diseases. The experiments were conducted under four scenarios by using feature sets of morphology, texture and color separately, and finally combining the three feature sets. Then, the experiment results were compared the performance of ANN and SOM together with RBF classification over the three scenarios. The total number of data sets is 10380. Out of these, 70% were used for training and the remaining 30% were used for testing. In general, the overall result showed that morphology and color features have more discriminating power than texture features and the recognition performance of SOM is 92.96 and by far better than ANN.

Keywords: *SOM, RBF, ANN, Plant Diseases.*

INTRODUCTION

Plant disease is a disease that affects plant and which occurs on the leaves, stems and roots now a day's plant diseases becomes critical problem and can cause significant reduction in both quality and quantity of agricultural products [1]. The aim of plants is not only to feed population but also an important source of energy in addition to this they can provide a solution to solve the problem of global warming [1]. Diagnosing of plant disease is very important in order to cure and control the spreading of diseases. The method of diagnosing these plant diseases is by using naked eye in, order to identify the diseases in this method experts are involved who have the ability to detect spot on the leaf and the changes in leaf color [2]. There are three types of plant diseases which occur on the leaves part of plants these are fungi, virus and bacteria. Fungal leaf spot can be found on plant leaves. Spotted leaves occur when fungal spores in the air find a warm, wet, plant surface to cling to [3]. As soon as that microscopic spore gets comfortable in its new home, sporulation (the fungal method of reproduction) occurs and the tiny brown fungal leaf spot begins to grow. Bacteria are microscopic single-cell organisms that reproduce by dividing in half. This process may occur as often as once every 20 minutes, or it may take several hours. In some of the faster multiplying species, a single bacterium can produce over 47 million descendants in 12 hours. Viruses are immobile and are usually transmitted from one plant to another by a living organism called a vector or carrier. Viruses can also be transmitted by other insects, mites, nematodes, fungi, infected pollen or vegetative propagating material, contact between plants, and infected or contaminated seeds [4].

RELATED WORK

Some papers are describing to detecting leaf disease using various methods suggesting the various implementation ways as illustrated and discussed here.

P.Revathi, M.Hemalatha[1] , consists of two phases to identify the affected part of the disease. Initially Edge detection based Image segmentation is done, and finally image analysis and classification of diseases is performed using our proposed Homogeneous Pixel Counting Technique for Cotton Diseases Detection (HPCCDD) Algorithm. The goal of this research work is identify the disease affected part of cotton leaf sport by using the image analysis technique [5].

Dheeb Al Bashish,et al, have proposed A Framework for Detection and Classification of Plant leaf and Stem Diseases in which the images at hand are segmented using the KMeans technique, RGB input images are converted into HIS color space. Then calculating color and texture based features. Neural network classifier that is based on statistical classification is used for classification [6]. Elham Omrani, et al[4] have proposed Potential of radial basis function-based support vector regression for apple disease detection, detection of leaf diseases has been used [7].

[Prakash M. Mainkar, Shreekant Ghorpade]. [8], in this paper, we are providing software solution to automatically detect and classify plant leaf diseases. In this we are using image processing techniques to classify diseases & quickly diagnosis can be carried out as per disease. This approach will enhance productivity of crops. They include several steps like, image acquisition, image pre-processing, segmentation, features extraction and neural network based classification.

[Premalatha.V, Valarmathy.S, Sumithra.M.G]. [9], in this paper, we have used spatial FCM & PNN classifier to identify the pest & type of disease in cotton plant. Image acquisition devices are used to acquire images of plantations at regular intervals. These images are then subjected to pre-processing using median filtering technique. The pre-processed leaf images are then segmented using Spatial FCM clustering method.

[Nikita Rishi, Jagbir Singh Gill]. [10], in this paper; heterogeneous plant diseases that are feasible and their apprehension using contrasting techniques have been discussed. These techniques include Otsu method, image compression, image cropping and image denoising including K means clustering to articulate the disease images. Neural networks including back propagation (BP) networks, radial basis function (RBF) neural networks, generalized regression networks (GRNNs) and probabilistic neural networks (PNNs) are also used to diagnose wheat and grape diseases. Cotton

leaf diseases and rice plant disease using sobel operator, canny filter and feature extraction are passed down to recognize the disease. Many other diseases like orchid leaf disease, rubber tree leaf disease; apple fruit disease and chili plant disease can also be encountered using other approaches like fuzzy logic, Multi-class Support Vector Machine and Local Binary Pattern. A miniature explication on all the diseases and their detection has been given in this paper.

[Jayme Garcia, Arnal Balbedo], on this paper they presents a survey on methods that use digital image processing techniques to detect, quantify and classify plant diseases from digital images in the visible spectrum. Although disease symptoms can manifest in any part of the plant, only methods that explore visible symptoms in leaves and stems were considered. This was done for two main reasons: to limit the length of the paper and because methods dealing with roots, seeds and fruits have some peculiarities that would warrant a specific survey. The selected proposals are divided into three classes according to their objective: detection, severity quantification, and classification. Each of those classes, in turn, is subdivided according to the main technical solution used in the algorithm [11].

[Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li], on this paper plant disease identification based on image processing could quickly and accurately provide useful information for the prediction and control of plant diseases. They extract, 21 color features, 4 shape features and 25 texture features were extracted from the images of two kinds wheat diseases (wheat stripe rust and wheat leaf rust) and two kinds of grape diseases (grape downy mildew and grape powdery mildew), principal component analysis (PCA) was performed for reducing dimensions in feature data processing, and then neural networks including backpropagation (BP) networks, radial basis function (RBF) neural networks, generalized regression networks (GRNNs) and probabilistic neural networks (PNNs) were used as the classifiers to identify wheat diseases and grape diseases, respectively. For the two kinds of grape diseases, the optimal recognition results were obtained when GRNNs and PNNs were used as the classifiers after reducing the dimensions of feature data with PCA [12].

Statement of the problem

Plant diseases are difficult to diagnose. So often, they display the same symptoms as plants that are perfectly healthy, except for stresses imposed upon them by our poor cultural practices. When a plant is diseased, it is because of a bacteria, fungus, or virus. A better understanding of each will help you diagnose and treat the problem if possible. This method involves lots of efforts, takes long time and also not practical for the large fields. Many times different experts identify the same disease as the different disease.

On the previous researches there is a scope for the design of classifier to detect the type of plant diseases this provide a better and more reliable results for the plants, in line with this, plant leaf diseases identification is very useful in encouraging good quality in plant diagnosis. There is a need for automated in recognition of plant leaves disease so that the abuses during diagnosis and treatment can be minimized. To this end this study answers the following research question:

- To what extent recognition effectiveness is registered for the plant leaves diseases?
- What are the features that distinguish the three types of plant leaf diseases?
- How to develop an automatic plant leaf diseases recognition system based on image processing techniques?

DESIGN OF PLANT LEAF DISEASES RECOGNITION

The task of recognition occurs in wide range of human activity. The problem of recognition is concerned with the construction of a procedure that will be applied to differentiate items, in which each new item must be assigned to one of a set of predefined classes on the basis of observed attributes or features. Accordingly, image analysis or computer vision is used in the recognition of plant leaf diseases to predefined classes. The predefined classes are the feature or attributes are computed from plant leaf images. These observed features of plant leaf were used to decide the class or the type of plant diseases. Hence, in this research the main interest is to differentiate the type of plant leaf diseases varieties by using image analysis technique this is because of in order to maximize the curability of the disease if we identify the type of plant diseases where it belongs to it is very simple to cure and also simple to stop spreading to others.

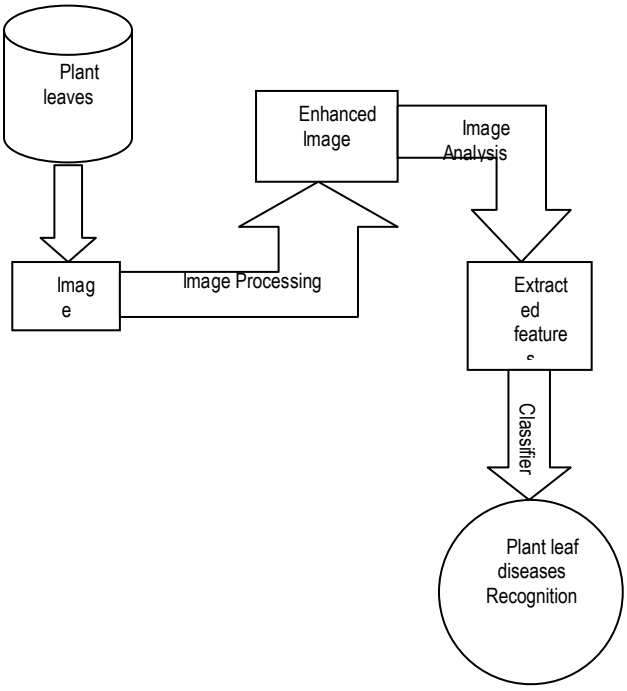


Fig (1) Plant leaf diseases Recognition process model

Feature extraction is the method by which unique features of plant leaf images are extracted. This method reduces the complexity in classification problems. The purpose of feature extraction is to reduce the original data set by measuring certain properties, or features, that distinguish one input pattern from another. We have the following three groups of features:GLCM (Texture features): GLCM is a powerful tool for image feature extraction by mapping the grey level co occurrence probabilities based on spatial relations of pixels in different angular directions. Morphological features: Morphology is the geometric property of a given image, in our case it is the size and shape characteristics of plant leaf diseases image.

Color features: Color is one of the features of plant leaf diseases, they have different color variation of each type and color analysis computed by taking.

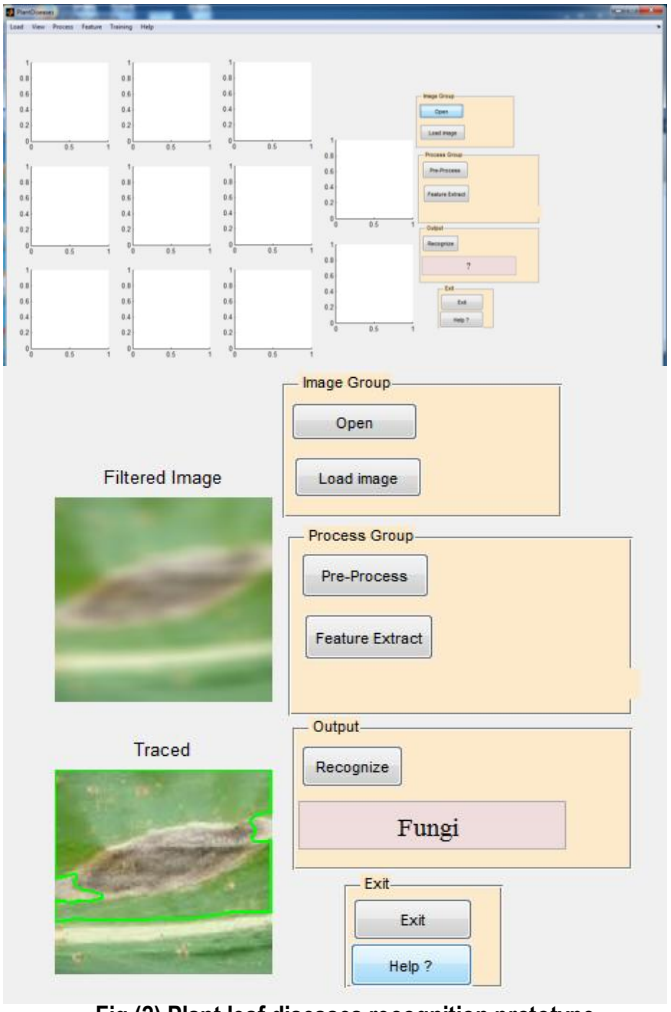
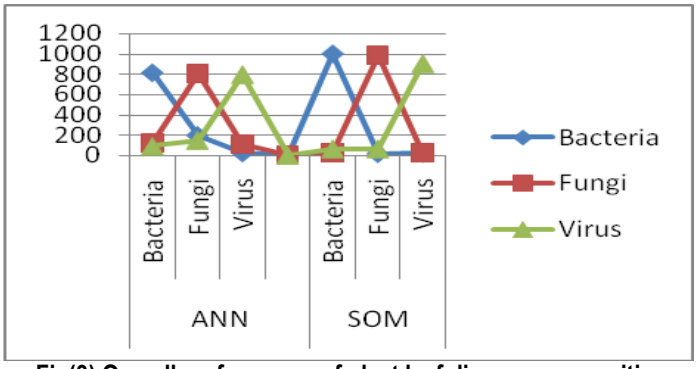


Fig (2) Plant leaf diseases recognition prototype

EXPERIMENTAL RESULTS

We extract 15 features (four morphology, five GLCM and six color features) were identified; hence, the total input features were fifteen. These features were used to classify different plant leaf diseases. In line with this, we have designed experimental scenarios to test the classification performance by taking the extracted features of leaf image The classifications were tested by three different algorithms namely ANN (Artificial Neural Network) and SOM (self organizing map) together with RBF(Radial basis function) in order to get a more accurate result. There are two basic phases of pattern classification. They are training and testing phases. In the training phase, data is repeatedly presented to the classifier, in order to obtain a desired response. In testing phase, the trained system is applied to data that it has never seen to check the performance of the classification. Hence, we need to design the classifier by partitioning the total data set into training and testing data set. We use for recognizing plant diseases form the from the given image a combination of RBF and SOM, we use RBF for fully controlled environments and SOM for uncontrolled environments. In RBF, all the training data is given to the network for training. Once the network is trained using RBF it is very simple to differentiate the diseases. Then the output of this RBF is taken by SOM for uncontrolled environments this help us to take a minimum iteration for choosing the activation value and also provides a higher rates of convergence.



Fig(3) Overall performance of plant leaf diseases recognition

Table (1) Summary Result of ANN and SOM Classifier Using All Features

	ANN				SOM		
	Bacteria	Fungi	Virus		Bacteria	Fungi	Virus
Bacteria	815	198	25	Bacteria	1002	17	19
Fungi	121	806	111	Fungi	29	986	23
Virus	91	149	798	Virus	66	65	907
	Total	3114		Total	3114		
	Classified	2419		Classified	2895		
	misclassified	695		misclassified	219		
	%	77.68144		%	92.96724		

As we have presented in detail in the previous section, the experiments were conducted under four scenarios by using feature sets of morphology, texture and color separately, and finally combining the three feature sets. Then, the experiment results were compared the performance of ANN and SOM together with RBF classification over the three scenarios. The total number of data sets is 10380. Out of these, 70% were used for training and the remaining 30% were used for testing. In general, the overall result showed that morphology and color features have more discriminating power than texture features and the classification performance of SOM is by far better than ANN.

CONCLUSION AND FUTURE WORK

The experiment was conducted under four scenarios of the features data set such as GLCM, Morphology, Color and combining the three features. The result of the experimentation showed that the three varieties of plant leaf diseases have been classified more accurately by SOM than using ANN classifier. The image analysis for the recognition of the type of plant leaf diseases can be further investigated. The work can also be seen in depth and researched by the different characteristics of its physical and chemical in connection to image technology. In light with this, the following recommendations are made for further research and improvements. Identification of leaf diseases type by exploring more features, leaf diseases recognition by levels of injuries using image analysis, implementing on mobile to make simplified for experts.

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