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Plant Disease Identification Techniques using Image Processing: A Study

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Abstract— Plants suffer from many diseases. This study refers to identify visually observable patterns facing different plant diseases. The study aims to find methods used by researchers all over the world for identification of plant diseases.

Keywords— Plant disease, leaf disease, ICT, image processing, Agriculture, Mobile technology.

I. INTRODUCTION

Information and Communication Technology (ICT), enables the dissemination of requisite information at easy and in cost effective manner at right time. ICT includes computers and communication technology along with associated software to perform activities such as generating, processing, transmitting, disseminating, sorting, archiving and retrieving information.

Mobile technology is rapidly evolving since past few years with its use in not merely to call and send messages but also for reading, editing and sending Office documents, using location services through GPS, accessing internet via Searching through Web browsing, communicating through Social networking, playing Games, to provide wireless connectivity with desktop or laptop, sending Emails, transferring files from one mobile to another mobile etc.

Images are used in various applications like Entertainment, Information presentation, Education, Agriculture, Medicine, Computer Aided Designing, Visualization, Computer Art, Telecommunication, Image Processing etc. The output of image processing may be either an image or a set of characteristics or parameters related to the image.

Data Mining is an analysis step of "Knowledge Discovery in Databases (KDD) "process. It is the computational process of discovering patterns such as group of data records (cluster analysis), unusual records (anomaly detection) and dependencies (association rule mining) and generating knowledge from large databases.

II. THE STUDY

Agriculture plays a major role and serves as the backbone of Indian Economy as it not only provides food and raw material but also generates employment opportunities to the large Indian population.

Fig : 1, Fig :2 and Fig 3 show observable patterns found in agricultural plants affected by diseases. In Agriculture crop plays a vital role. The major concern of this study is the diseases of crops. If in a crop, disease is detected in earlier stage the yield loss can be reduced.

All over the world the researchers are working for disease identification through the use of ICT. The following study describes the work done in this field.

Various crop diseases are observed in Gujarat

Fig 1: Tikka leaf spot disease in groundnut plant.

Fig 2 : Angular leaf spot disease in cotton plant

Fig : 3 Red rot disease in sugarcane plant

Weizheng S., Yachun. W., Zhanliang. C., and Hongda.W. inpaper [1] developed grading method for leaf spot disease. They analysed all influencing factors existed in the process of image segmentation and segmented leaf region by using Otsu method. In the HSI color system, H component was chosen to segment disease spot to reduce the disturbance of illumination changes and the vein. Then, disease spot regions were segmented by using Sobel operator to examine disease spot edges. Finally, plant diseases were graded by calculating the quotient of disease spot and leaf areas. Researches indicate that this method to grade plant leaf spot diseases is fast and accurate.

Kolhe S. , Saini H.S. , Kamal R.and Gupta G.K. in paper [2] presented a knowledge management system for crop disease named it KMSCD. The aim of their studywas to provide a knowledge management tool for efficient knowledge acquisition, storage, knowledge engineering, processing and proper maintenance of knowledge that can be ultimately used by the diagnostic expert system. The developed system simplifies the complete process of knowledge management by providing user-friendly interface to the domain expert for entering and storing knowledge to solve the disease identification and control problem particularly for oil seeds crops. The system presently applies to the knowledge management of 25 prevalent diseases of three major oil seeds crops of India viz. soybean, ground nut and rapeseed mustard.

Anthonys G., Wickramarachchi N. in Paper [3]the researcher has developed an image recognition system that can recognize paddy diseases. Images were acquired under laboratory condition using digital camera. Three major diseases commonly found in Sri Lanka, Rice blast (Magnaporthegrisea), Rice sheath blight (Rhizoctoniasolani) and Brown spot (Cochiobolusmiyabeanus) were selected for that research. Initially image of paddy leaf was digitized. Then a method of mathematics morphology was used to segment these images. Then texture, shape and color features of color image of disease spot on leaf were extracted. They used classification method of membership function to discriminate between the three types of diseases. The method was found achieve 70 percent classification accuracy for around 50 images used for sample.

Dheeb Al Bashish, Malik Braik and SauliemanBaniAhmad in paper[4] developed a neural network based software for automatic detection and classification of plant leaf disease.The program was tested on five diseases they are Early scorch, Cotton mold, Ashen mold, late scorch and tiny whiteness found in Ghor area in Jordan valley.They used K-means-based segmentation method for segmentation of RGB images which gave precision of about 93%.

Mr.Viraj A. Gulhaneand Dr. Ajay A. Gurjar in Paper [5] used color image segmentation method to extract intensity pattern in cotton plant. ANN method was used which provided 85 to 91% of exact disease detection depending upon the quality of image provided by the portable scanner and the training.

P. Revathi , R. Revathi and Dr.M.Hemalathain paper [6]suggested use of ABC Algorithm, SVM with RBF, ANNfor detection and control of plant diseases using Data Mining and Artificial Neural Network.

Jayamala K. Patil and Raj Kumar in paper[7]discussed use of image processing in agricultural applications.

Haiguang Wang , Guanlin Li ; Zhanhong Ma ; Xiaolong Li in paper [8] implemented neural network for study of 21 color features, 4 shape features and 25 texture features. Images of wheat stripe rust and wheat leaf rust diseases of wheat

plant and grape downy mildew and grape powdery mildew diseases of grape plant were used for study. 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. The results showed that these neural networks could be used for image recognition of these diseases based on reducing dimensions using PCA and acceptable fitting accuracies and prediction accuracies could be obtained. For the two kinds of wheat diseases, the optimal recognition result was obtained when image recognition was conducted based on PCA and BP networks, and the fitting accuracy and the prediction accuracy were both 100%. 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, and the prediction accuracies were 94.29% with the fitting accuracies equal to 100%.

Revathi, P., Hemalatha, M.in paper [9] researchers have worked on Foliar fungal disease of cotton and which is found to occur in all growing Indian regions. The work expressed new technological strategies using mobile captured symptoms of cotton leaf spot images and categorize the diseases using HPCCDD Proposed Algorithm. The classifier was trained to achieve intelligent farming, including early Identification of diseases in the groves, selective fungicide application, etc. The work was based on Image RGB feature ranging techniques to identify the diseases (using Ranging values) in which, the captured images were processed for enhancement. Then color image segmentation was carried out to get target regions (disease spots). Next Homogenize techniques like Sobel and Canny filter were used to identify the edges. The extracted edge features were used in classification to identify the disease spots. Finally, pest recommendation was given to the farmers to ensure their crop and reduce the yield loss.

Prof. Sanjay B. Dhaygudeand Mr.NitinP.Kumbhar in Paper[10] developed processing scheme consists of four main steps. First : Generation of a color transformation structure for the input RGB image. RGB generated in step 1 is converted to HIS. Second :Masked green pixels and removed them using specific pre computed threshold value. Third : Image was segmented and the useful segments were extracted,. from SGDM matrices. Fourth - finally performing the texture statistics by comparing texture papameter of affected leaf to normal leaf.

Mr.Pramod S. landge, Sushil A. Patil, Dhanashree S. Khot, Omkar D. Otari, Utkarsha G. Malavkar in paper [11] discussed use of colour transformation and formulation of neural networks as classification tool for automatic detection of leaves diseases. The approach was successfully implemented for maize leaf. The implementation steps were : 1. Colour Transformation structure to retrieve HIS image from a RGB image. 2. Masking of Green pixels- to identify healthy portion of leaves. 3 –Removing masked cells – removing of zeros Red, Green and Blue components for reducing processing time. 4. Matrix generation – Matrix is generated from binary image and transferred to Neural Network. 5. Neural networks are formulated as classification tool for automatic detection of leaves diseases.The algorithm was tested on various diseases which influence on the plants like Stem borer, Brown stripe downy mildew etc.

Mr.Hrishikesh P. Kanjalkar and Prof.S.S.Lokhande in Paper [12] developed software solution for automatic detection and computation of plant leaf diseases. Cotton and soybean plants were used for the experiment. The developed processing scheme consists of five main steps, first a color transformation structure for the input RGB image is created, then the noise i.e. unnecessary part is removed using specific threshold value, then the image is segmented with connected component labeling and the useful segments are extracted, finally the ANN classification is computed by giving different features i.e. size, color, proximity and average centroid distance. Experimental detected angular leaf spots on cotton plant with an accuracy of 83% and Soybean plant suffering from Bacterial pustule with 80 % , Bacterial gummosis 80 % , Bacterial blight with 70% accuracy.

Majid, K. , Herdiyeni, Y. and Rauf, A. in paper [13] have developed a mobile application for paddy plant disease identification system using fuzzy entropy and classifier probabilistic neural network (PNN) named I-PEDIA that runs on Android mobile's operating system. Paddy diseases are a major cause of yield loss and lower profit in rice production. Paddy diseases are extracted from digital paddy leaf images using fuzzy entropy and then the diseases are classified using PNN. The experiment result shows that the accuracy of paddy diseases identification using this application was 91.46%.

SmitaNaikwadi andNiketAmodain paper [14] have worked on algorithm and developed a software program in MATLAB in which the color features extraction are applied on samples of healthy leaf and the diseased leaf of the plant. The training process included the training of these samples by RGB layer separation technique which separates the layers into red, green, and blue layers and edge detection technique which detecting edges of the layered images. Once the histograms are generated for both samples and the testing image, immediately they are compared .The comparison is firstly with the testing sample and the healthy sample if the testing sample is diseased, it compare testing sample with the diseased sample and these steps take few minute to display the comparison result that is the testing sample is diseased or not and displays results through GUI (graphical user interface).

Paper [15] by P.R. Rothe and Dr. R. V. Kshirsagar presented a modus operandi for automatic classification of cotton leaf diseases through feature extraction of leaf symptoms from digital images. They have used Otsu's segmentation method for extracting color and shape features. Support vector machines (SVM) had been used for classification on the extracted features. Three diseases have been diagnosed, namely Bacterial Blight, Myrothecium and Alternaria with an accuracy of 90%. The testing samples of the images were gathered from CICR Nagpur, cotton fields in Buldhana&Wardha district.

Nitin S. Tijareand Prof.Sagar S. Badnerka [16] have discussed various methods suggested by different researchers to detect plant diseases by extracting image features like color, shape and texture feature.

Through study we conclude that the following methods have been used by different researchers for plant disease detection & analysis:

1. Back propagation neural network.
2. Airborne hyperspectral imagery & red edge techniques.
3. Image analysis integrated with Central Lab. of Agricultural Expert System (CLASE) diagnostic model.
4. Combination of morphological features of leaves, image processing , feed forward neural network based classifier & fuzzy surface selection technique for feature selection.
5. Support vector machines for developing weather based prediction models of plant diseases.
6. Wavelet based image processing technique and neural network.
7. Image Processing with PCA & Probabilistic Neural Network (PNN).
8. Combination of image growing, image segmentation, Zooming algorithm & Self Organizing Map (SOM) neural network for classifying diseased rise images.
9. Self organizing maps &back propagation neural networks with genetic algorithms for optimization &support vector machines for classification.
10. Image clipping, filtering &thresholding.
11. Otsu segmentation, K-means clustering &back propagation feed forward neural.

III. CONCLUSION

The literature survey done in this paper provides a new insight in detection and management of plant diseases. Today the mobile technology is booming application of ICT. Most of the people use mobile. There is still scope to develop new model and improve existing models for plant disease identification using mobile and multimedia technology. This proposed research will help the farmers in identification and managing of plant disease in their own language.

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