CROP DISEASE DETECTION AND PREVENTION USING SVM AND CNN

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***Abstract*- Agriculture plays a vital role in Indian economy. Indian agricultural sector accounts for 18 percent of India's GDP. Health of the crop is of extreme importance as agriculture provides employment to 50% of countries workforce. Crop disease detection provides a medium for keeping track of crop's health. This research paper presents a platform for crop disease analysis and suggests preventive measures using machine learning algorithms. Support Vector Machine is used to detect the presence of the disease and Convolutional Neural Network for crop disease analysis. Images are preprocessed and essential features are extracted and then crop disease is classified using machine learning algorithm. Proposed system will help farmers in early detection off crop and take preventive measures. In future it can be extended by introducing automation.**

***Keywords*- Machine Learning (ML), Support Vector Machine (SVM), Convolutional Neural Network (CNN), Crop Disease, Agriculture, Tomato, Corn.**

1. INTRODUCTION

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. The Indian food and grocery market is the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. India is agrarian country. Agriculture is the main backbone of the Indian economy. Total 60% of India's land comes under the agriculture. 70 % of population are directly or indirectly depend on agriculture in India. Agriculture not only plays the important role in large industries but also each and every person of the society are depend on it. So crop monitoring is crucial task to know the crop health. To grow the high quality product and maximize the yield production proper and in time "Crop Disease Detection" is very much needed. Disease in crop is natural but to identify it in timely manner is essential in agriculture sector.

Farmers are facing lots of problems, one of them is no effective system available for early detection of crop disease. Crop disease affects crop's health which affects the income of farmer. Different plants suffer from different diseases. Plants start getting infected from leaves. Leaves can be studied for detection of plants. The major categories of plant leaf diseases are based on viral, fungal and bacteria. The diseases on leaf can reduce both the quality and quantity of crops and their further growth. The easy method to detect the plant diseases is with the help of agricultural expert having knowledge of plant diseases. But this manual detection of plant diseases takes lot of time and is a laborious work. Hence, there is a need for machine learning method to detect the diseases using leaves.

2. RELATED WORK

Stephen Gang Wu in 2007, has developed a leaf recognition algorithm to extracted features and highly

efficient algorithms for recognition purpose. A Probabilistic Neural Network (PNN) was used for recognition of plant leaves. The accuracy of recognition observed was 85%.

A. Meunkaewjinda in 2008, has developed a system for identification of leaf diseases of the grape plant. The proposed system consists of three steps: 1) grape leaf color extraction from complex background, 2) grape leaf disease color extraction and 3) grape leaf disease classification. In this analysis, back-propagation neural network with a self-organizing feature map together used to recognize colors of grape leaf.

Further Modified Self Organizing Feature Map (MSOFM) and Genetic Algorithm (GA) developed for grape leaf disease segmentation and SVM for classification. Finally filtration of resulting segmented image is done by Gabor Wavelet and then SVM is again applied to classify the types of grape leaf diseases. This system can classify the grape leaf diseases into three classes: Scab, rust and no diseases. Average disease detection rate was 91.8 %.

Sanjeev S Sannakki in 2011, plant pathologists mainly rely on naked eye prediction and a disease scoring scale to grade the disease. It proposes an image processing based approach to automatically grade the disease spread on plant leaves by employing Fuzzy Logic. The results are proved to be accurate and satisfactory.

Godliver Owomugisha in 2014, has attempted to detect diseases in the banana plant such as banana bacterial wilt (BBW) and banana black sigatoka (BBS) that have caused a huge loss to many banana growers. There are various computer vision techniques which led to the development of an algorithm that consists of three main phases. 1) The images of banana leaves were acquired using a standard digital camera 2) It involves use of different feature extraction techniques to obtain relevant data to be used and 3)where images are classified as either healthy or diseased. Extremely Randomized Trees performed best in identifying the diseases achieving 0.90 AUC for BBW and 0.91 for BBS

P. R. Rothe in 2015, has used a pattern recognition system for identification and classification of three cotton leaf diseases i.e. Bacterial Blight, Myrothecium and Alternaria. The images required for this work are captured from the fields at Central Institute of Cotton Research Nagpur, and the cotton fields in Buldana and Wardha district. Active contour model is used for image segmentation and Hu's moments are extracted as features for the training of adaptive neuro-fuzzy inference system. The classification accuracy was found 85%.

Sanjeev S Sannakki et al in 2015, [11] has used Back Propagation Neural Network (BPNN) classifier for detection of plant diseases based on visual symptoms occurring on leaves. Two diseases of pomegranate plant namely Bacterial Blight (BB) and Wilt Complex (WC). Images of healthy and unhealthy leaf samples are captured by digital camera, enhanced and segmented to detect infected portions. Color and texture features are extracted and passed through BPNN classifier which correctly classifies the disease being occurred, thereby helping farmers in effective decision making. The accuracy in classification was 95.30%.

Al Bashish used an image processing based framework for detection of five diseases, namely, early scorch, cottony mold, ashen mold, late scorch, and tiny whiteness of rice leaves and stems. The K-means was used for clustering the diseased leaf images. Then clustered images were passed through an NN classifier. The result described that NN classifier detected leaf diseases with an accuracy of 93%. This framework significantly supports accurate and automatic detection of leaf diseases.

3. CROP DISEASE DETECTION

3.1 Data Set

The dataset of Crop Disease images used for this system is collected from UCI repository, CrowdaAI and from other internet source as well as some real time captured images, which are by normal student and PD person. This dataset contain total 6 different disease of tomato and corn 3 for each crop and each Disease contains 200 images so total dataset have 1600 images.

3.2 Design Architecture

General idea of our system is take crop image as input and then process the crop image and detect whether the disease is present or not using Support Vector machine. If disease is present then display disease name along with the brief symptoms and prevention methods using the Convolutional Neural Network algorithm else notify that the plant is completely healthy.

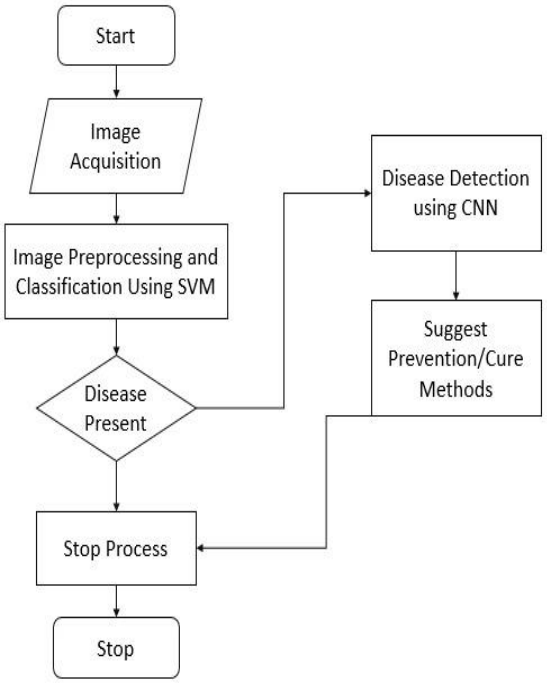

Fig. 1 Crop Disease Detection Flow Chart

3.3 Design of Crop Detection System

Crop Disease Detection System is designed using PyCharm IDE with Tensor Flow as backend library. System is available as app as well as website. The system consists of home screen where the farmer can upload the image of the suspected crop and the result screen where the presence or absence of disease is displayed. Symptoms and Prevention methods are also displayed on the result screen if the disease is present.

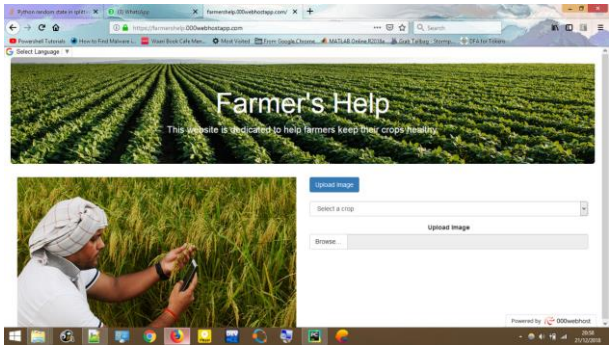

Fig. 2 Home Screen of Crop Disease Detection

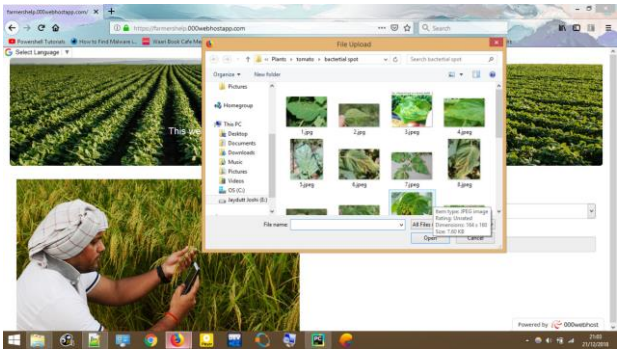

Fig. 3 Browse Input Image

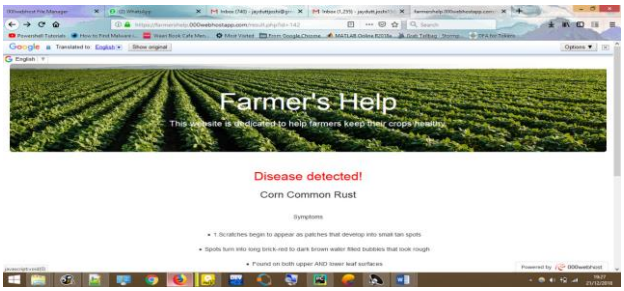

Fig. 4 Result Screen

4. RESULTS

In proposed work, crop disease in corn and tomato are captured using Support Vector Machine, processed and classified using Convolutional Neural Network.

Table 1-Performance of classifier

No. of disease Images	Accuracy
80	87.8%
400	88.89%
800	91%
1600	93.3%

Table 2-Evaluation of classifier

No. of trained Images	No. of tested Images	Correctly classified	Misclassified	Accuracy
1500	300	268	32	89.3%

The average accuracy of classification of proposed algorithm is 89.33.

5. CONCLUSION

Crop Disease analysis using Convolutional Neural Network and Support Vector Machine is useful technique to detect the disease of various crop. This detection of disease is very helpful to the farmer as well as whole society because it result into more productivity and high quality yield production. The proposed system will detect the 6 different types of crop disease of the tomato and corn disease with higher accuracy. Proposed system is very useful as per farmer point of view and indirectly it also beneficiary to the economy because it helps to produce the more and good quality product. Proposed system used the Support Vector Machine for detection of diseases' presence and Convolutional Neural Network for feature extraction and image classification.

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