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PREDICTION OF PLANT DISEASES USING IMAGE PROCESSING AND MACHINE LEARNING ALGORITHMS

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Abstract -Healthiness of plant is always monitored by healthiness of leaves, stem, flowers and fruits. Now-a-days people have no idea about all those things. This paper talks about how the problem is solved with computerized version generally there are few systems like k-means and different classification algorithm which identifies the diseases but not up to the mark so, the paper discuss a new technique called Convolution Neural Networks[CNN] in image processing which involves many hidden layers when compared to ordinary neural network techniques so that the project will return accurate results. This project considers some of the plants which are locally grown in India viz., tomato, corn, grape, potato and apple and their related diseases are predicted using image processing and machine learning algorithms. In this project the plant leaves are taken as pictures and these pictures are feed to the model which is main part of the work which predict whether given leaf is effected or healthy. Later the farmers provide fertilizers for the crop to control the disease.

Keywords: Machine Learning, Neural Networks, Convolution Neural Networks, plant disease prediction

1.INTRODUCTION

Agriculture is the backbone of Indian economy. Nearly 17-18% of GDP depends on Agriculture. Most of the rural population depends on agriculture and its related activities i.e, about 60% of the total population directly or indirectly depends on farming for their livelihood. There are many sectors in agriculture like crop production, livestock, forestry, fishing and aquaculture.

This project mainly focuses on crop production. Basically the crop yields depends on environmental factors like weather,soil, rainfall, seed quality, fertilizers and pesticides used along with these factors the main important issue to be considered is detection of plant diseases in specified time otherwise it shows more negative impact on the crop yields.

Generally the diseases can be identified when they become severe which reduces 20-30% of crop yields. So, the farmer should identity the disease in earlier stages, it may not be possible through optical observation of experienced persons. Now, the work is to make this process as easy as possible and to help the farmers in identifying the plant diseases so that it helps in reduce the damage caused by the disease which in turn increase the crop productivity.

2 Literature Review

Detection of plant disease is the major issue of the computer vision and machine learning. There are many phases like pre-processing, extracting the features and classification. The support vector machine(SVM) classifies the image into two categories. In the existing technique support vector machine is used for the classification. According to Simranjeet, et al.,[2019] the proposed methodology is based on the region based segmentation, textual feature analysis and k-nearest neighbor method is applied for the classification.

A new image recognition system based on multiple linear regression is proposed by Guiling Sun, et al., [2018]. There are many techniques

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available in image processing. One among them is histogram segmentation method which calculates an automatic threshold value accurately. To improve intelligence and accuracy of the system in prediction, a combined method of regional growth method and true color image processing are used. Multiple linear regression and feature extraction are used for image recognized system.After extracting the features of different training image sets the system gives effective image recognition with high precision.

The methodology proposed by Saradhambal, et al., [2018] is k-mean clustering algorithm to predict the infected area of the leaves. The segmentation model is defined to classify the infected leaves into one of the relevant class labels . In order to know about the time complexity and infected area of the leaf, some experimental analysis are performed on sample images. With the help of this analysis they can analyse the accuracy of the system.

Vijai Singh and Misra A K[2017] presents the survey on different diseases classification techniques used for plant leaf disease detection and an algorithm for image segmentation technique that can be used for detection and classification of plant leaf diseases automatically. Less computational efforts are needed to get optimum results in detection and classification of the leaf diseases. By using this method we can identify the plant diseases at earlier stage or at initial level . To improve prediction in classification of plant diseases Bayes classifier, Artificial Neural Network, Fuzzy Logic and hybrid algorithms can be used.

Sushil R. Kamlapurkar[2016] suggests a system with accurate results in identification and classification of plant diseases.In earlier days experts have to identify the plants and classify the disease. But in this system the input image undergoes some pre-processing techniques to resize the image later it will be converted into HSI color format . the system will extract some features like major axis, minor axis, eccentricity from the pre-processed image. These features are given to classifier for classification of plant disease.Method for quick and error free prediction & classification of plant diseases is suggested by Hartman et al.,[2009] they use different clustering and They used K-means clustering, Otsu's segmentation for clustering of plant leaves and back propagation feed forward neural network for classification of diseases that affect on plant leaves.

Back propagation neural network for recognition of leaves is proposed by Prasad Babu and SrinivasaRao[2007]. Shape of leaf image and back propagation is enough to classify the leaf species. Back propagation algorithm takes leaf token as an input which can be obtained through Prewitt edge detection and thinning algorithm. this proposed system has huge scope for enhancement by consider large datasets to recognize different plant species with different diseases effected by different virus and insects.

Neural network approach for segmentation of agricultural landed fields in remote sensing data is proposed by Alexander et al.,[2007] A Back propagation neural network algorithm is used for segmentation of the leaf images of plant infected by diseases that changes actual color of plants.

A prediction approach based on support vector machines for developing weather based prediction models of plant diseases is proposed by in Rakesh, et al.,[2006] . The performance of conventional multiple regression, Artificial Neural Network(ANN) and support vector machine (SVM) was compared. It was concluded that SVM based regression approach has led to a better description of the relationship between the environmental conditions and disease level which could be useful for disease management.

3. Factors Causing unhealthiness of leaves

There are mainly three factors that affects plants. they are insect damage, infectious pathogens and non-infectious physiological disorders.

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Let us discuss about first one : Insect damage . Some insects damage the plants by eating leaves and some other insects eat the material part in the leaf which causing leaf skeletonized .In other cases insects may soil the upper and lower leaf surfaces.

A second category of plant problems are caused by infectious pathogens like virus, bacteria or fungi .there are some helpful pathogens which helps the farmer or gardener in the concept of plant growth but in the major case they are very bad ,they will attack the plant which resulting in a disease, and one plant species can be attacked by many diseases at a time .Sometimes it is difficult to identify the disease which shows the same symptoms where as some diseases shows unique symptoms makes the identification process very easy .

The third category of plant problems are caused by non-infectious physiological disorders because of environment. Physiological disorders like too much water or too little water, too hot or too cold temperature, poor fertility in soil affects the plant. some of them can be controlled by the farmer or gardener by taking some care and regular monitoring of plants or crops whereas weather conditions shows great impact on plant growth which may effects some times. Following images are some of the examples of affected leaves.

Fig 1: Affected leaf Images

4. Model Development

There are many techniquesviz SVM, k-means, ANN & Fuzzy logic however the results are not upto the mark so, we are going to propose a new model in the prediction process which is nothing but Convolution Neural Networks(CNN) which is mainly used technique in image processing, considered as a sub topic in neural networks. CNN consists of several hidden layers where the work is divided among themselves to provide accurate results.

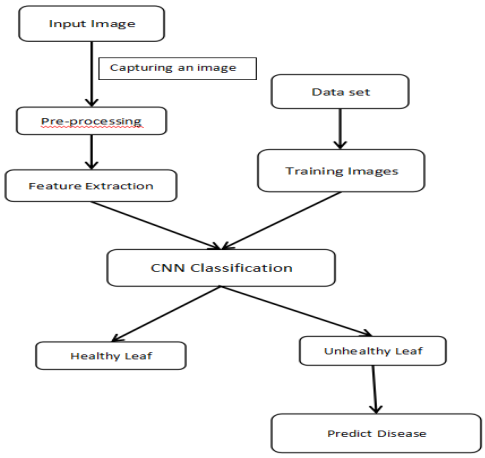

Fig-2: Architecture of system

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- **Data set**: The data set contains five plant species such as apple, corn, grapes, potato and tomato. Each species may effect with different types of diseases, this project considers some of the major diseases.

- **Capturing an image**: this system takes leaf image as a input. The user takes a picture of affected leaf and gives the image as input in the user interface by clicking on browse image button.

- **Pre-processing**: Given image undergoes pre-processing techniques like adjusting the pixel vales.

- **Feature Extraction:** From the image features are extracted in the form of single column vector. The image is passed to different hidden layers like convolution layer, ReLu layer, pooling layer, fully connected layer. By passing the image into the sequence of these layers will results in accurate results.

- **CNN Classification:** Feature value vector is given to the CNN model which results in a matrix based on the feature values the class which has maximum value can be labeled for the image

5. Processing Steps

This project is developed by following sequence of steps which are mentioned below:

- Step 1 :- Collect the database which contains images related to different plant species.
- Step 2 :- Train the model with the help of train and test data.
- Step 3 :- Take an image of a leaf and upload that image in the application.
- Step 4 :- Image undergoes some preprocessing like adjusting the pixel values.
- Step 5 :- Extract the features of the input image.
- Step 6 :- Send the features to the model.
- Step 7 :- The model will analyze the features and predict whether the given image is normal or affected, if it is affected then it will predict the disease name

6. **Demonstration**

First of all, capture the leaf image in a mobile phone or camera . Later share the image to desktop on which the image is going to test for its healthiness of the leaf. This leaf image is given as a input to the project by clicking on upload image button and select the captured leaf. This project works with different plant species and their related diseases which are shown below:

Table 1 : Plant and its related diseases

Plant	Disease
Apple	Apple_scab , Black_rot, Cedar_apple_rust, Healthy
Corn	Common_rust, Northern_Leaf_Blight, Cercospora_leaf_spot, Healthy
Grape	Black_rot, Black_Measles, Leaf_blight_(Isariopsis_Leaf_Spot), Healthy
Potato	Early_blight, Late_blight, Healthy
Tomato	Early_blight, Late_blight, Leaf_Mold, Septoria_leaf_spot, Spider_mites Two-spotted_spider_mite, Target_Spot, Yellow_Leaf_Curl_Virus, mosaic_virus, Healthy

In every plant species this project considers healthy leaves along with the diseases so that it will predict whether the input leaf is healthy or

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unhealthy, if it affected with any disease it will predict the disease name. Following picture shows the working of this project

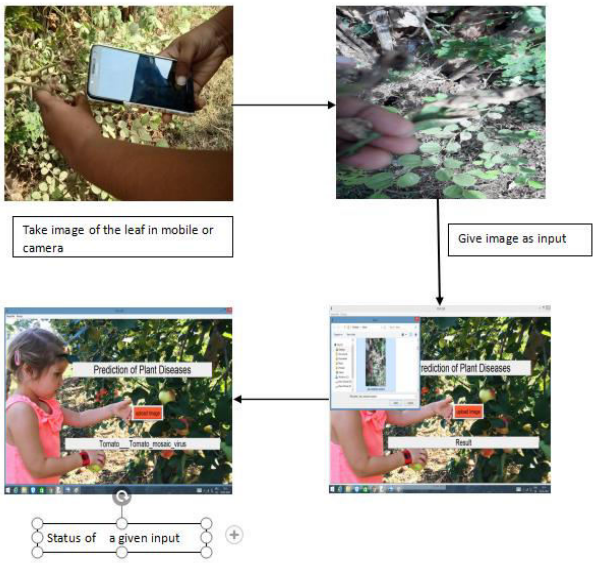

Fig 3: Execution of project

7. Testing

Testing the project involves verification of code and execution of project. In first case code is analyzed and remove errors if any, after that the execution of code is validated by giving different inputs which is explained with following diagram.

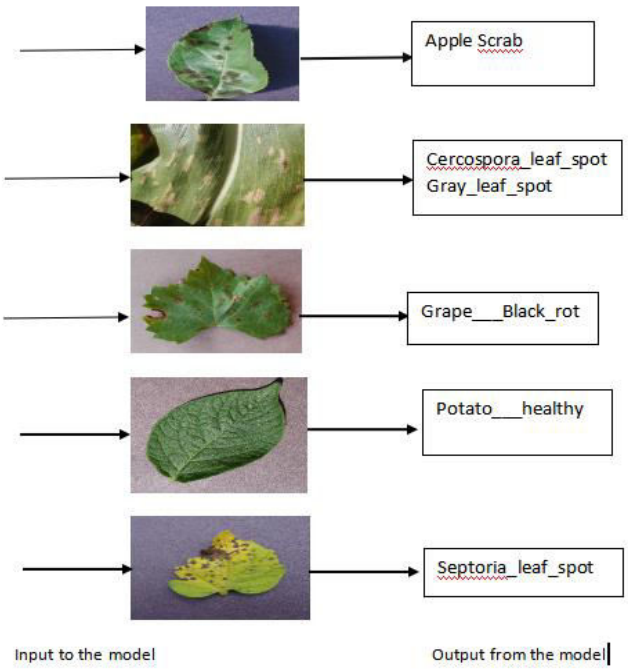

Fig 4: Testing

8. Results

Figure 3 shows the execution of the project , if the user wants to upload another image he can simply click on upload image button and upload new image as follows.

Fig 5: Continues execution of project

The following image shows the background execution of the project in IDLE.

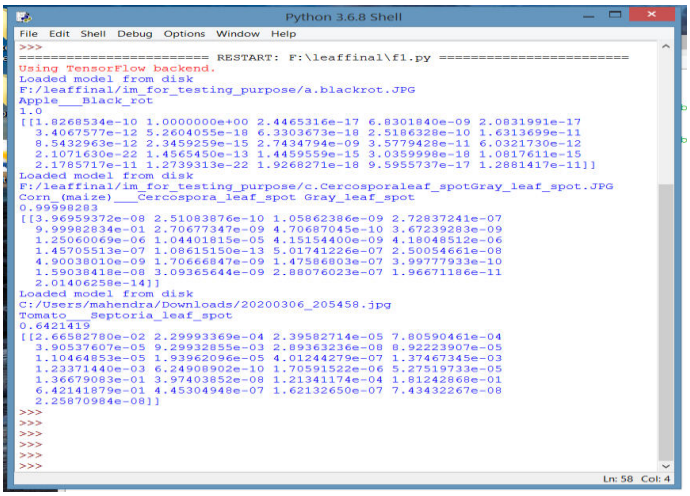

Fig 6: Results of the project execution in the background

7. Conclusion and Future Scope

Finally this project is going to predict the disease that the leaf is affected with. If the leaf is normal then it will says that the leaf is healthy else it will predict the disease name and gives it as output. This Project consider five plant species namely apple, corn, grape, potato and tomato with some basic disease that the plants are getting effected.

This project has a vast scope in the future for enhancement. It may include more number of plant species and diseases. So that it can help all the farmers. Along with the disease names it will

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provide the solutions by finding the intensity of the disease on the crop .

With the help of developed technologies like drones and many more algorithms, proposed methodology can be enhanced as "the drone will take the images of entire field along with longitude and latitude values which help the system to create a virtual crop image which shows the disease effected area with thick colors and normal regions with some normal colors so that the farmer can spray the pesticides in effected area". This will help the farmer for crop monitoring from one point to analyze the situation of the crops.

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