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# Plant Disease Identification Using ML

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**Abstract**: Agriculture have an important role in our day today life. Now adays the population has increased and it also increased the demand for food. So it is necessary to increase the production of crops. For better production of crops the plants should be properly fertilized and protected from diseases. Manual identification of disease is not possible for large scale farmers all the time as it is time consuming and need more labours for that. Diseases can be easily detected by using machine learning. By using machine learning technique we can identify the disease that is affected to the leaf, stem, root and fruits. Images captured using mobile camera will be processed using image processing technique. The features are extracted from the disease affected part and it can be classified using machine learning technique such as Convolutional Neural Network(CNN) and MobileNet. An application that can predict the disease affected to the plant and possible precautions to avoid the disease will be developed.

**Keywords**: Machine Learning, CNN, MobileNet, Image processing

## I. INTRODUCTION

When plants are affected by disease it may cause economic losses in agricultural field. So required treatments can be given if plant diseases are correctly identified early. The system uses image processing and machine learning technique to identify the diseases. Using machine learning technique we can reduce human effort to identify diseases and also it proposes the precautions to be taken to save the plant from disease. The system consist of a mobile application. It is a user friendly application which is installed on Android phone will help farmer to solve the problem to detect the disease. The farmer capture the images of the plant parts on the mobile phone and uploads the image to the database with the help of this application. The image is processed using the Image Processing techniques and CNN classifier helps to detect the disease. After the detection of disease precautions are predicted for the particular disease and the message is sent to the farmer and the farmer can view the message in his application. Using this system farmer can detect the diseases from its symptoms and required precautions can be taken.

## II. THEORY

A.CNN Classifier

Convolutional Neural Networks is an architecture of artificial neural networks. This architecture is mainly used for image classification. The system sees an image as an array of pixels. Every pixel is denoted by a number from 0 to 255. Because of this digital representation of image computers are able to work easily with the images. CNN accommodates 3 layers. They're input layer, hidden layer associated an output layer. Pre-processing of images is completed in CNN which is a vital step because the images in dataset may have some issues while comparing it with the image which is inserted.

B.Processor: i3

It is developed by Intel. The Core i3 is a dual-core processor which is used in desktop and laptop. It is one of the processors in the i series. Core i3 was introduced in 2010. The Core i3 do not have the Turbo Boost feature. It is available in market in different speeds [1.30 GHz -3.50 GHz] and features [3 MB or 4 MB] of cache. It uses LGA 1150 or LGA 1155 socket on motherboard. RAM used in Core i3 processor is DDR3 1333 or DDR3 1600. Core i3 processors are commonly used in laptops, because of their lower heat generation and low battery usage. When using a core i3 processor, laptops can be used upto five or six hours

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C.RAM : 4GB

Random-access memory (RAM) is a storage space of computer that helps to access data fastly in required order. A 4GB RAM can store 4GB of data temporarily otherwise we can say that a 4GB RAM can store 4294967296 characters. On other words RAM is the part of main memory that computer programs use to process. A computer with 4GB of RAM shows that it has almost 4 billion bytes of memory that can be used for program. But large size of RAM will not guarantee the fast running of the program.

D.Hard Disk: 500GB

It is an electro-mechanical data storage device. It can store and retrieve digital data using magnetic storage and one or more rigid fast rotating platters coated with magnetic material. The platters are coupled with magnetic heads, which is placed on a moving actuator arm. It performs read and write data on the platter surfaces. Individual blocks of data can be stored and accessed in any order. It is a non-volatile storage. If a hard disk is 500GB, it contains 500,000,000,000 bytes of space.

E.Python

Python was created in 1980s, and released in 1991, by Guido van Rossum. Python is high-level, taken and all purpose programming language. It is an object oriented programming language. Object-oriented approach helps programmers to write down clear and logical code for tiny and large-scale projects. It supports structured, object-oriented, and purposeful programming. Python 3.0 was released in 2008. It have many changes compared to Python 2. Python 2 code isn't supported on Python 3. Python 3.9 is the new version in Python 3 series.

F.MySQL

MySQL is an open-source database management system. A relational database arranges data into tables in which data types may be related to each other; these helps to structure the data. SQL is a language, which programmers use to create, modify and extract data from database, also control user access to the database. MySQL is free and open-source software under the GNU General Public License.

G.Anaconda Navigator

Anaconda Navigator is a graphical user interface (GUI). It helps to build application and easily handle conda packages, environments, and channels without using commands. It helps to build a virtual environment using python which can be accessed from any location. Anaconda is a free distribution of the Python and R programming languages.

## III.RELATED WORK

Here we introduce papers based on technologies used in the plant disease identification and papers are arranged in technology bases.

The aim of this paper [1] is to introduce a new system that can be applied on mobilephones.CNN face many problems, such as computational burden and energy, to be used in mobile phone and embedded systems. In this paper, they proposed a smart mobile application model based on deep CNN to identify tomato leaf diseases. To build this system, their model was inspired from MobileNet CNN model and it can recognize the 10 types of Tomato leaf diseases. This system was trained with the help of tomato leaf dataset. Mobilenet is a CNN architecture which is used for image classification. It takes very less computation power to run. Mobilenets are generally small, low latency and low power models.

In this paper [2] automatic paddy leaf disease detection using optimized fuzzy interference system (OFIS) has been introduced. The captured paddy images are converted into Red, Green and Blue band. Using median filter noise present in the green band is removed. Then the features are extracted from the pre-processed green band. The extracted features are given to OFIS system. So it can classify the image as disease affected or not . This system uses OFIS for classification. Around 85 images of leaves are tested in this system. This system gives higher accuracy. OFIS it gives an accuracy of 95% for leaf disease detection.

This paper [3] deals with the recognition of rice crop diseases using K-means clustering, SVM and CNN based classification techniques. Manual identification of crop disease may not be possible for large scale farming. By capturing the images using camera diseases can easily be predetermined. The image processing algorithms including K-means clustering, SVM and CNN. It helps in classification process. The training dataset involve 50 images which provides an accuracy over 95 percent. For feature extraction the classification techniques need to be pre trained. In SVM technique each image is segmented and then the user selects the segment of infected part. These segments are

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processed for feature extraction. For 30 images the accuracy obtained is around 90 percent. When the number of database images increases the accuracy of CNN algorithm also increases.

This paper [4] mainly deals with the plant disease detection using image processing technique. This system uses an open dataset. About 5000 pictures of disease effected parts of plants are used. In this system convolution technique and semi supervised approach are used to classify crop species and identify the disease of 4 different types. The system is trained with the images having a natural environment and got 99.32% classification accuracy. This proves the efficiency of CNN in plant disease detection.

This paper [5] presents a system for identification and classification of paddy leaf diseases based on the images of diseased plants. Captures the images of diseased plants using camera from the agricultural field for accurate extraction of features. Proposed K-means clustering mainly for the segmentation of diseased area from leaf image. Remove green pixels in the diseased area of paddy leaf. Extract the features based on colour, shape and texture. For a training dataset and test dataset obtained 93.33% and 73.33% accuracy respectively. Support Vector Machine(SVM) is employed for classification purpose.

This paper [6] deals with the classification of different types of diseases of plants such as tomato and brinjal. Diseases are recognized by its texture patterns. Grayscale is used for feature extraction purpose and GLCM matrix is used to compute the features. Mainly ANFIS based classification model is used for disease identification. ANFIS recognition gives an accuracy of about 90.7%. In this system the collected features that are extracted from grayscale images are taken to ANFIS classifier for classification process.

This paper [7] deals with the identification of disease which affect leaves of plants. Almost all types of disease symptoms are found in leaves, stem and fruit. For leaf disease identification and classification image processing technique can be used. Bacterial Blight, Anthracnose, Alternaria Alternata are some of the common diseases. If the number of diseases on plant leaf increases it will decrease the crop yield. By using multiclass support vector machine these types of diseases can be easily identified and classified. About 83.87% of accuracy is obtained. The system can be assigned to higher performance when the total program execution time is less.

This paper [8] deals with paddy leaf disease detection using SVM with RBF classifier. Disease in plants are the most important problem in agriculture field. By applying the various image processing and machine learning techniques the disease problems can be minimized. By using SVM automated paddy leaf disease identification can be done. The captured leaf image is converted to grayscale image. With image clipping, smoothing process and cropping noise in the image is removed. K-means clustering is used for segmentation and features are extracted from the segmented region. Then classification is done with the help of SVM. The efficiency of the system can be evaluated with the outcome of parameters such as error rate, sensitivity, specificity, and accuracy.

This paper [9] aims to combine different convolutional neural network architectures of deep learning models to get the highest accuracy rate. The model is already trained with 14,725 images of sugarcane leaves. Hence a 95.40% accuracy is obtained during training itself. To conduct this study three architectures of CNN ; StridedNet , LeNet and VGGNet are used. The models are used to classifying images of sugarcane leaves based on the leaf features. The dataset consist of 7 types of sugarcane images where 6 types are images of disease effected and one type is image of healthy leaves .

This paper [10] uses image processing technique. Through this plant leaf diseases can be detected. The main purpose of this work is to implement image analysis and classification. The system have four parts, they are image processing, segmentation using K-means clustering, feature extraction and classification of diseases. Statistical Grey-Level Co-Occurrence matrix(GLCM)is used to extract texture features and classification is done using support vector machine(SVM).

This paper [11] deals with the diseases that affect the leafs of soybean. With the concept of K-means clustering a semi automatic system was developed to classify healthy and disease affected leaves. The disease affected leaves are then classified into different disease categories. In this system the three models based on SVM classifier is trained with the combination of colour and texture features. The dataset used are selected from PlantVillage and provides a better accuracy. The system also detect the intensity of disease that affected the plant.

This paper [12] proposes a system to identify diseases of plants using deep learning methods. CNN model which identifies the plant diseases using leaf images are developed. The system was trained with the help of an open database. Different models are trained and got a best accuracy 99.53%. The high accuracy of the system is very useful for identifying the diseases and this will help the farmers to buy required pesticides and fertilizers. Also more improvements can be done to the system in the future.

This paper [13] proposes a system using image processing to identify the diseases affecting the tea leaves. The main aim of the system is to identify two diseases, brown blight disease and algal leaf disease. SVM technique is used to identify the disease. When an image is uploaded in the system it will identify the features of the image with the help of SVM database and identifies the disease. The system also provides accuracy above 90% and high speed. The system helps to reduce the diseases in tea plants and increase the production.

This paper [14] proposes a deep convolutional neural network for plant species recognition. Previous systems depends on colour, texture, shape, etc for plant leaf identification. This system is different from the last one. The high level

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features of leaf can be extracted by DCNN. The experiments conducted with the system shows the accuracy of the system. The system is trained with dataset and shows the efficiency of the system in identifying leaf.

In this paper [15] the main aim is to build the system which is fast, reliable , effective and error free. Hence using this system affected perform and yield. First the images are acquired from the digital high resolution camera or from the samples that is stored in the database. Then affected and unaffected images are stored and captures. Then they are applied for pre-processing to enhance the contrast of an image .Images are segmented using K means clustering. Features are extracted before using K means and SVM algorithm for coaching and classification .Finally diseases are identified and classified.

In this paper [16] propose a novel rice blast recognition method based on CNN. A positive samples of 2906 and negative samples are established. So that training can be done. Testing of the CNN model can also be done. The evaluation result show that the high level features which are extracted by CNN are more discriminate and effective. Quarantine evaluation results indicate the CNN with software and CNN with SVM machine have similar performances with higher accuracy, larger area under curve and better receiver operating characteristic curves than both LBPH plus an SVM as the classifier and Haar-WT plus an SVM as the classifier.

This paper [17] deals with the identification of disease in grapes. Diseases will be affected to leaf, stem and fruit because of bacteria, fungi, virus etc. This system deals with leaf diseases. The disease affected region is detected with the help of K-means clustering. The colour and texture of the disease affected part is extracted for further purpose. Then the disease is identified with the help of classification method. This system can identify the disease with accuracy 88.89%. As grapes are more cultivated in India it will be more helpful to farmers to deal with diseases that affect grapes.

This paper [18] propose a system to identify the leaf disease of ground nut. The main leaf disease that affect the ground nut is cercospora. This disease is affected to the ground nut in the beginning stage of leaf. Firstly RGB image is made. Then RGB image is then transformed into HSV image. Then plane separation is conducted. After this colour features is performed. At the end back propagation algorithm is used to identify the leaf disease that affected the ground nut. So the system will help to apply precautions early as possible.

This paper [19] uses GLCM and KNN for plant disease identification. For getting digital datas from image, image processing is used. Feature extraction, segmentation and classifications are the processes done in this system. Feature extraction is done with the help of GLCM algorithm. Segmentation of Input picture is done by K-means clustering algorithm. First the SVM classifier divides the input pictures into two. Later SVM is replaced by KNN for better performance. Then the accuracy of the system is increased and also the input data can be divided into many classes.

This paper [20] mainly focuses on the disease affecting the cotton plant and identifies the stage of disease. Images of the leafs are taken without any condition. That is, image can be taken by any person and with mobile phone. So the background of image makes the segmentation process difficult. Then two classifiers are used. First one will so segmentation process and the second one is trained to identify the disease with the help of hue and luminance of HSV colour space. The developed system can be generalised and used for detection of any disease.

## IV. CONCLUSION

This paper will be helpful to farmers who are facing plant disease problems in their crops. An application for identifying the plant diseases and predicting the necessary precautions for the disease will be implemented. The proposed system will be applicable for different plants. The system will be trained with image dataset of disease effected parts of plants. The plant parts include root, leaf, fruit and stem. This system will help to identify the plant diseases at the initial stage and proper precautions can be taken without consulting the experts. The machine learning and image processing technology will ensure the high accuracy of the system.

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