PLANT DISEASE DETECTION USING IMAGE PROCESSING

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***Abstract*—Plant disease research involves studying patterns on plants. Identifying plant diseases and monitoring plant health are important for sustainable agriculture.Agricultural productivity is very important to the Indian economy this is one of the reason that disease detection in plant is very important in agriculture.Image processing technology can be used to identify the diseases through following steps:Image acquisition,image pre-processing,image sample segmentation,feature extraction,and plant disease detection and classification.This can be done by precisely monitoring the health and detecting the diseases at ap- propriate stages of the plant's life time.Primary goal of this work is to detect the plant infections using the image processing.As part of technological development, researchers have been using image processing techniques to monitor and diagnose plant diseases at various stages.Appropriate machine learning algorithms are being developed and implemented to precisely identify the various plant diseases throughout their life cycle and sort of the treatment that may be given to them to prevent them form the diseases.**

I. INTRODUCTION

Because there is so much arable land in India, agriculture is regarded as a major and lucrative industry. India is a develop- ing nation. Additionally, India's fertile and varied soils enable the production of higher-quality and more varied crop kinds, which boosts revenue. However, when harvests are destroyed by plant diseases, these gains become losses.Plant disease detection is essential for crop management and production. Even though it requires a great degree of expertise, scouting professionals may watch and evaluate changes in plant leaves to successfully complete the task. Assessing the severity of plant diseases is an essential first step in creating precise and effective crop management strategies to increase production in the agricultural industry.

An fundamental component of a plant is a leaf. The pho- tosynthesis process is used by leaves to supply the plant with energy, which is essential for plant growth. Plant growth is impacted and the plant is put at danger when leaf diseases harm the leaf and its capacity to photosynthesize. Both the quantity and quality of plant products are impacted by these diseases. The majority of these illnesses are brought on by viruses and bacteria. It is crucial to identify these illnesses in order to protect the plants. Sometimes there is a significant yield loss as a result of ignorance about leaf disease, which causes a food scarcity. When the human eye makes these observations, it will take in A great deal of work, time, and money Numerous methods that make use of machine learning and artificial intelligence have been developed to facilitate this. Programs for detecting leaf diseases are created to identify the issue and fix it. Following the process, this model generates an output after analyzing the provided image. Making a software accurate requires testing and training, and selecting the right dataset is essential. This piece makes use of the "PlantVillage" collection, which consists of more than 20,000 original photos in 15 different categories. Because of its size, this dataset is helpful for testing and training algorithms and improves their accuracy. Numerous methods were examined in this study, including Support Vector Machine (SVM), Random Forest Classifier, K-Nearest Neighbors, and Convolutional Neural Network.

All of the states in the cultivated nation of India are used for farming. It is widely grown in various Indian states. For instance, a wide variety of crops are grown in Haryana, Punjab, Bihar, Uttarakhand, and so on. However, farmers suffer significant losses as a result of various diseases in the fields, and the nation's economy is greatly impacted by the enormous losses in agriculture. By simply observing the crops, farmers are unable to determine which disease is affecting them.

II. LITERATURE REVIEW

Singh Vijai et al. [1], The authors of this work present a technique that combines soft computing and photo segmenta- tion techniques to diagnose plant leaf diseases. Conventional The authors claim that methods for diagnosing plant diseases are typically slow and need human scrutiny, which may be expensive and time-consuming. They provide a brand-new approach to plant disease detection that uses soft comput- ing and image segmentation algorithms. An introduction to plant diseases and the significance of accurate and efficient detection techniques opens the essay. The suggested approach, which comprises segmenting digital photos of plant leaves and evaluating the produced segments using soft computing techniques like fuzzy logic and artificial neural networks, is then explained by the authors. They offer a brand-new technique for identifying and categorizing leaf states that uses fuzzy logic and computer vision technology.

An introduction to leaf diseases and the significance of accurate and efficient diagnosis techniques opens the essay. The authors go on to outline the recommended method, which entails digitally photographing plant leaves, segmenting the images to find diseased areas, drawing traits from the segmented areas, and grading the diseases' severity using fuzzy logic. Kumari Usha et al. [3], In order to identify leaf disease , this study focuses on feature extraction using K-means clustering and classification using artificial neural networks (ANN).

The authors assert that plant health and agricultural sustain- ability depend on the early detection of leaf diseases. They present a novel technique for identifying leaf diseases that uses ANN and K-means clustering to do so more effectively and consistently. An overview of the importance of early leaf disease diagnosis and the need for precise and efficient detection techniques is given at the beginning of the article. The authors then go over the recommended method, which comprises digitally photographing plant leaves, segmenting the images to identify diseased areas, using K-means clustering to extract features from the segmented areas, and scoring the disease severity Santhosh S. and others [4],

The writers argue that for plant health and agricultural sustainability, early and accurate diagnosis of leaf diseases is essential. They evaluate the advantages and disadvantages of various methods for detecting leaf diseases using image processing techniques.An introduction to leaf diseases and the importance of early detection opens the essay. After that, the authors explain image processing and demonstrate how it could be applied to the detection of leaf diseases. They go over image processing methods such as feature extraction, image segmentation, picture enhancement, and image extraction.

[5] U. Shruthi et al. In this research, the authors provide a thorough summary of various image processing techniques for plant leaf disease diagnosis. They stress the necessity of accurate and timely detection of leaf diseases to maintain plant health and promote sustainable farming. The authors examine the advantages and disadvantages of various image processing techniques for identifying leaf diseases. After talking about leaf illnesses and the importance of early diagnosis, they go on to talk about image processing and how it may be used to iden- tify diseases. The authors discuss image processing techniques such feature extraction, segmentation, picture extraction, and enhancement.

Agarwal Mohit et al. [6], According to the authors, applying deep learning can significantly increase the speed and accuracy of detection, leading to better crop management and higher yields. An overview of the significance of crops and the effects of disease on productivity is given at the beginning of the study. After that, the authors describe their recommended method, which is based on a convolutional neural network's (CNN) architecture. They examine the advantages of CNNs, including its ability to automatically extract features from images and their resilience to noise and lighting variations. The authors outline the many phases of their methodology, such as image acquisition, pre-processing, and classification.

Additionally, they offer information on the number and kind of layers that make up the architecture of their suggested CNN. The suggested model is trained and tested by the authors. on a collection of leaf photos that is openly accessible, and they claim encouraging outcomes, reaching a 95percent accuracy rate.

Pantazi et al., X.E. [7],The paper's authors present a novel method for automatically identifying leaf diseases in a range of crop species. The authors think that adding picture feature analysis can strengthen system robustness and that employing one-class classifiers can improve detection speed and accuracy. The study starts by describing the importance of identifying agricultural diseases and the problems that arise. The authors then go into their recommended approach, which is predicated on the extraction of many visual characteristics including color and texture, then detection applying classifiers that are one- class. The authors outline the different phases that make up their methodology, such as feature extraction, pre-processing, and image acquisition. Additionally, they offer information on the several one-class classifiers that were employed in their research, such as the one-class random forest (OCRF) and support vector data description (SVDD) classifiers. [8] Md. Nabobi et al. It offers a thorough analysis of the body of knowledge regarding image processing methods for plant leaf disease detection. The writers give a summary of the various types of plant diseases, the need for early detection, and the challenges that come with them. The importance of plant disease identification and the many methods for doing so are briefly discussed in the opening of the study.

The authors then discuss the several image processing methods, including feature extraction, segmentation, and clas- sification, that are employed for the identification of plant diseases. The authors also provide a thorough analysis of the many machine learning techniques used for the detection of plant diseases, including random forests, decision trees, artificial neural networks (ANN), and support vector machines (SVM).The authors examine and talk about the shortcomings and difficulties of the many datasets used to detect plant diseases. They also stress the value of uniform evaluation metrics and benchmark datasets for assessing the effectiveness of various approaches.

III. EXISTING SYSTEM

Experts can identify plant diseases using the basic, unaided- eye inspection feature of the current system. A group of professionals must continuously check plants, which raises expenses for big farms. Because the field of study is so small, diagnosing plant diseases in lab settings can be a laborious and less precise process. [1] Algorithms like GLCM for disease

classification and K-means for color segmentation are used in image processing for plant disease diagnosis. The author of [2] segmented the disinfected region using K-means. Fuzzy logic for illness classification and GLCM (Gray level Co-occurrence matrix) for texture feature extraction. Images of sick leaves are categorized using an artificial neural network (ANN).

IV. PROPOSED METHODOLOGY

This study suggests using pictures of different plant sec- tions, often captured with a camera or other imaging device, and then analyzing the pictures to identify the portions of the plant that are harmed. After that, image-processing techniques are used to analyze the pictures. The Plant Village dataset, which is accessible on Kaggle, was used for this project. Images of both healthy and diseased plants are included in the dataset, which has 33 class labels. some types of plant diseases are included in the dataset. Training and testing data are separated out of the dataset. The model uses the plant picture to forecast the illnesses after being trained on the training data. Preprocessing, feature extraction, categorization, and classifier are some of the procedures that must be done in order to ascertain whether the leaf is healthy or diagnosed. instruction,Converting all of the image sizes to one consistent size would be considered pre-processing. Once the image has reached the appropriate size, it is further segmented and turned to grayscale. The pipeline of the suggested model and the different algorithms utilized to identify plant diseases are described below:image This study uses the following algorithms for picture recognition and classification in order to identify plant diseases.

A. Convolution Neural Network:

A CNN is employed to classify the dataset of images. It takes an input image, gives various parts of the image significance, and can make a distinction between them. The input layer, hidden layer, and output layer are the parts of CNN. Each class's probability values are converted using either the Sigmoid or Softmax functions.The convolutional layer, activation function layer, and pool layer are the layers that make up the CNN model. A list of the several parts that make up a CNN is shown below:

1) Convolution Layer:: Features are extracted from the input images using this layer. The result, known as a feature map, includes details about the images' corners and edges.

2) Pooling Layer:: By shrinking the folded feature map's size, computational costs are decreased. Depending on the technique, there are several kinds of pooling procedures.

3) The fully linked layer:: is made up of neurons, weights, and biases. A mathematical function operation is carried out after the input image from the preceding slice has been smoothed.

4) Dropout:: Overfitting could result if every feature is connected to the layer FC. This issue is resolved by using a dropout layer, in which certain neurons

are left out, which causes the model's size to decrease. Performance is improved as a result.

5) activation functions: for binary classification models are Sigmoid and Softmax, whereas Softmax is employed for multi-class classification.

B. The Random Forest Algorithm:

This machine learning technique can be applied to classi- fication and regression issues. Decision trees trained with thebagging technique make up the random forest. The bagging technique is applied to enhance the final outcome. Combining multiple weak classifiers to create a single, powerful classifier is the core concept of the Random Forest Algorithm. To aid in the separation of the input data, each node is designated as either a test or train set. Every internal node denotes a weak classifier that divides the data based on a certain characteristic. The Random Forest Classifier's final conclusion is based on the most favorable result, which is decided by voting on each classification tree.

1) Step 1:: Choose samples at random from a predeter- mined data collection.

2) Step 2:: The algorithm will create a decision tree for each batch of data.

3) Step 3:: After that, the decision tree will vote.

4) Step 4:: Next, the ultimate forecast outcome is chosen who received the most votes. When it comes to classification problems, CNN is the model that is anticipated to function effectively and surpass the other algorithms. CNN is the model that is anticipated to perform well and surpass the other algorithms in classification tasks.

V. CONCLUSION

As, the other model is very complex in calculations and it is not the cost effective testing of each instance and inaccurate to wrong inputs. CNN algorithm is effectual classifier would be used to minimize the computational cost. In previous researches it has proved that CNN model has high accuracy rate. CNN classifier obtains highest result as compared to Other model like SVM .The comparison would be based upon two parameters Accuracy and Detection time. The study reviews and summarizes some techniques have been used for plant disease detection. CNN require less manual feature extraction.A novel approach for classification of plant disease has been proposed.

VI. REFERENCE

[1] Vijai Singh, A.K. Misra: "Detection of plant leaf dis- eases using image segmentation and soft computing tech- niques" Information Processing in Agriculture, Volume 4,
Issue 1, 2017, Pages 41-49

[2] Aakanksha Rastogi, Ritika Arora and Shanu Sharma: "Leaf Disease Detection and Grading using Computer Vision Technology and Fuzzy Logic" 2nd International Conference on Signal Processing and Integrated Networks (SPIN)2015.

[3] Ch. Usha Kumari; S. Jeevan Prasad; G.Mounika: "Leaf Disease Detection: Feature Extraction with K-means clus- tering and Classification with ANN" 2019 3rd International Conference on Computing Methodologies and Communication (ICCMC)

[4] Santhosh S. Kumar; B.K. Raghavendra "Diseases De- tection of Various Plant Leaf Using Image Processing Tech- niques: A Review" 2019 5th International Conference on Advanced Computing and Communication Systems (ICACCS)

[5] U. Shruthi; V. Nagaveni; B.K. Raghavendra: "A Re- view on Machine Learning Classification Techniques for Plant Disease Detection" 2019 5th International Conference on Advanced Computing and Communication Systems (ICACCS)

[6] Mohit Agarwal, Abhishek Singh, Siddhartha Arjaria, Amit Sinha, Suneet Gupta: "ToLeD: Tomato Leaf Disease Detection using Convolution Neural Network" International Conference on Computational Intelligence and Data Science (ICCIDS 2019)

[7] X.E.Pantazi,D.Moshou,A.Tamouridou: "Automated leaf disease detection in different crop species through image fea- tures analysis and One Class Classifiers" Aristotle University, School of Agriculture, Agricultural Engineering Laboratory,
Thessaloniki 54124, Greece

[8] Md. Nabobi Hasan, Mufrad Mustavi, Md. Abu Jubaer, Md. Tanvir Shahriar, Tanvir Ahmed:"Plant Leaf Disease De- tection Using Image Processing: Comprehensive Review": A Comprehensive Review", Malaysian J. Sci. Adv. Tech., vol. 2, no. 4, pp. 174–182, Oct. 2022.

[9] G. Shrestha, Deepsikha, M. Das and N. Dey, "Plant Disease Detection Using CNN," 2020 IEEE Applied Signal Processing Conference (ASPCON), Kolkata, India, 2020, pp. 109-113, doi: 10.1109/ASPCON49795.2020.9276722.

[10] G. Madhulatha and O. Ramadevi, "Recognition of Plant Diseases using Convolutional Neural Network," 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), Palladam, India, 2020, pp. 738-743, doi: 10.1109/I-SMAC49090.2020.9243422.

[11] Kapil K. Wankhede, Ph.D. Kalpana C. JonDhale Ph.D, Snehalata S.Dongre Ph.D, "A Clustering and ensemble based classifier for data stream classification, "2021 Applied Soft Computing Vol. 102, doi:10.1016/j.asoc.2020.107076.

[12] M. Gudadhe, K. Wankhade and S. Dongre, "De- cision support system for heart disease based on support vector machine and Artificial Neural Network," 2010 Inter- national Conference on Computer and Communication Tech- nology (ICCCT), Allahabad, India, 2010, pp. 741-745, doi: 10.1109/ICCCT.2010.5640377.

[13] Satish Thombre, Snehlata Dongre " A clustering and ensemble based classifier for data stream classifica- tion"2013 International Journal of Managment, IT and Engi- neering, International Journals of Multidisciplinary Research Academy,volume:3,issue:9,Online ISSN:2249-0558