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Modern Approach Towards Crop Disease Prediction

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Abstract— India is a large country. India has a very large dependence on agriculture. Government and farmers in India keep on trying and implementing new techniques for increasing crop production and the yield of the available crop. Machine learning along with AI are one of the most common and popular technologies that are being used by our government and private firms for making predictions of various things in various sectors like automobile, agriculture, healthcare. The yield of the crops is largely dependent on factors like weather, fertilizer, pesticide, soil and rain. A plant can be affected by a disease any time from the time of harvesting and sowing. This paper discusses how implementation of machine learning in various fields like agriculture can be largely beneficial. We can find a disease from which a plant is suffering using the dataset of images and machine learning techniques. This work will help farmers who are new and will guide them towards recognition of disease so that effective measures could be taken to prevent its spread.

Keywords— Agriculture, Accuracy, Disease, Yield, Clustering

I. INTRODUCTION (HEADING 1)

Artificial intelligence is the process by which we can program a machine to act in a manner that makes it appear as though it possesses intellectual abilities comparable to those of a human being, such as speech, decision-making, and abilities relating to visual perception and language transition [1]. Artificial intelligence, or AI, refers to the design of machines with the explicit goal of mimicking human behavior. The scientific and technological knowledge of creating intelligent software programs, in particular, is how John McCarthy, the father of AI, characterized the field. In order to forecast various types of values, both public and commercial enterprises use machine learning. If a country has a substantial agricultural basis, it is considered to be socially and economically affluent. Agriculture is the main industry for employment in the great majority of nations [2]. The number of staff needed to maintain a larger farm will increase. Therefore, precision agriculture is now necessary in order to maximize crop productivity while keeping the aforementioned issue in mind. [3] Precision Agriculture is a collection of operational approaches, tools, and procedures (PA). Precision agriculture is described as the application of technology and principles

through the use of information and data to maximize resource efficiency and reduce environmental degradation. D.A. Bashish (2010) divided any leaf image into four subsets using the k-means segmentation. He applied the Euclidean distances squared. He had employed a technique for extracting the feature known as the colors Co-occurrence method for both texture and color features [4]. Using a back Propagation method, classification is finally achieved. The overall accuracy for diagnosing and classifying diseases was found to be very close to 93 percent. M. Bhange (2015) by contributing fruit images to the system, he created a web-based tool for detecting fruit diseases [5]. The characteristics that have been used in the feature extraction procedure are morphology, color, and color coherence vector. The clustering process has been carried out using the K means technique. SVM method is used for infected or non-infected classification. In total, pomegranate illness was identified with an accuracy rate of 82%. J.D. Pujari (2015) investigated a range of crops, including cash crops, grain crops, plantation crops, vegetable crops, and all other sorts of crops. In order to find fungus illnesses on plant leaves, this was done. Each and every sort of crop that was available received a different approach [6]. The technique utilized for segmenting all fruit crops is k-means clustering. The major feature that was focused on was texture, which was subsequently classified using ANN and closest neighbor algorithms. This was able to obtain a 90.723 percent accuracy rate. All vegetable crops were segmented using the chan-vase method, and texture feature extraction was done using local binary patterns, SVM, and the k-nearest neighbor algorithm. This approach produced an accuracy of 87 percent overall. Grab-cut algorithm is what is utilized for segmentation for all commercial crops. In order to extract features from wavelet-based data, Mahalanobis distance has been employed. Classifiers have been created using PNN. The overall level of accuracy attained is 84.825 percent. K-means clustering and canny edge detection were the segmentation techniques employed for all cereal crops. V. Singh (2016) has attempted to automate the identification, classification, and reporting of plant diseases. His method involved applying a genetic algorithm to the process of segmenting images. Banana, beans, lemon, and rose leaves were the four plant leaves utilized in the training and testing sets. The color co-occurrence method has been used to extract features while accounting for both texture and color attributes. The SVM classifier and k-mean clustering both displayed accuracy of 86.54 percent and 95.71 percent when the disorders were categorized using the least distance criterion. [7] Combining the evolutionary algorithm, and the Minimum Distance Criterion classifier results in accuracy of 93.63 percent. E. Kiani (2017) tried to utilize a fuzzy decision maker to identify the disease of diseased leaves in a strawberry field when it was outside. Using this, the overall accuracy of disease detection and segmentation was 97 percent, and the processing time for disease detection was 1.2 seconds. [8] What if we create a system for automatic plant disease detection? Is the idea put out by G. Saradhambal in 2018? In order to identify the region of the leaves that were infected, algorithms like k-means clustering and the Otsu's classifier were applied. [9] The form and texture features were retrieved in the proposed study. The general design-oriented features that this study collected were perimeter, eccentricity, eccentric color axis length, area, and solidity. The contrast, correlation, energy, homogeneity, and mean properties of texture were highlighted. [10] A classifier based on a neural network was used to do classification in this research project.

II. PLANT DISEASE DETECTION

To know about the disease of a crop, consider the fig 1.

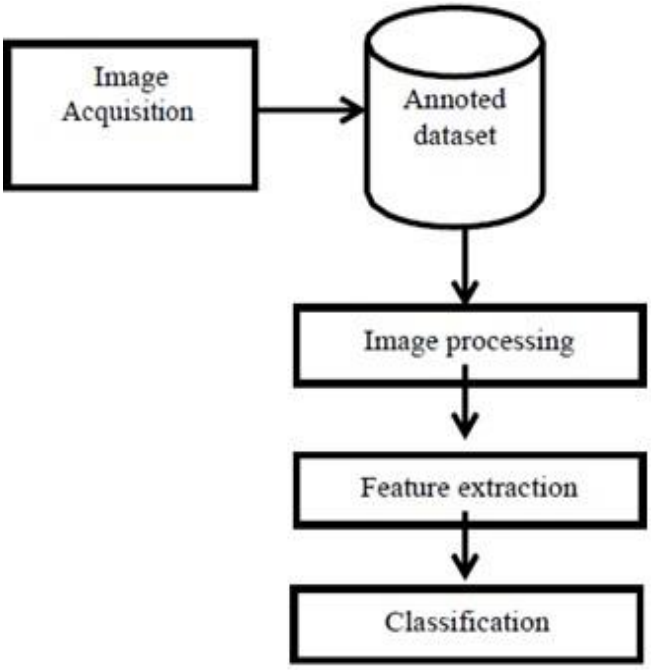

Fig. 1. Plant Disease Detection System

Image acquisition: We extract images in this step. Images can be acquired using a variety of techniques, such as a digital camera, scanner, or drones.
Annotated Dataset: For the photos that have been captured, a dataset based on the knowledge has to be constructed.
Image processing: The preparation of the captured images is necessary to enable efficient further processing. Plant images are divided into multiple segments using segmentation. This can be used to spot a leaf that is sick.
Extracting features: For the extraction of color, shape, and texture features of the diseased plant component, techniques such as blended vision, and artificial intelligence, among others, can be applied.
Classification: Any classification algorithm may be used at the conclusion to obtain the appropriate categorization.

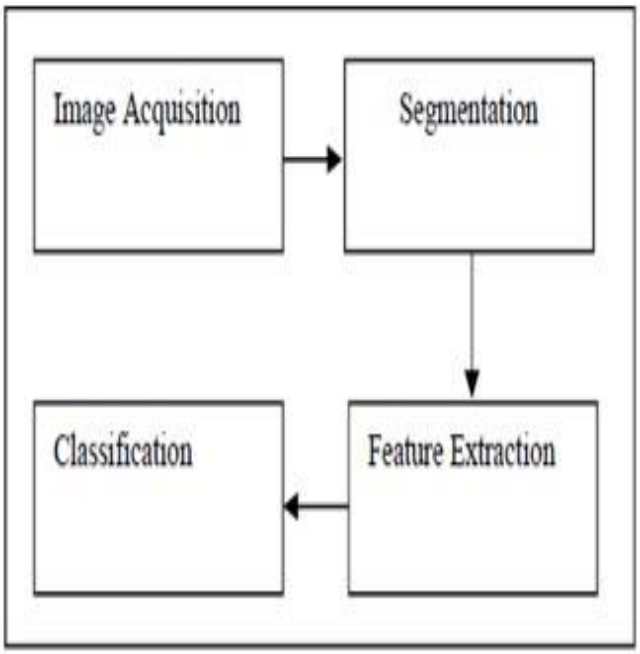

Fig. 2. Phase of Plant Disease Detection System

III. RESULT ANALYSIS

The Bayes theorem is the foundation of the supervised learning method known as the Naive Bayes algorithm, which is used to address classification issues. To classify any written text which contains high quality training database we use it. It is simplest and one of the most efficient and effective classification algorithms which makes the process to build machine models faster and the models which can make faster predictions. It predicts on the basis of possibilities of an object since it is a system of possible classification. Most popular example of naïve bays algorithm are spam filtering, Sentimental analysis and article division.

One of the most popular supervised learning techniques, SVM is utilized to solve both classification and regression issues. It is mostly employed to solve categorization issues in machine learning. This algorithm's main objective is to establish the best decision boundaries or lines that can divide n-dimensional space into classes, allowing for the future classification of new data. We call this decision boundary a hyper plane. This algorithm is known as support vector algorithm since the end points are known as support vector and thus the name support vector algorithm.

In n-dimensional space, we can use a lot of lines, or so-called decision boundaries, to divide the classes, but we need to figure out which choice boundary is the best to help classify our data points. The SVM hyper plane is the best boundary out of all of them.

The support vector is the data point or vector that is closest to the hyper plane and has an impact on the position of the hyper plane. They are called support vectors because they support hyper planes.

The total number of points multiplied by 100 divided by the total number of points that were properly identified is how accuracy is determined.

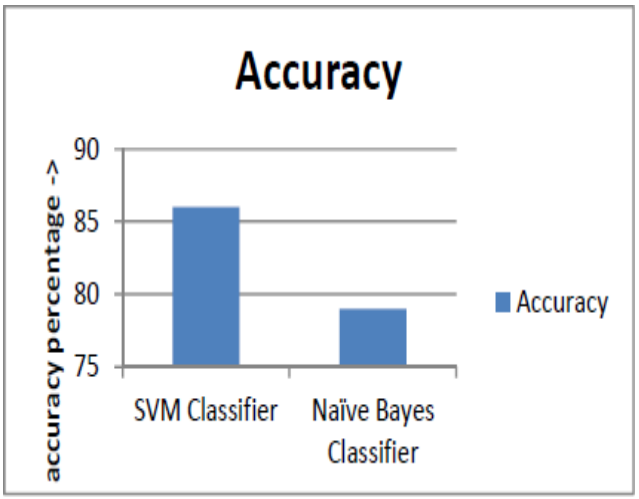

Fig. 3. Accuracy

Execution Time: Execution time is defined as the interval between the start time and the end time at which an algorithm stops operating. Execution time is equal to the algorithm's start and end times.

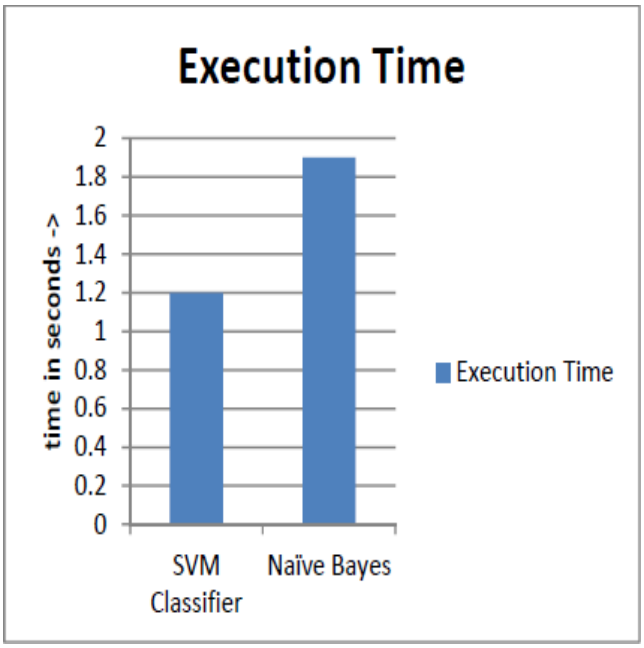

Fig. 4. Execution Time

Convolutional neural networks, often known as CNNs, are a type of feed-forward artificial neural network. The Convolutional neural network's link topology was modelled after the tissues found in an animal's visual brain. Only a few small clusters of cells in the visual cortex are sensitive to particular certain orientations. When a vertical edge is provided, some neurons light up, whereas others light up when a horizontal or diagonal edge is presented. An artificial neural network of this kind is a Convolutional neural network. It is employed in deep learning to assess visual data. These networks are capable of handling a wide range of activities, including those involving images, audio, text, video, and other types of media.

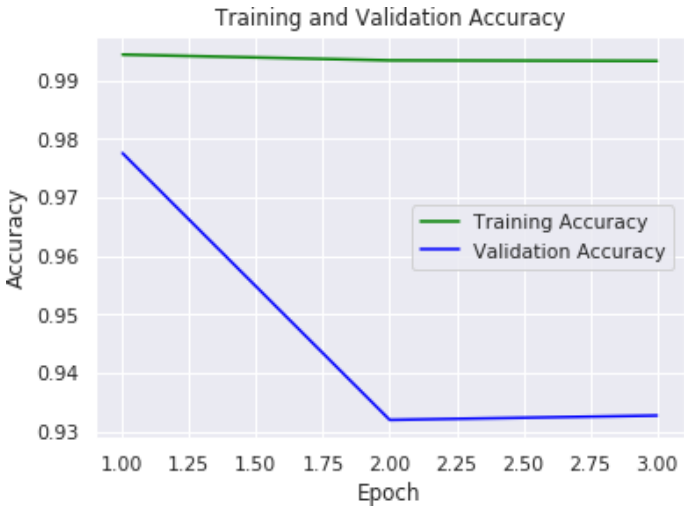

Fig. 5. Training and Validation Accuracy

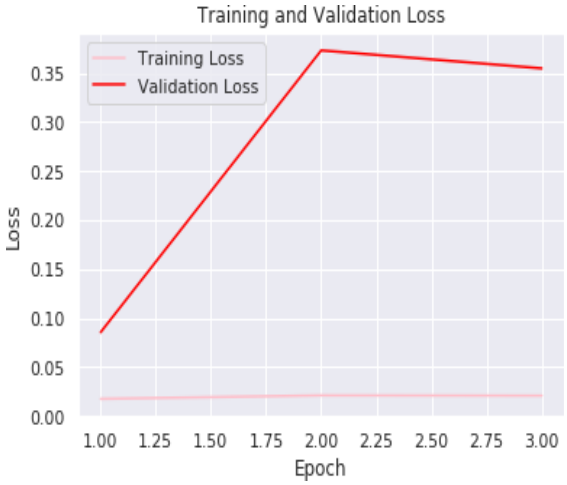

Fig. 6. Training and Validation Loss

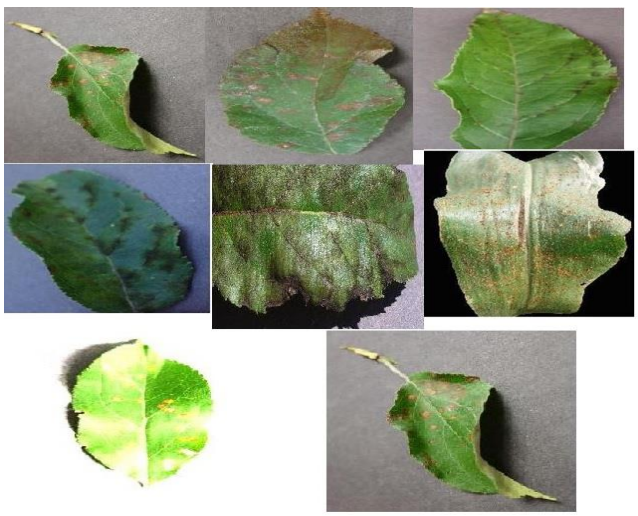

Fig. 7. Disease Infected Leaves

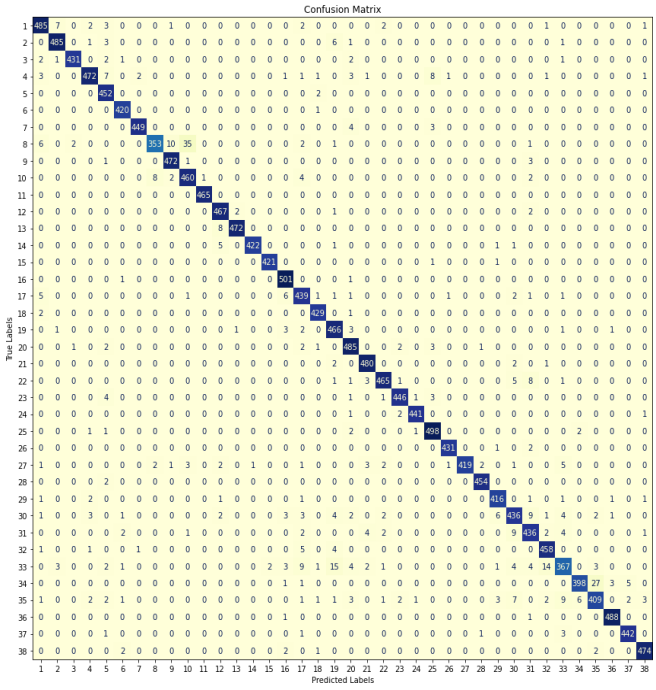

Fig. 8. Confusion Matrix

IV. CONCLUSION

The suggested model was created to accurately estimate the crop. The outcome demonstrates that the CNN classifier accurately and broadly diagnoses more diseases. This work will help farmers who are new and will guide them towards recognition of disease so that effective measures could be taken to prevent its spread. Future plant disease detection and automatic diagnosis of all types of agricultural ailments may make use of several machine learning classification techniques, such as decision trees, Naive Bayes classifier an many more. using the dataset of images and machine learning techniques.

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