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Plant Pathology Disclosure

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***Abstract*—Farming is a crucial sector of the Indian economy. In order to boost output yield, the agricultural industry must overcome a number of obstacles, including an illness brought on by microbes, infections, and organisms. The manual monitoring, observation, or treatment of plant diseases is an extremely difficult undertaking. A quick and inventive technique is required to diagnose a plant early, and farmers would profit from a system that recommends plants. Therefore, this is the ideal time to develop disease evaluation methods that could be helpful for the current agricultural productivity. The current method for detecting diseases utilising a computer vision technique can only do so after the sickness has already manifested itself. Therefore, this application is built on two techniques: first, deep learning for disease diagnosis and recognition, and second, image processing techniques linked to machine learning (ML). Using machine learning algorithms, which comprise procedures like dataset construction, loading images, prepping, segmentation, feature extraction, training a classifier, and classification, it is possible to classify plant diseases. Several diseases deplete the chlorophyll in leaves, which results in brown or black spots on the surface of the leaf. These can be found out utilising machine learning methods for classification, feature extraction, image preprocessing, and image segmentation. For feature extraction the Grey Level Co-occurrence Matrix (GLCM) is employed. One of the machine learning techniques used for classification is called the Support Vector Machine (SVM).**

Using the researched ML/DL techniques, web-based application development will definitely boost agricultural productivity.

I. INTRODUCTION

INDIA has 159.7 million hectares of arable land area, which is the second largest in the world. There are different problems in Indian agriculture like instability, weather, production loss due to plant disease, and much more. [1] To inspect tree foliage humans are bound to physically traverse large areas of the agricultural environment, hence, this may result in more time-consuming and can be costly. Crop diseases cause serious economic losses to farmers. Many computer vision approaches have been developed over the year for the automatic detection and identification of disease attacks. One major issue of these approaches is that they detect disease based on apparent characteristics of the disease attack. At this stage, the disease is usually incurable or has already caused serious damage to the crops. The losses due to disease at this stage are untreatable. [2]There is a need for solutions that can predict the occurrence of the disease attack before it causes losses. Detection of plant leaf infections is an essential task in agriculture, to overcome plant disease issues various researchers have used image processing along with ML/DL algorithms. Research has shown that for the recognition and categorization of plant diseases, image-processing techniques can be considered valuable assets. So, in this study hereby we propose some recent advances in DL models that can be used to identify plant diseases. Moreover, the study identifies the various research gaps existing in the existing literature to make the vision of symptoms experienced in the plant leaf disease classification process in a clearer sense.

II. LITERATURE REVIEW

S.Sladojevic., [3] Various different approaches are currently used for detecting plant diseases and most common are artificial neural networks (ANNs) [4] and Support Vector Machines (SVMs). They are combined with different methods of image preprocessing in favour of better feature extraction. In machine learning and cognitive science, ANN is an information-processing paradigm that was inspired by the way biological nervous systems, such as the brain, process information. The brain is composed of a large number of highly interconnected neurons working together to solve specific problems. [5]

M. Appalanaidu et al., [6]segmentation of image is applied for background subtraction. The classification approach is administrated by KNN, ANN and SVM methodology. [7] In KNN, it classifies samples victimisation nearest distance between trained and testing subjects [6]. S. M. Nagashett et al., [7] has developed model for extraction thresholding technique and morphological operation. Then multiclass SVM is employed as classifier. For segmentation, supported a collection of marks generated by analysis of the colour and luminousness parts of various regions of image is $L * A * B$ color areas. The GLCM is employed for feature extraction. [8] thought-about samples of plant leaves like rose/beans (bacterial disorder), lemon (sun burn disorder), banana (early scorch) and beans (fungal) that are captured employing a photographic camera. The inexperienced regions as background mistreatment thresholding rule. Finally, the genetic rule is employed to induce the metameric image. the colour co-occurrence is customized for helpful extraction of options from the metameric pictures. The Minimum Distance Criterion so SVM classifier is employed for classification purpose.

M. Saleem et al. [9] studied several image processing techniques in order to identify disease in plants. After taking image as input in order to identify leaf disease and classify them several steps need to follow just like image processing, image segmentation feature extraction and classifier. Segmentation using k-means clustering in order to identify the disease ares, using statistical Grey-Level Co-Occurrence Matric (GLCM) is used for feature and classification. [10]This paper also helps

in identify the difference between different algorithm which helps in choosing the correct one just like KNN (K-Nearest Neighbor) [11], RBF (Radial Basis Function), PNN (Probabilistic Neural Networks), BPN (Back-propagation Network), SVM (Support Vector Machine). Paper helps to identify the advantages and disadvantages of this algorithms.

[8]ML technologies enables the machines to communicate and act like a human being. It can also make the decision on the behalf of human. ML is help in classifying plant disease. The challenges that face the world today, related to the diseases affecting plants and humans, can be reduced if the diseases are identified before they spread to vast areas. The use of ML is widespread in the world today [12]. Diverse methods used in ML and DL help the experts to analyse the plant diseases and know their source in time. The enhancement phase facilitated the texture feature extraction phase by using the GLCM technique, [13] which achieves a 100 accuracy level when it feeds the classifier. These features are quite important for the use of SVN classification levels, which are as follows: the contrast of intensity among contiguous pixels upon the image, the correlation of contiguous pixels upon the image, the entropy (the clutter of intensity in a region), the energy of pixels' uniformity, and the homogeneity of similar pixels [14].

III. METHODOLOGY

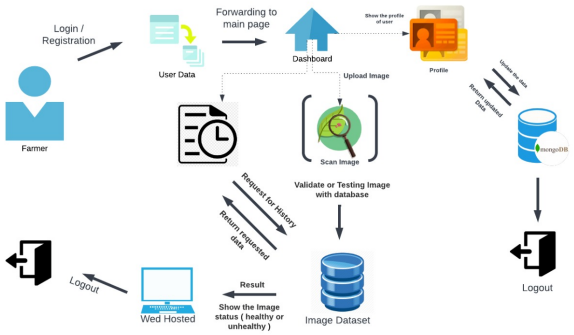

Fig. 1. Show the workflow of Plant Pathology Disclosure

The system's operation is shown in the above figure. When the application is opened for the first time, the user will see the front page, which is nothing more than the landing page, which shows the small details about the project and also contains the contact section. Over their will are options like "login" or "register." If the user is not already registered with the system, he or she must first register. After clicking on "Register," a registration form will get opened that contains some details like First name, Last name, Email, Password, Mobile, and Aadhar Card No. After submitting this form, an email will be sent to the user by the system to their registered email address. That email also contains a login form link, or the user can login by simply clicking on "login." After entering the correct details, the user will be directly redirected to the main page. If a user forgets their password, they can simply click on "forget password," and a dialogue box will open after submitting an email about their reset password, which will be shared with the user via email. After clicking on that link, a reset password page will open, which contains a new password and a confirm password box that will help the user change the password, but the password must be in standard format.

After successful login, the user will be redirected to the main page, which contains the dashboard, including home, upload images, and history. After clicking on the upload image option, the user will see options like "capture" or "upload." After submitting the image, a result will be generated and shown on the same page, which includes stage of the disease, impact of disease on the plant and what care the farmer needs to take. Our system helps farmers better understand the amount of pesticide they need to use for plant health. It also informs the farmer whether or not the disease can be treated with organic fertilizer. If possible, which fertilizer is beneficial should also be mentioned.

Figure 2 illustrates the system's architecture or flow from login to logout.

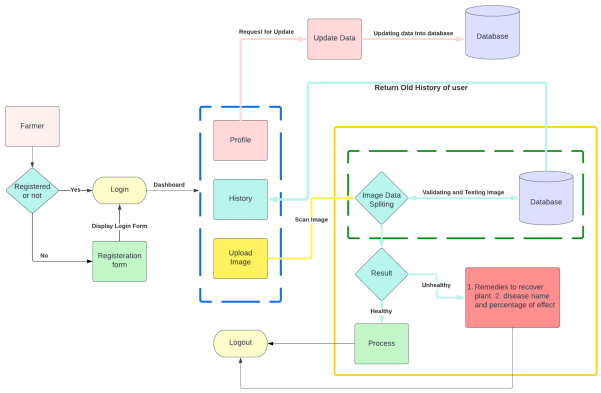

Fig. 2. Illustrations, System Architecchture.

IV. DATASET

The data sets used [15]in the study contain descriptions of the leaves both before and after the diseases impacted them. The data is presented in tables and images of the leaves that were captured in the fields. The data is analysed and categorised for the readers' ease of understanding. A collection of information could be referred to as an information set (or dataset). [16]A data set is compared to one or more database tables in the case of unthinkable information, where each table's column corresponds to a certain variable and each push is compared to a specific record of the data set by address. For each component of the information set, the information set keeps track of values for each of the factors, for instance, the protest's weight and height. A collection of archives or documents can also be included in information sets.// In machine learning, a dataset is a group of data points that may be analysed and predicted by a computer as a single entity.

V. Image Processing

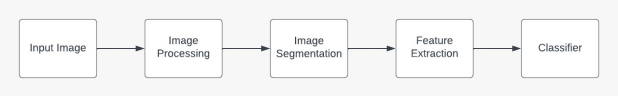

Fig. 3. Illustrations, The process after image upload or image received as input.

1. Image Processing : [17]Image processing plays a crucial role in our system, as we wanted to extract details from images and use those details for comparison and generating results. It is one of the techniques used to perform operations on images in order to get useful information. For image processing, input can be an image, and output can be characteristics or features associated with that image. There are two techniques to process images. First, analogue processing digital images (DIP) [18]. For physical copies like prints and photos, analogue is employed. Digital photos can be edited using digital image processing (DIP). In our system, we are going to use A typical method in digital image processing (DIP) is image segmentation.

2. Image segmentation : Image segmentation is a technique for dividing a digital image into multiple "image segments." It enables the image's complexity to be reduced in the future, allowing for simpler image processing or analysis. Rather than processing the entire image, a portion of the image selected by the segmentation algorithm can be fed to the detector. [18] It helps in processing only the damaged area of an image rather than the entire image. There are various types of image segmentation. We will, however, use region-based segmentation, which divides images into areas with similar properties. Region-based segmentation methods are preferred over edge-based segmentation methods in the case of a noisy image. [19]The process of converting an image into a binary image, where each pixel is either black or white, is known as "binary thresholding." The threshold value is chosen so that all pixels with brightness levels lower than the threshold are black and all pixels with brightness levels greater than the threshold are white. The objects in the image are segmented as a result, as they are now represented by distinct black and white regions.

3. Feature Extraction : All the data we collect through image segmentation is vast and takes various forms. [20] To understand this data, we need to process it, and then we use the next step in image processing, which is nothing but feature extraction. Feature extraction is the process of "dimensionality reduction," which involves breaking down a large initial set of raw data into smaller, easier-to-manage groups. [21]After dividing all the data into various segments, those data will have a large number of variables. This technique helps to get the best features from those large datasets by selecting and combining variables into features. These features are easy to process.

4. Image classifier : Image classification is the process of arranging and grouping pixels or vectors. Within an image, based on specific rules, classification helps identify the particular image. [16] Further classification can be supervised or unsupervised. Image classification is simply the process of labelling an image with a label from a predefined set of categories [1].

Scientists in this field use scanning images of healthy and unhealthy plants as a basis for comparison. Deep learning (DL) can be used to detect plant defects. A computer "sees" digital images as a function: I(x, y) or I(x, y, z), where "I" is pixel intensity and (x, y) or (x, y, z) are the image coordinates (for binary/grayscale or RGB images, respectively). [22]To classify diseases based on their impact on plants, pixel-wise operations are used to analyze leaves collected from sick plants. The visible patterns in these leaves are used to identify plant diseases. The computer may not be able to work directly with images captured in the fields. The images are transformed into data that machines and computers can understand. Many diseases attack various parts of the leaf; some attack the entire leaf, while others attack the edges or the stalk. The images of the leaves can be analyzed using an image-based detection system to determine the disease classification.

[23]To obtain precise results, some background noise should be removed prior to feature extraction. So, first and probably most important, the RGB Before being smoothed with a Gaussian filter, the image is converted to grayscale. The image is then binarized using Otsu's thresholding algorithm. The binarized image is then subjected to a morphological transform to close the small holes in the foreground. [24]Following foreground detection, the bitwise AND operation is applied to a segmented image to produce an RGB image. After that, the binarized and original color images are combined. leaf. Following image segmentation, the image's shape, texture, and color features are extracted. The area of the leaf and its perimeter are calculated using contours. Contour lines connect all of the points along the edges of objects that have the same shape, color, or intensity. [15] The mean and standard deviation of each channel in an RGB image are also computed. estimated. To determine the amount of green color in the image, we converted it to HSV color space and calculated the ratio of pixels with hue (H) channel pixel intensities ranging from 30 to 70, as well as the total number of pixels in one channel. The non-green component of the image is calculated by subtracting the green color component from 1. SVM is one of the machine learning algorithms that is used for classification, which classifies data into different categories. SVM draws a decision boundary that is a hyperplane between two classes in order to classify them. [25] The main objective of SVM is to segregate a given dataset. For implementation, SVM uses different libraries like TensorFlow, Keras, Colab, etc.

[2]RF(Random forest) is a method that combines the prediction of multiple decision trees. Each tree is trained by a random subset of all available data and the output is the combination of the results of all trees.

VI. CONCLUSION

Disease detection associate degree identification is finished by victimization an image process and machine learning algorithms. The data is collected from the Kaggle web site named "new plant diseases dataset" containing completely different pictures of healthy and unhealthy crop leaves. Leaf disease portion is segmental from the image and completely different features are extracted employing a gray level co-occurrence matrix (GLCM). A detected portion of the leaf is recognized through SVM. SVM has given eightieth accuracy. to enhance on accuracy, the convolutional neural network is employed for the identification of plant diseases. Aaccuracy that is over the accuracy achieved victimization laboriousding techniques. This work are helpful in automatic identificxation of plant leaf disease and can increase agriculture production by early detection of diseases.

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