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Plant Leaf Disease Detection using KNN Algorithm

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Abstract: *Software has always been a companion for humans since the boomed invention of automation. All the automation which has been done till date always carried a motive for the ease of complex processes and sometimes for replacing enormous human activities. The project presents plant leaf disease detection, effect of disease on plant yield and the remedies for its cure. In agriculture, research of automatic plant disease is essential in monitoring large fields of plants, and thus automatically detect symptoms of disease as soon as they appear on plant leaves. Every other field has got some benefit from new technologies as compared to the agricultural field. According to past studies, 42% of agricultural production is in loss and that too because of the increasing rate of loss due to plant leaf diseases. To overcome this major issue, this plant leaf disease detection technique can be applied to detect a disease from the input images. This process involved steps like image preprocessing, image segmentation, feature extraction.*

Keywords: Plant Leaf Detection.

I. INTRODUCTION

India is a country with a majority of the population relying heavily on the agricultural sector. The crop cultivation area in India spans around 3,50,000 hectares approximately and the production quantities roughly sum up to 53,00,000 tons, making India the third largest agricultural producer in the world. The sensitivity of crops coupled with climatic conditions have made blights common in the crop during all the stages of its growth. Blight affected leaves constitute 10-30% of the total crop loss. Identification of such blights in the leaf is very important in preventing any heavy losses in yield as well as the quantity of the agricultural product. Monitoring the leaf blights manually is a difficult task due to its complex nature and is a time consuming process. Therefore, there is a need to reduce the manual effort put into this task, while making accurate predictions and ensuring that the farmer's lives are hassle free. Visually observable patterns are difficult to decipher at a single glance, leading to many farmers making inaccurate assumptions regarding the blight. As a result, prevention mechanisms taken by the farmers may be ineffective and sometimes harmful. Farmers usually come together and implement common blight prevention mechanisms, as they lack expert advice on how to deal with their crop infestation. There have been circumstances where due to inadequate knowledge or misinterpretation regarding the intensity of the blight, over-dosage or under-dosage of the pesticide has resulted in crop damage. This is the underlying motivation for the proposed methodology that aims to accurately detect and classify blights in the crop. The methodology suggested in the paper pertains to the most common blights found in the leaf like, Bacterial leaf spot and Septoria leaf spot, Yellow Leaf Curl among many others. Any leaf image given as input can be classified into one of the bright classes or can be deemed healthy. The dataset used for evaluation is a subset of Leaf Village, a repository that contains 54,306 images of 14 crops infested with 26 blights. The subset includes around 18160 images of different leaf blights. Broadly, the proposed methodology consists of three major steps: data acquisition, pre-processing and classification. The images used for the implementation of the proposed methodology were acquired from a publicly available dataset called Leaf Village, as mentioned earlier. In the next step, the images were resized to a standard size before feeding it into the classification model.

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II. PROBLEM STATEMENT

India is an agricultural country, where most of the population depends on agricultural products. So the cultivation can be improved by technological support. Diseases may be caused by pathogens in plants at any environmental condition. In most of the cases diseases are seen on the leaves of the plants, so the detection of disease plays an important role in successful cultivation of crops. There are lots of techniques to detect the different types of diseases in plants in its early stages. Conventional methods of plant disease detection in naked eye observation methods and it is non-effective for large crops. Using digital image processing and machine learning, disease detection in plants is efficient, less time consuming and accurate. This technique saves time, efforts, laborers and use of pesticides. Hope this approach will become a little contribution for agriculture fields.

III. OBJECTIVE

- To enhance the given input image by Image acquisition and Image pre-processing.
- Identify the affected part through texture analysis and Segmentation.
- Classify the healthy and affected leaf part by feature extraction and classification.
- Train the model by using testing data for accurate results.

Software has always been a companion for humans since the invention of automation. All the automation which has been done till date always carried a motive for the ease of complex process and sometimes for replacing enormous human activities. This project will be very helpful to farmers in rural areas and also will help then in saving their yields from diseases as farmers lose a huge amount of their cultivated crops because of diseases and this system will help them to avoid the similar situation.This project can also provide them cure by suggesting preventive measures and cure according to the prevailing disease and this project will also display and give an idea about the effect of crop disease on crop yield. The main goal of this project is to identify the most common diseases seen in Plant Leaf and suggest suitable measures to prevent them.

IV. LITERATURE SURVEY

4.1 Classification of Pomegranate Diseases Based On Back Backpropagation Neural Network [1]

S Sannakki and V.S. Rajpurohit, proposed a"Classification of Pomegranate Diseases Based on Back Propagation Neural Network"[1] which mainly works on the method of segment(The affected area , color and texture) are used as the features. Here they have used neural network classifier for the classification .Backpropagation is the essence of neural network training. It is the method of fine-tuning the weights of a neural network based on the error rate obtained in the previous epoch (i.e., iteration). Proper tuning of the weights allows you to reduce error rates and make the model reliable by increasing its generalization. Backpropagation in neural network is a short form for "backward propagation of errors." It is a standard method of training artificial neural networks. This method helps calculate the gradient of a loss function with respect to all the weights in the network. The main advantage is it converts to L*a*b to extract chromaticity layers of the image and categorization is found to be 97.30% . The main disadvantage is that it is used only for the limited crops.

4.2 Cotton Leaf Disease Identification Using Pattern Recognition Techniques [2]

R Rothe and R.V .Kshirsagar introduced a "Cotton leaf disease identification using pattern recognition techniques"[2] which uses snake segmentation , here Hu's moments are used as distinctive attribute. Active contour model used to limit the vitality inside the infection spot, BPNN classifier tackles the numerous class problems. The average classification is found to be 85.52%.Pattern recognition is achieved by utilizing the concept of learning. Learning enables the pattern recognition system to be trained and to become adaptable to provide more accurate results. A section of the dataset is used for training the system while the rest is used for testing it. Pattern recognition is the use of machine learning algorithms to identify patterns. It classifies data based on statistical information or knowledge gained from patterns and their representation. In this technique, labeled training data is used to train pattern recognition systems. A label is attached to a specific input value that is used to produce a pattern-based output.

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4.3 Leaf Disease Detection and Grading Using Computer Vision Technology and Fuzzy Logic [3]

Aakankhsha Rastogi,Ritika Arora and Shanu Sharma proposed a "Leaf disease detection and grading using computer vision technology and fuzzy logic"[3]. This paper imparts a simple and computationally proficient method used for leaf disease identification and grading using digital image processing and machine vision technology. The proposed system is divided into two phases, in the first phase the plant is recognized on the basis of the features of leaf, it includes pre-processing of leaf images, and feature extraction followed by Artificial Neural Network based training and classification for recognition of leaf. In the second phase the disease present in the leaf is classified, this process includes K-Means based segmentation of defected area, feature extraction of defected portion and the ANN based classification of disease. Then the disease grading is done on the basis of the amount of disease present in the leaf. Here K-means clustering is used to segment the defected area ; GLCM algorithm is for the extraction of texture features ,Fuzzy logic is used for the disease grading. They used an artificial neural network(ANN) as a classifier which mainly helps to check the severity of the diseased leaf.

4.4 Automated Vision-Based Diagnosis of Banana Bacterial Wilt Disease And Black Sigatoka Disease [4]

Godliver Owomugisha, John A.Quinn, Ernest Mwebaze and James L was proposed "Automated vision-based diagnosis of banana bacterial wilt disease and black sigatoka disease"[4]. In this paper they have described that there are machine learning techniques which have been used in an attempt to detect diseases in the banana plant such as banana bacterial wilt (BBW) and banana black sigatoka (BBS) that have caused a huge loss to many banana growers. Hence, here the study investigated various computer vision techniques which led to the development of an algorithm that consists of four main phases. In phase one, images of banana leaves were acquired using a standard digital camera. Phase two involves use of different feature extraction techniques to obtain relevant data to be used in phase three where images are classified as either healthy or diseased. Of the seven classifiers that were used in this study, Extremely Randomized Trees performed best in identifying the diseases achieving 0.96 AUC for BBW and 0.91 for BBS. Colour histograms are extracted and transformed from RGB TO HSV,HSV to L*a*b. Peak components are used and area under the curve analysis is used for classification. They used nearest neighbors, Decision tree, random forest, extremely randomized tree, Naive Bayes and SV Classifier.

4.5 SVM-Based Multiple Classifier System for Recognition Of Wheat Leaf Diseases [5]

Uan Tian ,Chunjiang Zhao,Shenglian Lu and Xinyu Guo proposed a "SVM-Based Multiple Classifier System for Recognition of Wheat Leaf Diseases"[5], This paper presents a SVM-based Multiple Classifier System (MCS) for pattern recognition of wheat leaf diseases. The proposed system uses stacked generalization structures to combine the classification decisions obtained from three kinds of support vector machines (SVMs)-based classifiers. And three different feature sets including color features, texture features and shape features are used as training sets for three corresponding classifiers. Firstly, these different feature sets are classified by the classifiers in low-level of MCS to different corresponding mid-level categories, which are partly described by the symptom of crop diseases according to the knowledge of plant pathology. Then the mid-level features are extracted from these mid-categories produced from low-level classifiers. Finally high-level SVMs will be trained and correct errors made by the color, texture and shape SVMs to improve the performance of recognition.

4.6 The Detection and Classification of Leaf Diseases Using Multiclass Support Vector Machines [6]

Yangon Myanmar, Ko Ko Zaw, Zin Ma Myo, and Wah Hlaing proposed "The detection and classification of leaf diseases using Multiclass Support Vector Machines [6] ", on 11th National Conference on Science and Engineering, In this paper, they have described a method of detection and classification of plant disease using image processing and machine learning techniques. They have used standard images of leaves of several types of plants to test our method. Initially, the method segments the input image to isolate disease parts of the leaf. Then the obtained result has various features from the diseased affected segmented image. Finally, the leaves are classified into healthy and disease types based on its features using the Multi-class Support Vector Machine (SVM) classifier. Experimental results indicate that this method yields a very high accuracy rate for detection and classification of plant diseases. SVM, is initially proposed for binary classification technique, with simple manipulation can be used for a multiple class case. This project also tries to attempt

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for improvement in classifying the leaf diseases. Most of the work involves extracting statistical features of RGB signals converted into LAB form.

4.7 A Survey of Disease Identification And Classification Though Leaf Images: A Computational Method [7]

Sukhvir Kaur, Shreelekha Pandey, Shivani Goel proposed "A Survey of Disease Identification and Classification Through Leaf Images: A Computational Method[7]". Here the researchers have thus attempted to automate the process of plant disease detection and classification utilized on computer vision technologies aspects. A discussion on commonly identify those that seem to work well across several crops or crop categories.

4.8 Design Innovations for 3c's Compute Communicate Control Plant Disease Detection Using Machine Learning [8]

In 2018 in International Conference on "Design Innovations for 3C's Compute Communicate Control Plant Disease Detection Using Machine Learning[8]" by Shima Ramesh, Mr. Ramachandra Hebbar, Niveditha M, Pooja R, Prasad Bhat N, Shashank N,Mr. P V Vinod proposed that according to past studies, 42% of agricultural production is in Loss, and that too solely as a result of plant leaf diseases. With this technique, plant leaf diseases can be detected from input images to overcome this major issue. This process involved steps like image pre-processing, image segmentation, feature extraction. On the basis of these three steps, K Nearest Neighbor (KNN) classification is applied. As a result of the proposed implementation, it has a 98.56% accuracy rate in predicting plant leaf diseases. This paper makes use of Random Forest algorithm in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification.

4.9 The Detection of Plant Diseases and Pests using Deep Learning[9]

In 2021 in BMC(Biomed-central) Jun Liu and Xuewei Wang proposed "The detection of plant diseases and pests using deep learning[9]".In this study, the evaluation of the performance results using different approaches of nine powerful architectures of deep neural networks for plant disease detection is done. Transfer learning and deep feature extraction methods are used, which adapt these deep learning models to the problem at hand. The utilized pre-trained deep models are considered in the presented work for feature extraction and for further fine-tuning. The obtained features using deep feature extraction are then classified by support vector machine (SVM), extreme learning machine (ELM), and K-nearest neighbor (KNN) methods. The experiments are carried out using data consisting of real disease and pest images from Turkey. The accuracy, sensitivity, specificity, and F1-score are all calculated for performance evaluation. The evaluation results show that deep feature extraction and SVM/ELM classification produced better results than transfer learning. In addition, the fc6 layers of the AlexNet, VGG16, and VGG19 models produced better accuracy scores when compared to the other layers.Here SVM is used for recognizing image samples. The accuracy of implementation is about 92% with a sufficient and stable dataset used for the project

4.10 Citrus Canker Detection Based On Leaf Images Analysis[10]

Min Zhang, and Qinggang Meng have proposed research on "Citrus canker detection based on leaf images analysis". Citrus canker is a bacterial disease that causes lesions on the leaves, stems, and fruit of plants including citrus and other plants in the citrus family. Canker causes the citrus tree to continually decline in health and fruit production until the tree produces no fruit at all. Citrus canker is highly contagious and can be spread rapidly. Citrus canker is a quarantine disease which may cause huge damage to citrus production. Effective and fast disease detection methods must be undertaken to minimize the losses of citrus canker infection. In this paper, a new approach is presented to detect citrus canker from leaf images collected in the field. Firstly, a global canker lesion descriptor is used to detect citrus diseased-lesion from leaf-background. Then a zone-based combined local descriptor is proposed to identify citrus canker disease from other similar diseases-lesions. Thirdly, a two-level hierarchical detection structure is developed to identify the canker lesion and AdaBoost is adopted in feature selection and classifier learning.

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III. CONCLUSION

To prevent losses, small holder farmers are dependent on a timely and accurate crop disease diagnosis. This service is free, easy to use and requires just a smartphone and internet connection. Overall, this study is conclusive in demonstrating how KNN may be applied to empower small-holder farmers in their fight against plant disease. The final result was a plant disease detection app. In the future, work should be focused on diversifying training datasets and also in testing similar web applications in real life situations. Without such developments, the struggle against plant disease will continue. So Implementation of the project work was done successfully and we got to learn many more things from this project.

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