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Original Article

Plants Disease Detection using Image Processing Techniques

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***Abstract** - Identifying plant diseases is essential for preventing losses in agricultural product production and quantity. The study of plant diseases entails the examination of visually discernible patterns on the plant. Plant health monitoring and disease detection are crucial for sustainable agriculture. Manually monitoring plant diseases is quite tough. It necessitates a great deal of effort, as well as knowledge of plant diseases and long processing times. As a result, by taking Images of the leaves and comparing them to data sets, image processing is utilized to identify plant illnesses. The data collection is made up of several plants in Image format. Apart from detection, consumers are led to an e-commerce website that lists several pesticides along with their rates and usage instructions. This website may be used to compare the MRPs of various pesticides and purchase the ones necessary for the disease identified. This document intends to effectively support and assist greenhouse growers.*

***Keywords** - Plant disease detection, Tensor flow, Greenhouse, Convolution neural network.*

I. INTRODUCTION

India is a cultivated country, with agriculture employing over 70% of the population. Farmers have a wide range of options when it comes to choosing appropriate crops and insecticides for their plants. As a result, crop damage would result in a significant loss of output, affecting the economy.

Leaves being the most sensitive part of plants, show disease symptoms at the earliest. The crops need to be monitored against diseases from the very first stage of their life-cycle to the time they are ready to be harvested. Initially, the method used to monitor the plants from diseases was the traditional naked eye observation that is a time-consuming technique that requires experts to manually monitor the crop fields. A variety of strategies have been used in recent years to produce automated and semi-automatic plant disease detection systems, and automatic detection of diseases by simply looking at the symptoms on the plant leaves makes it easier and less expensive. So far, these methods have been shown to be faster, cheaper, and more accurate than farmers' conventional approach of manual observation.

Symptoms of illness can be noticed on the leaves, stems, and fruits in the majority of cases. The illness symptoms are seen on the plant leaf, which is used to detect the sickness. There are numerous instances where farmers lack a thorough understanding of the crops and the diseases that might impact them.

Rather than going to an expert and seeking their advice, farmers may utilize this document to increase their productivity. The major goal isn't just to use image processing tools to diagnose the sickness. It also takes the user to an e-commerce website where they may buy the treatment for the diagnosed condition sickness by comparing the rates and applying them correctly according to the instructions a given Greenhouses, sometimes known as glasshouses or moth houses, are structures with walls and roofs composed of transparent material, such as glass, in which plants that require regulated climactic conditions are cultivated. Because greenhouse farming is becoming increasingly popular these days, this study will be of great use to greenhouse farmers. To examine plant disease detection and discuss in terms of various parameters, a variety of methodologies may be applied. The following are the portions of the paper. The first section provides a quick overview of the significance of plant disease detection. The second section analyses and examines recent work in this field, as well as the strategies utilized. In the third section, we discuss the approaches we employed in our work. Finally, the fourth section brings this article to a close by outlining future directions.

II. LITERATURE SURVEY

Apple diseases such as Alterna leaf spot, Brown spot, Mosaic, Grey spot, and Rust are all common and have an impact on production. However, current research lacks a reliable and quick detection of apple disease to ensure the apple industry's continued health. Object detection methods like SSD, DSSD, and R-SSD may be divided into two categories: The pre-network model, which is employed as a basic feature extractor, is the initial part. The other is an auxiliary structure that detects using a multi-scale feature map [1]. The leaf image is partitioned into four groups using K-means segmentation and squared Euclidean distances. For both color and texture data, the Color Co-occurrence technique [4] was used to extract features. Finally, a neural network detection approach based on back propagation techniques is used to finish the classification. The total accuracy of the system in detecting and classifying diseases was found to be about around 93 percent.

To identify fungal infections on plant leaves, a variety of crop types were used, including fruit crops, vegetable crops, cereal crops, and commercial crops. For each type of crop, several strategies have been used [5]. The segmentation approach utilized for fruit crops is k-means clustering, and texture characteristics have been focused on and identified using ANN and closest neighbor algorithms, with an overall average accuracy of 90.723 percent. The Chan-vase approach was utilized for vegetable crop segmentation, local binary patterns for texture feature extraction, and SVM and k-nearest neighbor algorithm for classification, resulting in an overall average accuracy of 87.825 percent.

The grab-cut algorithm was used to segment the commercial crops. Utilizing an overall average accuracy of 84.825 percent, wavelet-based feature extraction was used, with MahalNobis distance and PNN as classifiers. Using k-means clustering, cereal crops have been segmented. Edge sleuth with a keen sense of what's around the corner. Features such as color, shape, texture, color texture, and random transform have been retrieved. The entire average accuracy was 83.72 percent, thanks to the employment of SVM and closest neighbor classifiers. A chilli plant leaf Image was analyzed to identify the plant's health state. Their strategy ensures that the chemicals are exclusively applied to the afflicted chilli plant. For feature extraction and Image recognition, they employed MATLAB. The pre-processing in this work is done with the Fourier filtering, edge detection, and morphological operations are all examples of morphological operations. For object categorization, computer vision extends the image processing paradigm. The Image capture is done using a digital camera, and the GUI is built with the LABVIEW software program [7]. The FPGA and DSP-based systems are designed for plant disease monitoring and control. For monitoring and troubleshooting, the FPGA is utilized to get field plant Image or video data.

The video or image data is processed and encoded using the DSP TMS320DM642. Data is sent via the nRF24L01 single-chip 2.4GHz radio transmitter. It employs a multi-channel wireless connection to reduce the overall system cost and has two data compression and transmission methods to fulfill the needs of various users.

III. METHODS OF DISEASE DETECTION

As illustrated in Figure 3.1, the plant disease detection system goes through four stages. The initial phase is gathering Images from a digital camera or a mobile phone, as well as from the internet. The second step divides the Image into a number of clusters, each of which can be treated differently. The next part is about feature extraction methods, and the last step is about illness categorization.

A. Image Acquisition

Images of plant leaves are collected using digital media such as cameras, mobile phones, and other devices with the necessary quality and size at this step. Images can also be downloaded from the internet.

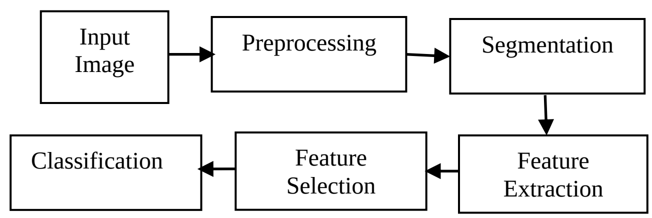

Fig. 1 Disease detection Stages

B. Image Segmentation

This phase aims at simplifying the representation of an image such that it becomes more meaningful and easier to Analyze. As the premise of feature extraction, this phase is also the fundamental approach of image processing.

There are various methods using which images can be segmented, such as k-means clustering, Otsu's algorithm, and thresholding, etc. The k-means clustering classifies objects or pixels based on a set of features into K number of classes. The classification is done by minimizing the sum of squares of distances between the objects and their corresponding clusters.

C. Feature Extraction

As a result, the characteristics from this region of interest must be retrieved in this stage. These characteristics are required in order to deduce the meaning of a sample image.

Color, shape, and texture may all be used to create features. Recently, the majority of researchers have expressed an interest in using texture traits to identify plant illnesses. Gray-level co-occurrence matrix (GLCM), color co-occurrence technique, spatial grey-level dependency matrix, and histogram-based feature extraction are some of the feature extraction approaches that may be used to construct the system. The GLCM technique is a texture categorization statistical approach.

D. Classification

The classification phase entails determining whether or not the input Image is healthy. If a sick Image is discovered, some previous investigations have categorized it into a number of disorders. A software procedure, often known as a classifier, must be created in MATLAB for classification.
In recent years, researchers have utilized a variety of classifiers, including k-nearest neighbor (KNN), support vector machines (SVM), artificial neural networks (ANN), back propagation neural networks (BPNN), Nave Bayes, and Decision tree classifiers.

SVM is proven to be the most often utilized classifier. Every classifier has benefits and drawbacks; however, SVM is an easy to use and reliable methodology.

IV. OVERVIEW OF PLANT DISEASE

Infectious agents such as fungus, bacteria, and viruses are commonly responsible for plant illnesses. Plant disease signs are obvious indications of infection, whereas symptoms are the obvious repercussions of these diseases. Symptoms of fungal infections include visible spores, mildew, or mould, as well as leaf spots and yellowing. Infectious agents such as fungus, bacteria, and viruses are commonly responsible for plant illnesses. Plant disease signs are obvious indications of infection, whereas symptoms are the obvious repercussions of these diseases. Symptoms of fungal infections include visible spores, mildew, or mould, as well as leaf spot and yellowing. Fungal diseases are fungi-caused plant illnesses. Fungi can be solitary or multicellular, but both take nutrients and tear down tissue to infect plants. The most prevalent type of infection in plants is a fungus

Plants have various distinct symptoms or illness effects that might be seen. Symptoms of fungi infections include spots on plant leaves, yellowing of foliage, and bird-eye marks on the fruit.

Fig. 2 Leaf affected by a fungal infection

When it comes to some fungal illnesses, the organism may be seen on the leaves as a growth or a mould. It's possible that they are malformations on stems or the undersides of leaves. Signs of infection are direct observations of the disease-causing organism. Bacteria are prokaryotic single-celled creatures. Bacteria may be found almost everywhere, and although many are helpful, others may cause illness in humans and plants. Because bacteria are small, their signals are typically more difficult to detect than those of fungus. Bacterial ooze is a milky white liquid that appears when you cut an infected stem. One symptom of a bacterial illness is this.

Fig. 3 Leaf affected by Bacteria

Water-soaked lesions, which are moist areas on leaves that exude germs, are another symptom The lesions eventually expand and develop reddish-brown blotches on the leaves as the disease proceeds. Leaf spots or fruit spots are a typical indication of bacterial illness. Unlike fungal spots, they are frequently enclosed by leaf veins. Viruses are infectious particles that are too tiny for a light microscope to detect. They infiltrate host cells and take over host machinery, forcing the host to replicate the virus millions of times.

Plants exhibit no symptoms of viral infections because viruses are invisible even under a light microscope. There are, however, signs that a trained eye may detect. Virus infection is marked by a mosaic leaf pattern, yellowed or crinkled leaves, and other symptoms. Many plant viruses, such as the tobacco mosaic virus, receive their names from this typical pattern of discoloration. Reduced plant growth is also a typical symptom of viral infections. So, here are our thoughts on how to identify different plant diseases and how to avoid them.

Fig. 4 Leaf affected by Virus

V. PROPOSED SYSTEM

With TFLite, the proposed system has an end-to-end Android application. The proposed system chose to create an Android app to identify plant illnesses. Using Convolution Neural Network, it has the techniques and models to distinguish species and illnesses in crop leaves. Collab is used to edit source code in the proposed system.

Plant Village data-set is a collection of 54,305 Images of damaged and healthy plant leaves taken under controlled settings. Apple, blueberry, cherry, grape, orange, peach, pepper, potato, raspberry, soy, squash, strawberry, and tomato are among the 14 crops depicted. It includes Images of 17 fundamental illnesses, 4 bacterial illnesses, mould (oomycete) illnesses, 2 viral infections, and 1 mite illness. In addition, 12 crop species exhibit healthy leaf Images that are not diseased. Our database includes solutions for a variety of plant textures, including,

1. Apple scab
2. Apple black rot
3. Apple cedar apple rust
4. Cherry including sour powdery mildew
5. Cherry including sourhealthy
6. Corn maize cercospora leaf spot gray leafspot
7. Corn maize commonrust
8. Corn maize northern leafblight
9. Corn maizehealthy
10. Grape blackrot
11. Grape esca black measles
12. Grape leaf blight isariopsis leafspot
13. Grapehealthy
14. Orange haunglongbing citrus greening
15. Peach bacterial spot
16. Peach healthy
17. Pepper bell bacterial spot
18. Pepper bell healthy
19. Potato earlyblight
20. Potato late blight
21. Squash powdery mildew
22. Strawberry leafscorch
23. Tomato bacterial spot
24. Tomato earlyblight
25. Tomato late blight
26. Tomato leafmold
27. Tomato septorialeafspot
28. Tomato spider mitestwo spotted spider mite
29. Tomato targetspot
30. Tomato yellow leaf curl virus 31. Tomato mosaic virus

Data generators have been built up to receive images from our source folders, transform them to float32 tensors, and feed them to our network (along with their labels).

Data that is fed into neural networks are generally standardized in some way to make it easier for the network to process. In our situation, we'll pre-process our Images by converting the pixel values to the [0, 1] range (all values are now in the [0, 255] range). The input data will need to be scaled to 224x224 pixels or 299x299 pixels, as needed by the networks. You may choose whether or not to use image enhancement.

Aside from identifying plant disease using the methods described above, our system also connects the user to an e-commerce website. This page lists all of the pesticides that are available for the illness that has been discovered, along with their MRP rates. The instructions for using it are also provided on the website. Thus, the customer may acquire pesticides by comparing their rates and qualities

VI. RESULTS AND DISCUSSION

There are two types of training and testing environments. One is in a lab setting, which means the model is evaluated using Images from the same dataset that it was trained on. The other condition is the field condition, which indicates that our model has been evaluated using Images captured in real-world scenarios (land). When we collect samples from the real world, the lighting circumstances and backdrop attributes of the Images are completely different; thus, there's a potential that our model may yield very low accuracy when compared to the accuracy values obtained in the lab. To counteract this, we came up with the notion of using a range of Images throughout the training period (heterogeneity).

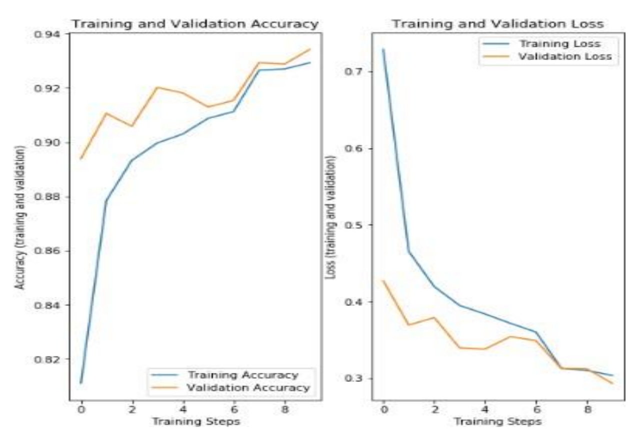

Fig. 5 Leaf affected by Virus

When compared to the suggested system, which identifies several illnesses in a single system, the accuracy of Real-time detection of apple leaf disease utilizing deep learning methodology based on enhanced convolution neural networks is lower.

Table 1. Proposed system results & values

Input (apple)	**Faster R-CNN**	**Proposed system results**
Scab	58.82	70.82
Black rot	68.12	82.68
Cedar apple rust	90.34	94.96

VII. CONCLUSION

As a result, an application for identifying disease-affected plants and healthy plants has been developed, with the suggested work focusing on accuracy values in real-world situations. This work is implemented using different plant disease Images.

Overall, this work is created from the ground up and has a reasonable level of accuracy. The goal for future work is to expand the number of Images in the specified database and to adapt the architecture to the dataset in order to improve accuracy.

REFERENCES

[1] Peng Jiang , Yuehan Chen, Bin Liu, Dongjian He, Chunquan Liang, Real-Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks , 7 (2019) 6.

[2] Zhou, R., Kaneko, S., Tanaka, F., Kayamori, M., Shimizu, M., Disease detection of Cercospora Leaf Spot in sugar beet by robust template matching, Computers, and Electronics in Agriculture, 108 (2014) 58-70.

[3] Barbedo, J.G.A., Godoy, C.V., Automatic Classification of Soybean Diseases Based on Digital Images of Leaf Symptoms, SBIAGRO, (2015).

[4] Barbedo, J.G.A., A review on the main challenges in automatic plant disease identification based on visible range images, Biosystem Engineering, 144 (2016) 52-60.

[5] Bashish, D.A., Braik, M., Ahmad, S.B., A Framework for Detection and Classification of Plant Leaf and Stem Diseases, International Conference on Signal and Image Processing, (2010) 113-118.

[6] Punajari, J.D., Yakkundimath, R., Byadgi, A.S., Image Processing Based Detection of Fungal Diseases In Plants', International Conference on Information and Communication Technologies, 46 (2015) 1802-1808.

[7] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin MdShakaffRohaniBinti S Mohamed Farook, Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques, Third International Conference on Intelligent Systems Modeling and simulation, (2012).

[8] Chunxia Zhang, Xiuqing Wang, Xudong Li., Design of Monitoring and Control Plant Disease System Based on DSP&FPGA, Second International Conference on Networks Security, Wireless Communications and TrustedComputing, (2010).

[9] Omrani, E., Khoshnevisan, B., Shamshirband, S., Saboohi, H., Anuar, N.B., Nasir, M.H.N., Potential of radial basis function-based support vector regression for apple disease detection, Journal of Measurement, (2014) 233-252.

[10] Gharge, S., Singh, P., Image Processing for Soybean Disease Classification and Severity Estimation, Emerging Research in Computing, Information, Communication, and Applications, (2016) 493-500.

[11] AnandR,VeniS,Aravinth J., An Application of image processing techniques for Detection of Diseases on Brinjal Leaves Using K-Means Clustering Method , Fifth International Conference On Recent Trends In Information Technology, (2016).

[12] ChaitaliG. Dhaware, Mrs. K.H. Wanjale., A Modern Approach for Plant Leaf Disease Classification which Depends on Leaf Image Processing" 2017 International Conference on Computer Communication and Informatics (ICCCI)05 – 07 (2017).

[13] G.P.Saraswathy, G.Ramalakshmi., Detection of Leaf Diseases and Classification using Digital Image Processing, International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), (2017).

[14] Namrata R. Bhimte, V.R. Thool., Diseases Detection of Cotton Leaf Spot using Image Processing and SVM Classifier, Proceedings of the Second International Conference on Intelligent Computing and Control Systems , ICICCS, (2018).

[15] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin MdShakaff, Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques, Third International Conference on Intelligent Systems Modelling and Simulation, (2012).

[16] Surendiran, R., and Alagarsamy,K., 2010. Skin Detection Based Cryptography in Steganography (SDBCS). International Journal of Computer Science and Information Technologies (IJCSIT), 1(4), pp.221-225.

[17] Surendiran, R. and Alagarsamy, K., 2010. PCA based geometric modeling for automatic face detection. Int. J. Comput. Sci. Inform. Technol, 1(4), pp.221-225.

[18] NorfarahinMohdYusoff, Ili Shairah Abdul Halim, Noor Ezan Abdullah, Real-time Hevea Leaves Diseases Identification using Sobel Edge Algorithm on FPGA: A Preliminary Study, 9th IEEE Control and System Graduate Research Colloquium, (ICSGRC) (2018).

[19] Manahoran, N., and M. V. Srinath, K-Means Clustering Based Marine Image Segmentation., International Journal of MC Square Scientific Research, 9(3) (2017) 26-29.