IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DETECTION OF PLANT DISEASE USING IMAGE SEGMENTATION AND SUPPORT VECTOR MACHINE

[1] Manjunatha Badiger,[2] Dr. Jose Alex Mathew

[1]Assistant Professor, [2]Professor,

[1]Department of Electronics & Communication Engineering, [2]Department of Electrical & Electronics Engineering

[1]Sahyadri College of Engineering and Management, Mangaluru, India, [2]Srinivasa Institute of Technology Mangaluru, India

Abstract: Agriculture is a major source of income for the country. Leaf diseases in agriculture are a major concern for many countries, as food consumption is increasing rapidly owing to population growth. The early and precise detection and diagnosis of leaf diseases are critical to preventing their spread. Image processing techniques including mathematical equations and mathematical transformations can be employed for disease identification. For human eyes, an image is a mixture of RGB colours from which we can extract the features. Modern computers, on the other hand, store images in a mathematical structure, which means the computer views the image as numbers. After evaluating the image as a numerical array or matrix, we may apply various transforms to it to extract specific features. However, before the picture can be transformed, it must first go through different procedures such as transformation. K-Means Clustering and the Support Vector Machine Algorithms are used in MATLAB to identify and classify several forms of leaf diseases.

***Index Terms* - Algorithm; Classification; Feature extraction; Plant Leaf Diseases; Segmentation; Training**

I. INTRODUCTION

Agriculture is one of the world's most important sources of revenue. Agriculture employs half of the world's population. Research is being performed to boost agricultural yield and improve crop quality at a lower cost. Plant diseases pose serious concerns to global food security by lowering crop yield worldwide. According to data, plant diseases are responsible for around 20% -40% of all crop losses worldwide, according to data [1]. Plant diseases not only pose a worldwide danger to food security, but they may also have devastating effects on smallholder farmers whose livelihoods rely on healthy crops. Each disease has unique features that necessitate specific treatments. As a result, disease identification is crucial to preventing the spread of plant diseases and reducing agricultural economic losses. Image-based technologies, including mathematical equations and manipulations, are frequently employed for illness identification. It may be utilised to understand visual material in a variety of multidisciplinary activities, such as medical imaging [2, 3], and food computing [4]. For natural eyes, a picture is a blend of RGB colours, but for digital devices like computers and cameras, images are real numbers inside a matrix [5]. Since modern images include digital and numerical features, we may perform some mathematical transformations on them and extract some of their hidden details by modifying their parameters [6].

Based on those retrieved characteristics, we may do more study. A image will be treated as a series of numbers within a matrix, and the magnitude of these numbers will define the colour of that pixel in the real world. We highlight key integers inside that matrix using a few methods and mathematically modify the matrix to extract some information. We cannot, however, discover the nature of the disease by extracting the features; instead, we must make an evaluation of the acquired data, which takes time and requires human intervention. Image processing technology and algorithmic advancements can be utilized in medical research to diagnose various illnesses and their phases. Some disorders may be visually assessed, whereas others require both visual examination and medical tests to be confirmed [7]. Because computers can change the properties of pictures, they can reliably identify particular areas of images as abnormal based on training data, saving time. The main aspect of AI is that, after training, it will learn on its own, providing a dynamic reaction to new data kinds. Furthermore, AI is employed everywhere in today's society, and in the future, all AI-based systems may be merged as one, significantly improving the interface.

II. LITERATURE SURVEY

Plants are employed in a number of industrial applications, including herbs and ayurvedic medicinal ingredients, biofuels, biomass, and so on [8]. India has a long history of utilizing plants as a source of food and medicine. Automatic plant identification and classification will increase automatic enhancement systems with additional functionality, such as automatic labelling and flexible searching, with the use of sophisticated information technology, image processing, and machine learning techniques. Image segmentation and object identification are two components of digital image processing that are rapidly being employed in a variety of applications, including leaf recognition [9].

Sachin D. Khirade and A.B. Patil [10] suggested an approach for identifying leaf disease by supplying green leaves; the technique depends on K-Means clustering and certain auxiliary algorithms. After the pre-processing stage takes over and perform some basic transformations, the detecting phases entail picture capture. Following that, picture segmentation is performed using the K-Means cluster technique, followed by classification using the ANN block. This article also provides the mathematics underlying mathematical transformations. Several advancements in agricultural disease monitoring and identification, such as RGB imaging, X-ray, ultrasound, and multispectral and hyperspectral technologies, have been developed.

The approach suggested by Macedo-Cruz et al. in sought to measure frost damage in oat crops [11]. First, the RGB colour space is converted to the L*a*b* colour space. The authors used three distinct thresholding methods: Otsu's approach, the Isodata algorithm, and fuzzy thresholding.

The approach described by Yao et al. in [12] aims to identify and categorize three categories of rice crop illnesses. Otsu's approach is used to segment the picture, following which the sick parts are separated. Colour, shape, and texture characteristics are retrieved, with the latter coming from the HSV colour space. The features are then fed into a Support Vector Machine, which provides the final classification.

P.K. Agarwal and C.M. Procopiuc [13] devised a method to solve the K-Centre problem in a variety of system-related matrices. They also demonstrated that the approach can be extended to other matrices and that discrete K-Centre problems may be solved. They also gave an outline of a basic K-Centre problem estimate method.

Phadikar and Sil [14] suggested a method for detecting and distinguishing two diseases that impact rice crops. After transforming the image to the HSI colour space and segmenting it using entropy-based thresholding. The intensity of the green components is utilised to detect spots after applying an edge detector to the segmented image.

The major purpose of Ahmed S. Abljtaleb's article [15] is to expand the entropy-based thresholding approach for 2D histograms, as well as to investigate individual pixel grey level values and neighbourhood average values. This demonstrates that the threshold is a vector with two access points, the first of which is the pixel's grey level, and the second of which is the threshold's average value. Furthermore, when the noise level is low, the suggested approach performs well.

Monzurul Islam and Monzurul Islam [16] are two names for the same person. Modern phenotyping and plant disease identification are encouraging signs of progress toward food security and long-term agriculture. Image and computer vision-based phenotyping, in particular, allows for quantitative plant physiology analysis. Manual interpretation, on the other hand, takes a large amount of work, plant disease expertise, and a long processing time. In this paper, we offer a strategy for diagnosing diseases from leaf images that combines image processing and machine learning. Using a publicly accessible plant photo collection called 'Plant Village,' this automated approach detects infections on potato plants. Over 300 photos were classified with a 95 per cent accuracy using our segmentation approach and support vector machine application. As a result, the proposed approach paves the path for large-scale automated plant disease detection.

III. Proposed Methodology

The Figure 1. depicts the basic flowchart of the plant disease detection system. The system is mostly used to identify leaf diseases.

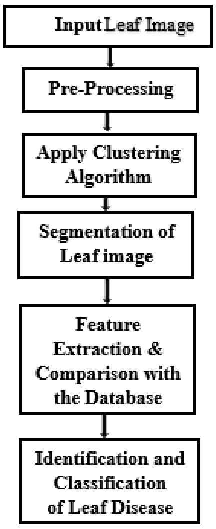

Figure.1 Flow chart of Plant Disease Detection

The flowchart of the disease detection system comprises:

Input image:

The most significant need for doing image processing is the availability of an image; a suitable image with proper size and resolutions must be given. The image can be imported from the root folder, or after taking the image, we can connect an external camera to our system, and the image can be fed into the system as the primary input for live image processing. We can use an internet picture library as a supply of images if necessary. The photographs are saved in the cloud, and we can access them to instantly load the image. If the image is not available, the system decides to use a null matrix to represent it.

Pre-processing:

The input image is converted into a two-dimensional RGB matrix by the Disease Detection System. It is able to determine the dominant colour of the input picture as well as to identify and classify the image type as leaf based on the magnitude of the numbers inside the matrix. Finally, all of the photos are shrunk to a uniform size.

Image Clustering and Segmentation:

The input image contains all of the necessary data for processing. The fundamental issue, though, is that the affected region might be anywhere on the image. The K-means technique divides the entire image into fine chunks and then performs image processing across each component. Which is then used to determine the damaged region. If any unaffected places are located, they are ruled out of the equation. It saves affected regions for subsequent investigation if it discovers them. The K-means algorithm is an iterative method for segmenting a dataset into K distinct, non-overlapping subgroups.

Feature extraction and database comparison:

This is among the most important aspects of the disease detection process. The process of converting raw visual data into numerical features is known as feature extraction. This reduces the number of resources needed to represent the data and allows it to be processed while preserving the original data set's information, resulting in better results. The picture components, such as colour, intensity, and so on, are modified such that the illnesses' hidden characteristics are emphasized. When compared to a validation database of leaf disease, these extracted attributes will aid in the detection of disease extremely rapidly and efficiently.

Disease Identification and Categorization:

The disease detection system receives an image of a diseased leaf as input. For classification, the SVM Classifier is utilized. If the image provided is of leaf disease, the system will identify and classify it as either Alternaria Alternata, Anthracnose, Bacterial Blight and Cercospora Leaf Spot.

IV. Experimental Results

For training and prediction, we used a variety of datasets relevant to leaf disease, including Alternaria, Anthracnose, bacterial blights, Cercospora, Leaf Spot, and Healthy Leaf. Figure 2. shows an improved version of the input image that is used as input to the model.

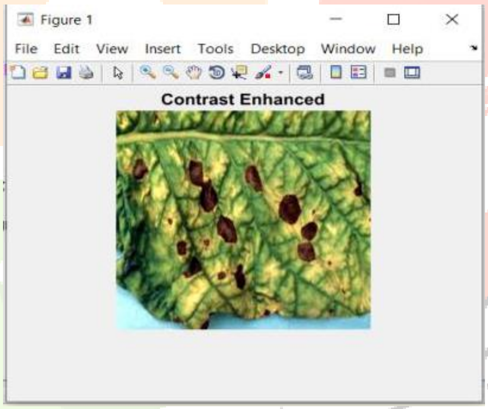

Figure. 2 The improved version of the input

The number of clusters is determined using K-Means Clustering, as illustrated in Figure 3.

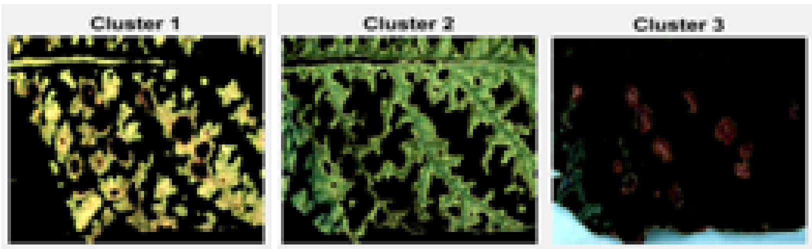

Figure. 3 After the K-Means cluster

Once the k-means algorithm has generated the clusters, the affected region cluster number should be entered in the pop-up box shown in Figure. 4.

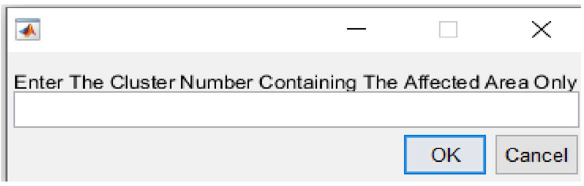

Figure. 4 Enter the cluster number of the affected region.

Figure 5 depicts the result window, which shows the type of input, disease type and description, Scientific Classification, and treatment required.

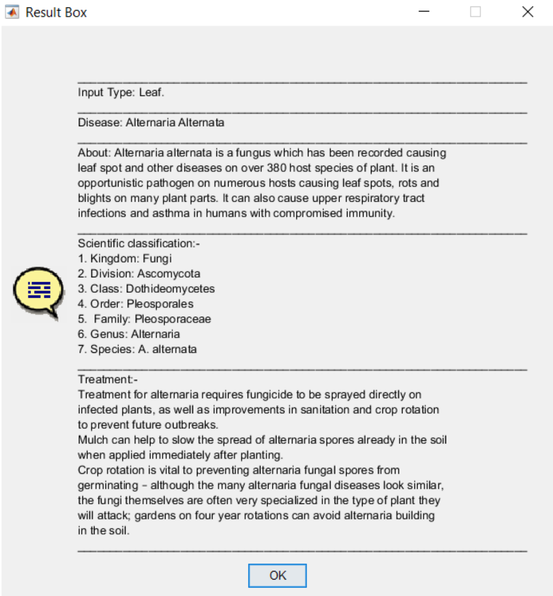

Figure. 5 The resulting window

Table 1. compares several leaf disease detection techniques/algorithms. We may simply conclude from the table above that SVM outperforms other classifiers.

TABLE 1. COMPARISON OF DIFFERENT DETECTION TECHNIQUES/ ALGORITHMS

Reference	Applied technique	Disease	Accuracy
Xu et al., 2011 [17]	K-Nearest Neighbor	Tomato	82%
Asfarian et al., 2013 [18]	Texture Analysis and PNN	Rice	83%
Hu YH et al,2016[19]	Hyperspectral Imaging	Potato	95%
Monzurul Islam et al, 2017 [16]	RGB Imaging	Potato	95%
Proposed	K-Meas & SVM	Tomato	96%

V. CONCLUSION

It is critical to detect and classify diseases correctly in order to avoid unanticipated occurrences. In this article, we examined several functional blocks and methods that are essential for image processing. The study efficiently recognised and classified leaf diseases based on their physical appearances using the aforementioned algorithms. By modifying the training data, we may increase illness detection. The above-mentioned system can be expanded to include a real-time video access system, allowing for continuous plant maintenance.

REFERENCES

[1] Z. Li et al., “Non-invasive plant disease diagnostics enabled by smartphone-based fingerprinting of leaf volatiles,” Nature Plants, vol. 5, no. 8, pp. 856–866, Aug. 2019.

[2] G. Litjens et al., “A survey on deep learning in medical image analysis,” Med. Image Anal., vol. 42, pp. 60–88, Dec. 2017.

[3] E. Moen, D. Bannon, T. Kudo, W. Graf, M. Covert, and D. Van Valen, “Deep learning for cellular image analysis,” Nature Methods, vol. 16, no. 12, pp.1233–1246, 2019.

[4] W. Min, S. Jiang, L. Liu, Y. Rui, and R. Jain, “A survey on food computing,” ACM Computer. Surv., vol. 52, no. 5, pp.92:1–92:36, 2019

[5] Manjunatha Badiger et al., “ Leaf and Skin Disease Detection using Image Processing ”, Global Transitions Proceedings(2022), doi: https://doi.org/10.1016/j.gltp.2022.03.010

[6] Sarker, I.H. Machine Learning: Algorithms, Real-World Applications and Research Directions. SN COMPUT. SCI. 2, 160 (2021).

[7] F. Andreotti, O. Carr, M. A. F. Pimentel, A. Mahdi and M. De Vos, "Comparing feature-based classifiers and convolutional neural networks to detect arrhythmia from short segments of ECG," 2017 Computing in Cardiology (CinC), 2017, pp. 1-4

[8] P. M. Kumar, C. M. Surya and V. P. Gopi, "Identification of ayurvedic medicinal plants by image processing of leaf samples," 2017 Third International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN), 2017, pp. 231-238.

[9] VijaiSingh and A.K.Misra, “Detection of plant leaf diseases using image segmentation and soft computing techniques” Information Processing in Agriculture Volume 4, Issue 1, March 2017, Pages 41-49

[10] Sachin D. Khirade, A. B. Patil. Savitribai Phule Pune University Pune, India: Plant Disease Detection Using Image Processing. 2015 IEEE.

[11] Macedo, Antonia & Pajares, Gonzalo & Santos Peñas, Digital Image Sensor-Based Assessment of the Status of Oat (Avena sativa L.) Crops after Frost Damage. Sensors (Basel, Switzerland). 11. 6015-36. 10.3390/s110606015.

[12] Q. Yao, Z. Guan, Y. Zhou, J. Tang, Y. Hu and B. Yang, "Application of Support Vector Machine for Detecting Rice Diseases Using Shape and Color Texture Features," 2009 International Conference on Engineering Computation, 2009, pp. 79-83, doi: 10.1109/ICEC.2009.73.

[13] L. Bottou and Y. Bengio, “Convergence Properties of the k-means Algorithms”, Advances in Neural Information Processing Systems 7, G. Tesauro and D. Touretzky, eds., pp. 585-592. MIT Press, 1995

[14] SantanuPhadikar, JayaSil and Asit KumarDas, “Rice diseases classification using feature selection and rule generation techniques” Computers and Electronics in Agriculture Volume 90, January 2013, Pages 76-85

[15] A.S. Abutaleb, "Automatic thresholding of grey-level pictures using two-dimensional entropy," Computer Vision, Graphics, and Image Processing, 47: 22-32, 1989.

[16] M. Islam, Anh Dinh, K. Wahid and P. Bhowmik, "Detection of potato diseases using image segmentation and multiclass support vector machine," 2017 IEEE 30th Canadian Conference on Electrical and Computer Engineering (CCECE), 2017, pp. 1-4, doi: 10.1109/CCECE.2017.7946594.

[17] Hu YH, Ping XW, Xu MZ, Shan WX, He Y, “Detection of Late Blight Disease on Potato Leaves Using Hyperspectral Imaging Technique,” PubMed, 36(2), 2016, pp. 515-519.

[18] A. Asfarian, Y. Herdiyeni, A. Rauf and K. H. Mutaqin, "Paddy diseases identification with texture analysis using fractal descriptors based on fourier spectrum," 2013 International Conference on Computer, Control, Informatics and Its Applications (IC3INA), 2013, pp. 77-81, doi: 10.1109/IC3INA.2013.6819152.

[19] Hu YH, Ping XW, Xu MZ, Shan WX, He Y, “Detection of Late Blight Disease on Potato Leaves Using Hyperspectral Imaging Technique,” PubMed, 36(2), 2016, pp. 515-519.