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A PLANT DISEASE DETECTION USING IMAGE PROCESSING OF LEAVES

Priya Padwal & Raminder Preet Pal Singh

Research Scholar, ECE Department Sri Sai University, Palampur, India

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ABSTRACT

The significant task of image processing in the domain of plant disease is to detect the diseases in plants as the data utilized for input is complex in nature. If the diseases are not identified in the early stages, then may adversely affect the total yield, resulting in a decrease in the farmers' profits. To overcome this problem, many researchers have presented different state-of-the-art systems based on Deep Learning and Machine Learning approaches. The infected plants are diagnosed in diverse phases. For this purpose, various algorithms i.e SVM, GLCM and k-mean are available. K mean algorithm is used for colour segmentation and glcm is used for disease classification. Automatic plant disease using image processing technique is beneficial for the farmers as it reduces large human labours and can help to detected by symptoms at early stage. The prior works presented SVM (Support Vector Machine) algorithm in order to detect the disorder. Using machine learning approaches, the images of leaves or fruits are used as input data. This research work introduced a voting classification system for enhancing the diverse metrics such as accuracy, precision and recall in comparison with the earlier work. The proposed model achieved 96% accuracy.

KEYWORDS: *Plant Disease, GLCM, K-mean, SVM, Voting Classifier*

1. INTRODUCTION

The plant disorders lead to create serious threats to global food security and mitigate the crop yield worldwide Thus, the necessary task is to diagnose the disorders of plants for preventing the spread of plant diseases and mitigating the economic losses in farming fields. At present, image-based technique becomes popular to accomplish several interdisciplinary operations by deciphering the visual content, such as medical imaging, food computing and analysing the cellular image [1-2]. The image processing technique used to diagnose plant diseases has diverse stages such as to pre-process the image, segment it, extract the features and classify the diseases as defined in Figure 1. The initial stage focuses on attaining the plants, suspicious of having a disease. After generating the images, the methods to pre-process the images are executed for enhancing the quality of the images. The next stage aims to separate the plant from the background and recognize the diseased portions. Diverse segmentation methods are available, such as threes holding, clustering, and edge detection [3-5]. The third stage is executed to extract the significant attributes from the segmented image

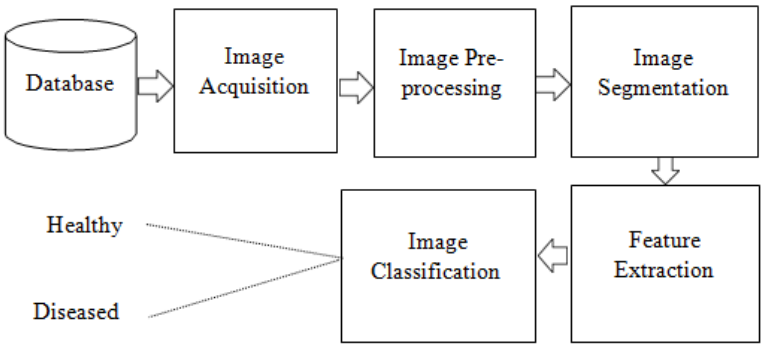

Figure 1: Workflow of Plant Disease Detection.

The last stage emphasizes on classifying the images as normal and having a disease [6-8]. Support Vector Machine (SVM) is a classifier comes under the supervised learning (SL) model with associated learning algorithms for analysing the data while classifying it and performing regression analysis. To classify a novel data, the mapping of this data is done onto the similar space and its location is considered for predicting its kind. Artificial neural network is a kind of Artificial Intelligence (AI) [9-10].

2. LITERATURE REVIEW

Table I: Analysis of Papers

Sr. No.	Title Name	Author Name and year of Publication	Techniques Used
1.	Plant disease detection using hybrid model	Punam Bedi, Pushkar Gole,2021	CAE and CNN algorithms used
2.	K-means Clustering and SVM for Plant Leaf Disease Detection and Classification	S N Kumar, Suresh Varuvel, Ajay Kumar Haridhas, 2019	Classifies plant disease with color, shape and size
3.	Detection of Tomato Leaf Diseases for Agro-Based Industries	Kyamelia Roy, Sheli Sinha, Jaroslav Frnda, 2023	Tomato leaf detection using F-RCNN
4.	Handling Severity Levels of Multiple Co-Occurring Cotton Plant Diseases	Serosh Karim Noon, Muhammad Amjad, Abdul Mannan, 2022	Improving Spatial Pyamid pooling block
5.	Automatic Detection of Citrus Fruit and Leaves Diseases	Asad Khattak, Ulfat Batool, Abdu Gumael, 2021	CNN technique used

3. RESEARCH METHODOLOGIES

This research work is focused on recognizing the diseases in plants. The entire cycle to detect the infection contains different functions that are Image Pre-processing, Segmentation, Feature Extraction, Classification

Pre-processing: The image is pre-processed in this function with the objective of diagnosing the diseases from leaves of plants. The images are captured to be fed in input. A public dataset called Plant Village is created which includes all the aggregates. The Plant Village is a website that is helpful for deriving the information about the plant and its disease's kind.

Segmentation: - The second function aims to split a digitized image into distinct portions. The process to segment an image is adopted to identify the objects and retrieve the information from the images. The technique of segmenting an

image is put forward to locate the RoI and bounding line of pictures. Every pixel is marked with a label. This work adopts KMC (K-means clustering) for segmenting the pictures of plant leaves. Moreover, samples are gathered into various clusters according to the distance using this algorithm. Two points having a least distance amid them are assisted in offering compressed and independent cluster as a closing target. After that, this phase selects the essential portion from the part of an input leaf which suffers from infection.

Feature Extraction: The prior stage offers the output in the form of RoI (region of interest). This function is carried for retrieving the attributes from the required region. This process is effective to extract a set of values

known as attribute. The further processing is done on the basis of attributes having information regarding the images. A number of elements, namely color, texture, morphology and color coherence vector help in detecting the infections in plants. Several methods are adopted for extracting the attributes from the images. A diseases diagnosis system is constructed on the basis of these features. GLCM, SGLDM, and HOG algorithm are useful approaches for extracting the attributes. The texture features are classified via GLCM.

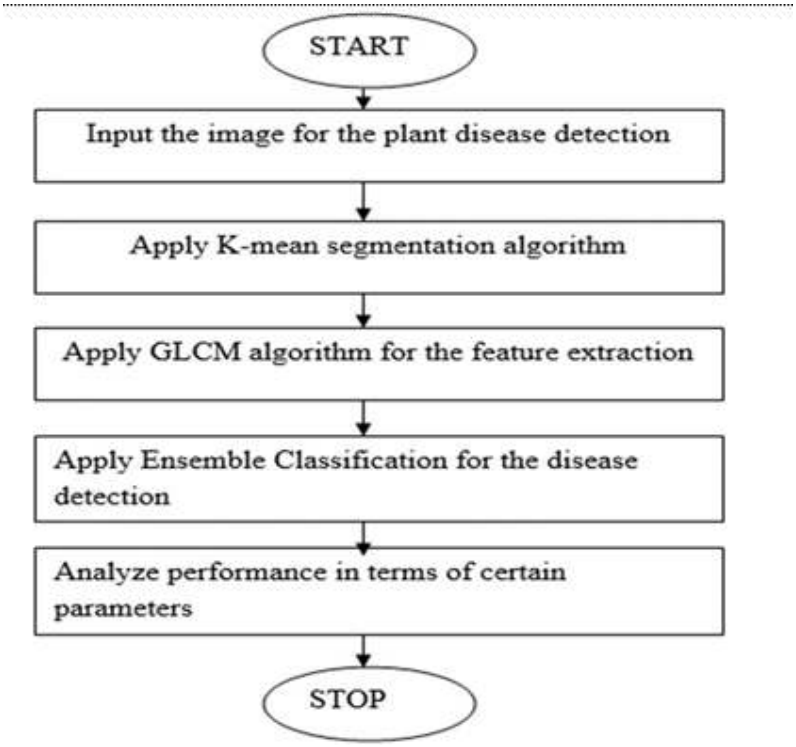

Figure 2: Research Methodology Flow Chart.

Classification: - The final stage is carried out for generating a classification algorithm in order to diagnose the infected plants. There are 2 sections of entire dataset. Image classification can be performed using a number of available classification algorithms. Some popular classification algorithms for plant disease detection include Support Vector Machine, GLCM, K-mean etc. The offered algorithm is optimized for either of two algorithms to cast their vote and obtain the final predictive result.

4. RESULT AND DISCUSSIONS

This work considers Plant Village website to gather a dataset. A set of images for wheat is taken in this dataset so that diverse kinds of infections of plants are diagnosed. The execution of every stage is discussed as:

Input Database: these steps firstly take a plant's photograph as input and then convert it into grey scale photograph. After this, a filtering approach is employed for the image delousing. The collection of data is done from the plant village dataset. The sample images are represented as:

Figure 3: Is The Representation of the Sample Images Utilized to Accomplish the Further Processing.

Segmentation: The K-Means algorithm is adopted for segmenting the images into specific portions. The images whose segmentation is done are defined in figure 2.

Feature Extraction: This stage is executed to extract the features. The GLCM (gray-level co-occurrence matrix) algorithm is adopted to retrieve 13 features to classify the images.

Classification: The final stage emphasized on predicting the disease. The figure 3 defines the predicted disease image.

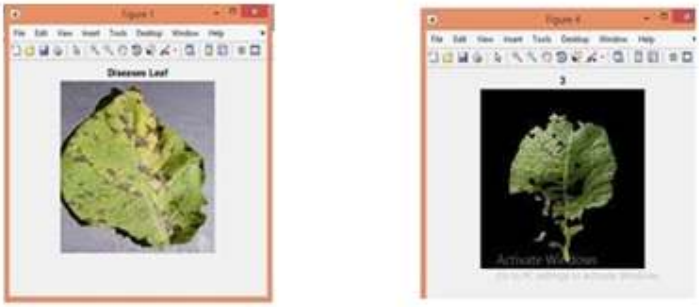

Figure 4: Represents that the Image 'A' Is Utilized for the Input and Image B Is Used To Illustrate the Detected Image Which Contains Infection.

Precision: It is calculated as the number of true positives divided by the total number of true positives and false positives.

$$\text{Precision} = TP/ (TP+ FP) \quad (1)$$

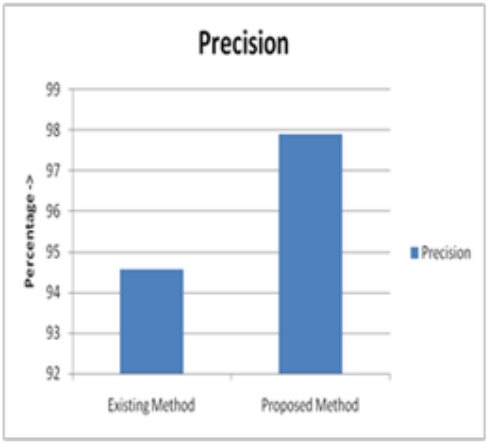

Figure 5: Precision Comparison.

Recall: It is calculated as the number of true positives divided by the total number of true positives and false negatives.

$$\text{Recall} = TP / (TP + FN) \quad (2)$$

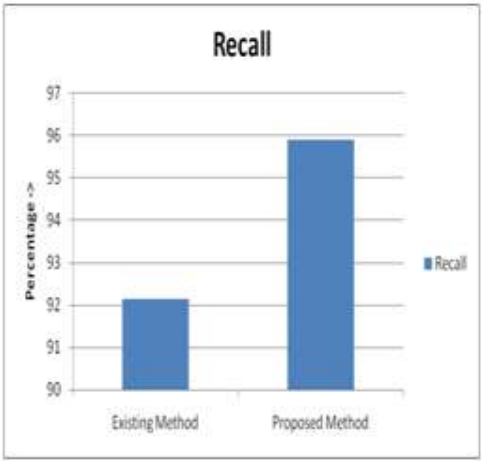

Figure 6: Recall Comparison.

Accuracy: It is the ratio of the number of correctly classified points to the total number of points multiplied by 100.

$$\text{Accuracy} = (t / n) * 100 \quad (3)$$

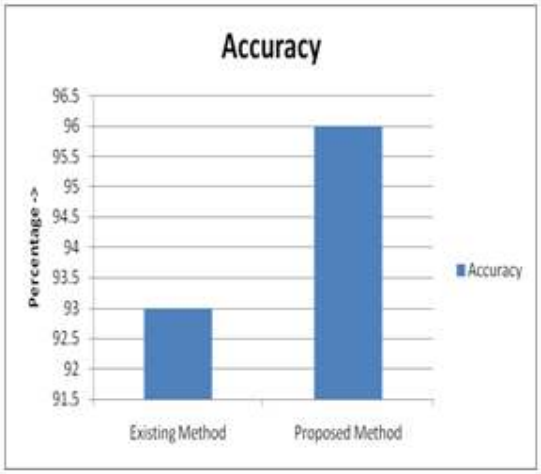

Figure 7: Accuracy Comparison.

5. CONCLUSIONS

This work proposed K-means clustering algorithm for the detection of leaf disease and classification. The proposed work using SVM and GLCM algorithms to makes disease detection The feature extraction was performed by Gray Level Co-occurrence Matrix (GLCM). This technique detects the infected plants in diverse phases. This work adopts a texture-based approach to extract attributes. The disease is predicted using RF (Random Forest) and DT (Decision Tree) algorithms. The proposed work provides greater effectiveness than the conventional technique concerning accuracy, precision and recall for the detection of infected plants. The proposed model achieves accuracy of 96 percent which approx. 3 percent higher as compared to existing SVM classifier.

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