IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Voting Classification Method for the Plant Disease Detection

[1]Poonam Sahotra, [2]Baljinder Singh, [3]Gureshpal Singh

[1]Research Scholar, [2]Assistant Professor, [3]Assistant Professor

[1]Computer Science and Engineering, Sardar Beant Singh State University, Gurdaspur, Punjab, India

[2,3]Department of Information Technology, Sardar Beant Singh State University, Gurdaspur, Punjab, India

Abstract: The main difficulty faced in image processing is to detect the disease of plant. It has 4 phases in which infection of plant is detected such as to pre-process the image, segment it, extract the attributes and classify the disease. The initial stage aims at de-noising or maximizing the contrast of the input picture. The textural attributes are extracted using GLCM. The final stage exploits the classification algorithms for predicting the infected plants in accordance with the extracted attributes. The SVM, k-nearest neighbour, DT and RF are extensively employed algorithms. A number of algorithms are designed on the basis of these 4 stages while detecting the disease of plant. The performance of earlier designed algorithms is computed with regard to different parameters such as accuracy, recall, etc.

Index Terms **- Plant Disease, GLCM, SVM, KNN, Voting, K-means**

I. INTRODUCTION

All the operations executed on digital images focused on changing the photometric or structural features of the image have comprised in image processing scheme. Digital image processing has employed the digital computers to manipulate the images. This process has been widely implemented from the past few decades. The applications of this process are adopted in healthcare, education and remote sensing field, etc. Multimedia systems, the basis of the present world is depending upon the digital image processing. The regulation of this scheme is a very immense in which not only digital signal processing methods but also the schemes precise to images have included. An image is considered as f (x, y) that has x and y as two continuous variables [1]. The sampling and transforming of this image have done into a matrix of numbers so that it can be processed in digital manner. As limited precision is employed in expressing the numbers by the computer, the quantization of these numbers is required for representing them digitally. These limited precision numbers are manipulated in DIP. The issue related to protect the plant is directly dealt with the issues occurred due to the climate change and sustainable agriculture. Several researchers concluded that the change in climate results in modifying the stages and the scales of pathogen growth and changing the hot resistance due to which the variations on host-pathogen relations are found physiologically. The global rate of transmission of disease is simpler at present which causes more complexity in the situation. The new diseases are found in the regions at which there is no prior knowledge regarding those diseases and no local professional is available to deal with these infections[2]. The inexpert farmers make the deployment of pesticides which develops long-standing opposition to pathogens. As a result, their potential for retaliation is lessened. To detect the plant diseases accurately and at initial stage is a significant pillar of precision agriculture. The redundant wastage of financial and other resources are prevented to attain healthy productivity. For this, the issue related to the long-lasting pathogen resistance growth is tackled, and the poor impact of global warming is alleviated. In the varying environment, it becomes significant task to detect the diseases of plant properly in primary stage so that these diseases can be prevented [3]. Various techniques are implemented for detecting the infections occurred on plants. There are some diseases whose symptoms are not appeared and impact can be seen later on. In such circumstances, the major task is to analyze the disease in advance. But, most of the diseases illustrate the visual spectrum. The widely utilized technique among experts is to analyze the disease naked eyes so that the disease of plant can be detected[4]. The plant pathologist requires superior observational skills to identify the symptoms for diagnosing the infections in accurate manner. The symptoms of disease are varied on the plants due to which the diseases cannot be detected exactly. It becomes challenging for the inexpert farmers to detect the disease. The CAS is assisted in recognizing the disorders of plant on the basis of view. The visual symptoms are useful for agriculturist in the framing process and also for trained professionals as a validation system for diagnosing the disease. India is at first position all over the world with regard to contribute towards the farming. The economical development of India is increased with the progress in the agriculture field[5]. India has 210 million acres of farming land for the agriculture. The pulses, sunflower, Jowar, wheat, and groundnuts are the main yield of this country. CVS is a major technique which is widely adopted in agricultural applications. This application is effective to classify the fruits and recognize the food products using fruit processing, classify the grains, detect the weeds and carry out various tasks. The digital images are captured using digital camera and image processing techniques are utilized to process the images. These methods are implemented to extract the considerable attributes from those images [6]. Advancements in computer vision offer a chance to develop and improve the exercise of precision agricultural conservation and to expand the market for computer vision applications in the area of precision agriculture. Common DIP schemes including analyzing

the colour and thresholding are adopted for the purpose of detecting and classifying diseased plants. The commonly occurred diseases on plants are viral, fungal and bacterial diseases, the early and late scorch etc. The diseases of plants are detected on the basis of image processing using several stages in which image acquisition is performed, image is pre-processed, segmented, features are extracted, and image is classified [7]. Figure 1 represents the general process to detect the plant disease.

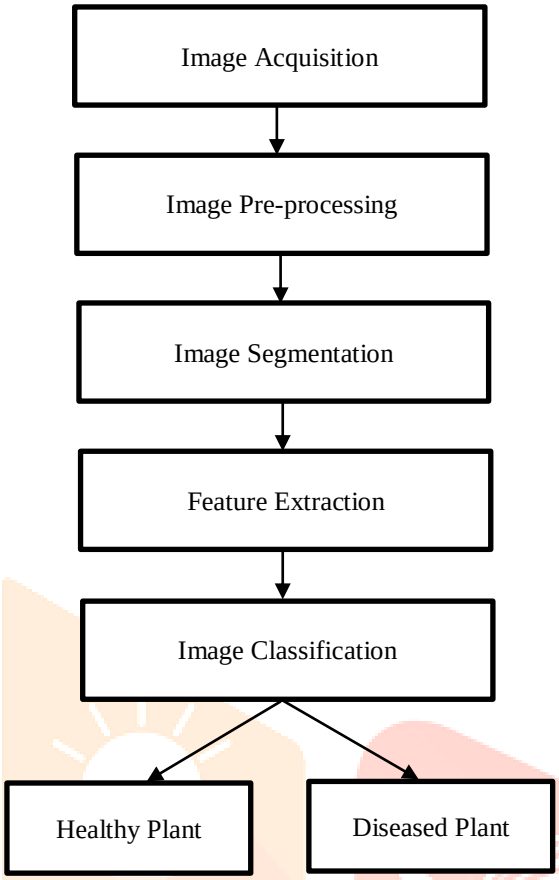

Figure 1: Plant Disease Detection based on Image Processing.

II. Literature Survey

Fatma Marzouf, et.al (2020) implemented an automated scheme on DL (Deep Learning) frameworks based on ANN (artificial neural network) for recognizing the illnesses happened in plants [8]. This scheme additionally utilized ConvNet alongside the ResNet to identify the plant illnesses at beginning stage. An expanded dataset was used in which pictures of unaffected and tainted leaves were included. This approach was equipped for arranging the pictures as sick or typical. Eventually, Anaconda 2019.10 was used for contrasting the proposed approach and others. The results portrayed that the proposed approach performed all the more really in correlation with the current model while recognizing the infections of plants.

Md. Arifur Rahman, et.al (2019) underlined on fostering a method to recognize the infections of plants [9]. An improved division strategy was presented by combining thresholding with the morphological functions. The more computing power was not needed in this procedure. The DNN (deep neural network) was executed for the classification. The Plant Village information base was used to assess the created strategy and the got accuracy was determined around 99.25%. in the time ahead, the feature vector size would be moderated and the accuracy would be expanded for improving the system formed.

Melike Sardogan, et.al (2018) proposed a methodology in view of ConvNet and LVQ algorithmic approaches to recognize and categorize the infection type in the leaves of tomato plants [10]. The qualities were extricated and the classification was completed naturally through ConvNet. The filtering techniques were utilized on three channels based on RGB constituents. The feature vector obtained from convolution part was used in LVQ (Learning Vector Quantization) for the network training. The results of trials exhibited that the proposed approach was versatile in identifying the 4 assorted sorts of tomato leaves infections.

R. Deepika Devi, et.al (2019) presented a basic and viable IoT (Internet of Things) empowered infection identification framework with the goal of distinguishing and classifying the bunchy top of banana and sigatoka disorders happened on plants grown in mountains [11]. The RF (Random Forest) and GLCM (Gray Level Co-event Matrix) were used in this framework. The RF scheme used utilizing GLCM attributes to classify the infection at the observing site and the plant pathologists dissected these traits to give measures. The accuracy gained from the presented framework was counted close to 100% while recognizing the infections of plants. The results got on acquired dataset showed that the presented RFC-GLCM approach was superior to several schemes.

Sammy V. Militante, et.al (2019) constructed a framework for identifying the infections happened on various plant types [12]. A dataset containing 35000 pictures of normal plant leaves and contaminated leaves was used for training the DL architecture. Utilizing this, the nonattendance or presence of illnesses in plants was distinguished and recognized. The devised framework was found 96.5% accurate in distinguishing the plant and obtained 100% accuracy in recognizing the assortment of plant and sort of illness happened in plants.

Umut Bariş Korkut, et.al (2018)introduced image processing and ML strategies for identifying the sicknesses of plants naturally [13]. A superior harvest quality and yield was essential for the discovery of plant illnesses precisely and on schedule. The expense of plant infections and wasteful medication use was lightened by diagnosing the sicknesses ahead of time. The assortment of leaf pictures of various plants was carried out and the transfer learning method was used for taking out the characteristics. The success ration of the introduced methodology was counted as 94%.

Hilman F. Pardede, et.al (2018) applied a non-supervised feature learning calculation with convolutional autoencoder to identify the plant infections [14]. The handmade qualities were not needed in this scheme as the network had the potential to learn the method for producing distinguishing properties. This cycle was completed in an unsupervised manner and labelling data was not fundamental. The result of the autoencoder was inputted to SVM-based classifiers to identify the plant infections robotically. The presented proved superior when contrasted with conventional autoencoder with more secret layers.

Abdul Hafiz Bin Abdul Wahab, et.al (2019) suggested an IPT (image processing Technology) in view of computer vision for recognizing the infections on Chili plant with the assistance of its leaves' pictures [15]. The withdrawn of properties was done from processed pictures. These pictures were grouped into classes utilizing the separated traits. Different characteristics and kernel functions were carried out for measuring particularly Support Vector Machine (SVM) classifiers. The results demonstrated that the prescribed scheme could classify the plant as sick and sound plants.

Jibrael Jos, et.al (2020) intended a new pseudo colour region attribute for anAI system for locating spots in tomato plants [16]. An algorithm based on HSV (hue, saturation, lightness) was deployed for recognizing the plant properties. The region properties were utilized and an improved and effectual feature vector was generated to locate the disorder. The underlying AI (Artificial Intelligence) framework was enhanced using intended attributes. A scalable data structure was utilized in this algorithm for storing store regions counts to achieve which a hash function was implemented. The intended approach had an extensive applicability in the AI realm.

III. Research Methodology

Plant disease detection is the strategy concerned with the discovery of the unhealthy part of the input leaf image of the plant. The scheme initiated in this work for detecting plant diseases, consists of many steps. All these steps have been defined below: -

1. **Pre-processing**: - This is the primary phase for recognizing infections from the leaves of the plants. This progression acknowledges a picture dataset as info. The pictures in the dataset are gathered from the dependable information source. This work utilizes straightforwardly existing plant village dataset. The plant town is the authority site that gives data about plant and the infection type. The gathered dataset comprises pictures of the potato leaves. The in general dataset is expanded into three segments. The primary area incorporates solid leaves, next one incorporates leaves the pictures of early blight sickness and the last segment incorporates pictures showing late blight infection. The gathered info pictures are changed over to dim scale to make the ensuing processing simple.

2. Segmentation: - Segmentation process is concerned with branching a digitized into a number of parts. The chef idea of segmentation is to recognize objects or extract information from images. This step makes image analysis process easy. The region of interests and bounding line of pictures are located using image segmentation approach. A label is assigned to every pixel within an image. Every pixel with same labelling has different features. This work applies K-means clustering for segmenting the images of plant's leaves. The main impression of K-means is to collect the samples into different clusters based on the distance. The closer the two points are, the more compact and independent clusters they will receive as the closing target. The best value of k which used as input is 3. The image is segmented in accordance to the value of K. Then, the required part is selected from the disease part of the input leaf.

3. Feature Extraction- The consequence of picture segmentation is the locale of interest (RoI). The main issue of feature extraction step is to separate features from the district of interest. Hence, feature extraction is the most common way of extricating a bunch of values named features from a picture. The features contain a ton of data about the image for additional processing. The discovery of plant illnesses relies upon various features including shading, surface, morphological and coherence vectorvector. There are different strategies for extricating features from the picture. An infection recognition model can be planned utilizing these features. The most widely recognized feature extraction techniques are GLCM, shading co-event strategy, spatialgrey-level dependence matrix, and histogram-specific feature extraction. The GLCM technique is a statistical methodology for characterizing texture attributes.

3. Classification of Data: - The development of a classifier model is the last stage in the location of plant illnesses. This interaction partitions the entire dataset into subsets of training and testing. The extent of training subset will be more than the testing subset. The carried out classifier model accepts input as training and test set. The division of complete dataset is done in the proportion of 60:40. The 60% represents training set and 40 percent signifies test set for the infection identification. KNN is occurrence-based classifier model. This classifier represents obscure examples by interfacing obscure to known through partition or such comparability capacities. The it is delayed to learn interaction of this classifier. As such, this model can be prepared and tried simultaneously. This algorithm look through K closest focuses and apportions class of greater part to the obscure occasion. It is a simple to-utilize algorithm. In this algorithm, classification depends upon greater part casting a ballot and its k neighbour. KNN classifier is generally reasonable for both classification as well as relapse undertakings. The RF method is basic machine it is quick and adaptable to learn algorithm that. This algorithm is combination of tree predictors. The OK results are gained from this algorithm pretty much without fail. Its presentation isn't effortlessly improved. Different sorts of information are handled utilizing this algorithm like mathematical, binary and nominal. RF classifier is built utilizing various trees. These trees are assembled for producing proper outcomes with high accuracy. The RF algorithm is appropriate for classification as well as regression. Classification is an essential undertaking in AI. The hyper boundaries that are like DT or bagging classifier are included in it. The random trees overlap in this algorithm is the reality of RF and can be analyzed without any problem. For example, seven random trees give data of some factor. Four of these trees concur and staying three conflicts. The AI model is developed by the greater part casting a voting. In the RF, the outcomes with better accuracy are acquired from the irregular subset of features in the datasets. The result of both RF and KNN takes is inputted to the voting classifier which can cast a vote between two classifiers and yields highly accurate prediction outcomes.

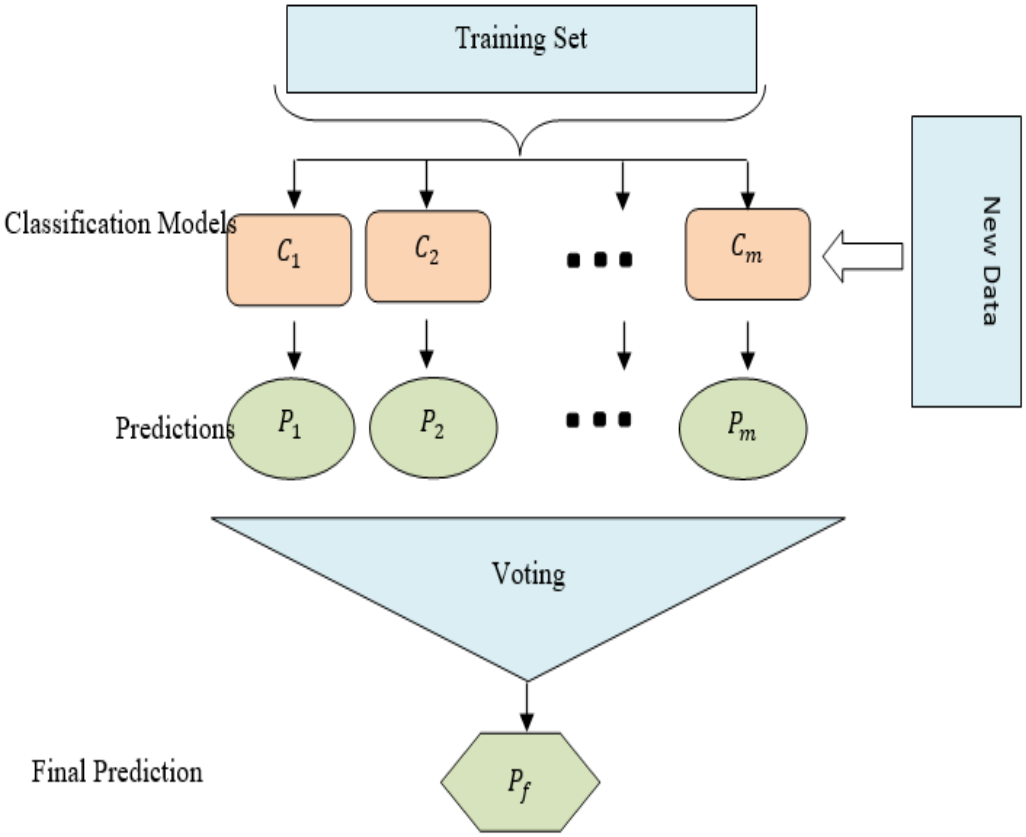

Figure 2: Proposed Model

IV. Results and Discussion

The plant village dataset is implemented to conduct the tests on the suggested system. The plant village is the open plate in which information related to the plants and disorders is obtained. Each photo is tagged with its disease type.



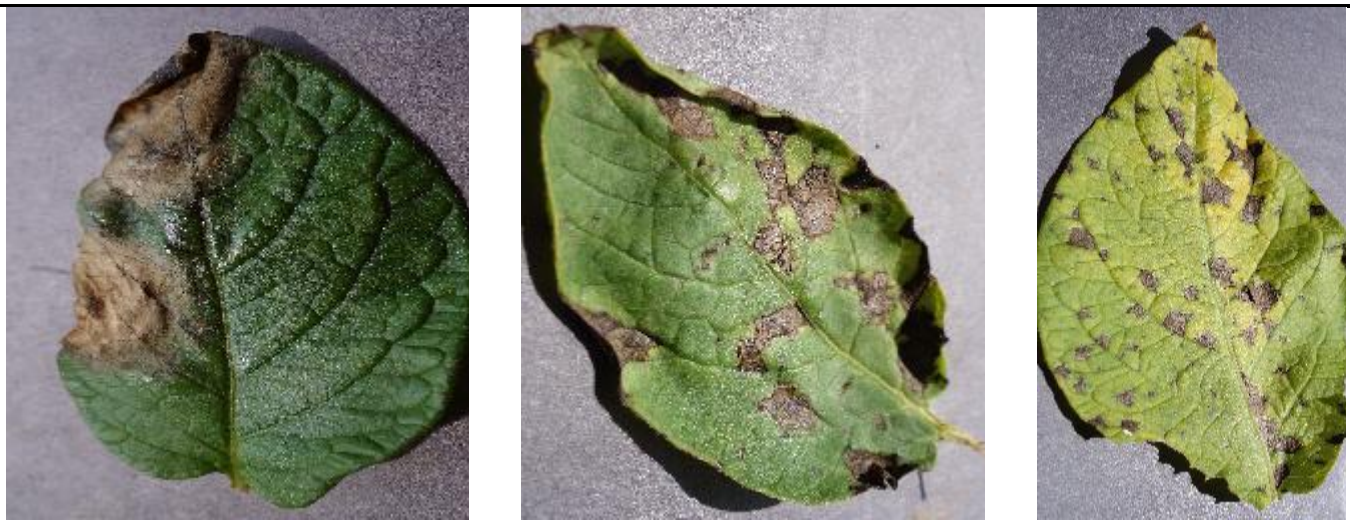

Figure 3: Input images

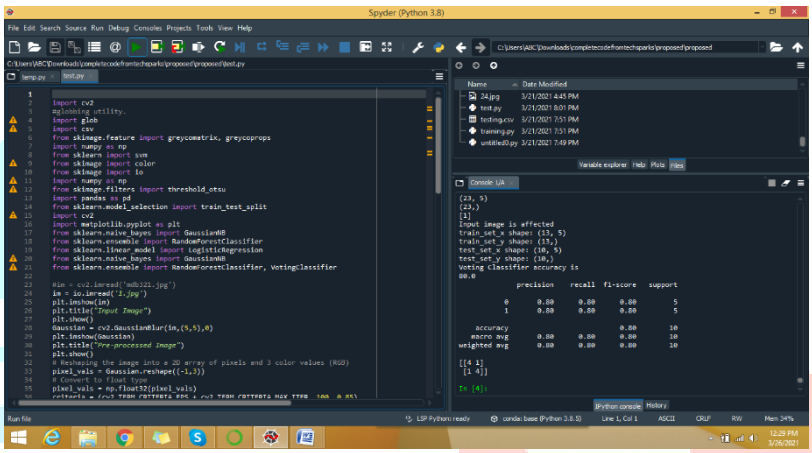

Figure 4 Implement Voting Classifier

Figure 4 features the prediction of plant diseases with voting classifier.

Table 1 Comparing Existing and Proposed Algorithms w.r.t Accuracy

ACCURACY COMPARISON		
IMAGE	SVM (EXISTING ALGORITHM)	VOTING CLASSIFIER (PROPOSED ALGORITHM)
IMAGE 1	84	95
IMAGE 2	81	92
IMAGE 3	84	95
IMAGE 4	81	92
IMAGE 5	80	91

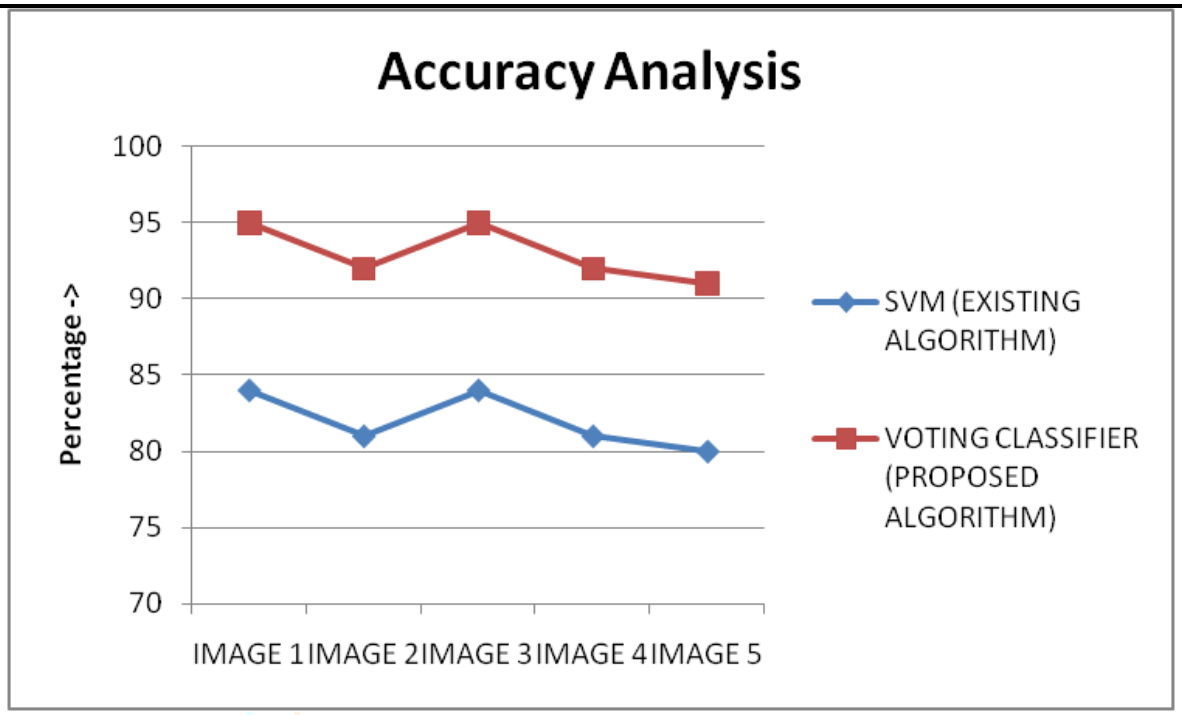

Figure. 5 Accuracy Analysis

Bigure 5 displays the accuracy-based comparison between existing and proposed algorithm. Using the Voting Classifier accuracy of Proposed Algorithm is increased.

Table 2 Precision Comparison of Existing and Proposed Algorithms

PRECISION COMPARISION		
IMAGE	**SVM (EXISTINGALGORITHM)**	**VOTING CLASSIFIER (PROPOSED ALGORITHM)**
IMAGE 1	**73**	**76**
IMAGE 2	**78**	**82**
IMAGE 3	**73**	**77**
IMAGE 4	**76**	**81**
IMAGE 5	**79**	**82**

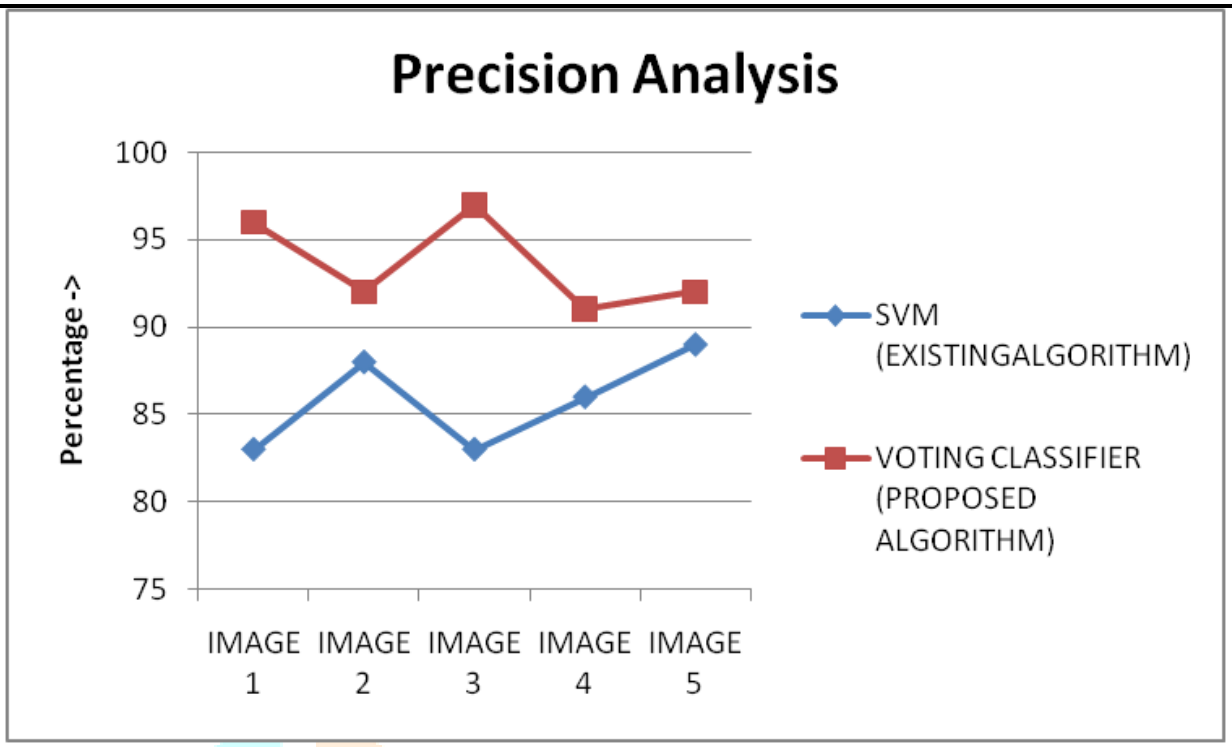

Figure 6 Precision Analysis

Fig. 6 Shows the Precision Comparison of SVM and Voting Algorithms. Using the Voting Algorithm, precision increases.

Table 3 Recall Comparison of Existing and Proposed Algorithms

RECALL COMPARISION		
IMAGE	**SVM (EXISTING ALGORITHM)**	**VOTING CLASSIFIER (PROPOSED ALGORITHM)**
IMAGE 1	88	92
IMAGE 2	83	98
IMAGE 3	89	92
IMAGE 4	82	97

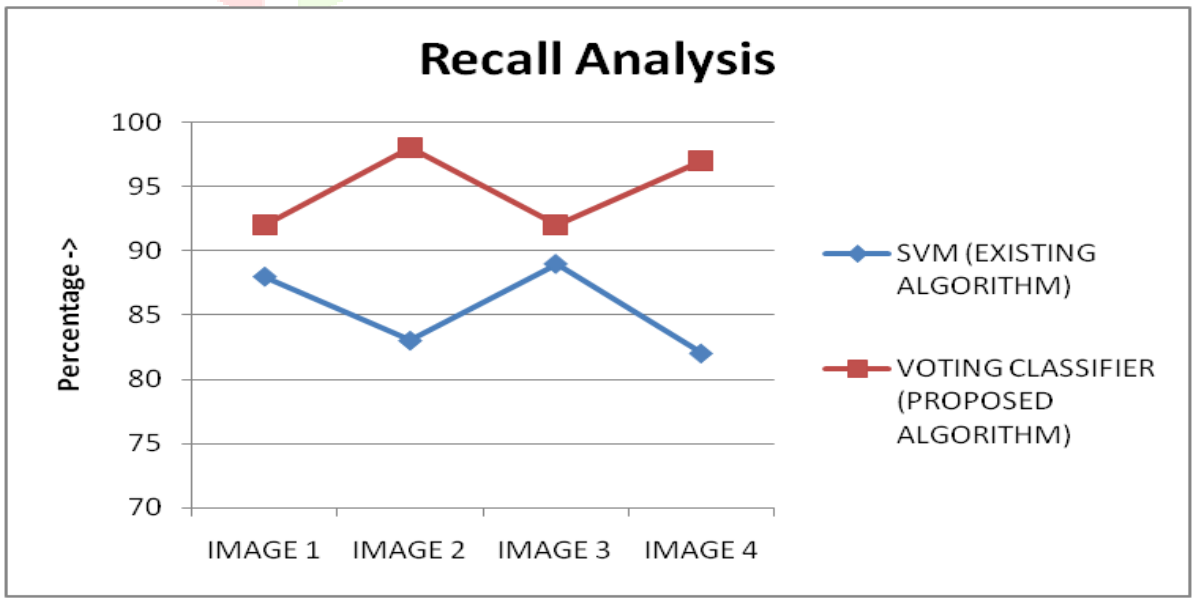

Figure. 7 Recall Analysis

Fig.7 Shows the Recall Comparison of SVM and Voting Algorithms. Using the Voting Algorithm Recall of Proposed Algorithm is increased.

Conclusion

This work summarized that the diseases occurred on the plants are detected successfully from the leaves of plants. The techniques, utilized to detect the diseases of plants, consist of four steps such as to pre-process an image, segment an image, extract the features and classify an image. The use of microscopes was quite popular in old time to detect the infected plant. However, every leaf of plant can't be inspected individually in real-time. The traditional algorithms make the implementation of Grey Level Co-occurrence Matrix to extract the textural attributes. This work employs KMC model for segmenting the images. The voting classifier is adopted in the introduced approach for classifying the data into diverse classes. The introduced approach is quantified with regard to3parameters. The obtained outcomes based on the comparison of introduced approach with the traditional algorithm, depicts that the accuracy is augmented significantly and mitigated the FPR (False Positive Rate) up to10%.

References

[1] S. Muthuselvi and P. Prabhu, "Digital Image Processing Techniques: A Survey", 2016, International Multidisciplinary Research Journal

[2] Kavita, Ritika Saroha, Rajani Bala, Ms. Sunita Siwach, "Review paper on Overview of Image Processing and Image Segmentation", 2013, International Journal of Research in Computer Applications and Robotics

[3] Kulkarni, P.M., Naik, A.N., Bhadvankar, "A.P., Review Paper on Image Processing Techniques", 2015, International Journal for Scientific Research & Development, volume 3, issue 10

[4] Basavaprasad B, Ravi M, "A Study on the Importance of Image Processing and Its Applications", 2014, International Journal of Research in Engineering and Technology (IJERT), Volume: 03, Issue: 03

[5] Shubhra Mathur, Rajendra Purohit, Ashutosh Vyas, "A Review on basics of Digital Image Processing", 2016, International Journal of Engineering Research & Technology (IJERT), Volume 4, Issue 12

[6] Mr.V Suresh, D Gopinath, M Hemavarthini, K Jayanthan, Mohana Krishnan, "Plant Disease Detection using Image Processing", 2020, International Journal of Engineering Research & Technology (IJERT), Vol. 9, Issue 03

[7] Santhosh Kumar.S, B.K.Raghavendra, "Diseases Detection of Various Plant Leaf Using Image Processing Techniques: A Review", 2019, 5th International Conference on Advanced Computing & Communication Systems (ICACCS)

[8] Fatma Marzougui, Mohamed Elleuch, MonjiKherallah, "A Deep CNN Approach for Plant Disease Detection", 2020, 21st International Arab Conference on Information Technology (ACIT)

[9] Md. Arifur Rahman, Md. Mukitul Islam, G M Shahir Mahdee, Md. WasiUl Kabir, "Improved Segmentation Approach for Plant Disease Detection", 2019, 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT)

[10] MelikeSardogan, AdemTuncer, YunusOzen, "Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm", 2018, 3rd International Conference on Computer Science and Engineering (UBMK)

[11] R. Deepika Devi, S. Aasha Nandhini, R. Hemalatha, S. Radha, "IoT Enabled Efficient Detection and Classification of Plant Diseases for Agricultural Applications", 2019, International Conference on Wireless Communications Signal Processing and Networking (WiSPNET)

[12] Sammy V. Militante, Bobby D. Gerardo, Nanette V. Dionisio, "Plant Leaf Detection and Disease Recognition using Deep Learning", 2019, IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE)

[13] UmutBarişKorkut, ÖmerBerkeGöktürk, OktayYildiz, "Detection of plant diseases by machine learning", 2018, 26th Signal Processing and Communications Applications Conference (SIU)

[14] Hilman F. Pardede, EndangSuryawati, Rika Sustika, Vicky Zilvan, "Unsupervised Convolutional Autoencoder-Based Feature Learning for Automatic Detection of Plant Diseases", 2018, International Conference on Computer, Control, Informatics and its Applications (IC3INA)

[15] Abdul Hafiz Bin Abdul Wahab, Rahimi Zahari, Tiong Hoo Lim, "Detecting diseases in Chilli Plants Using K-Means Segmented Support Vector Machine", 2019, 3rd International Conference on Imaging, Signal Processing and Communication (ICISPC)

[16] Jibrael Jos, K A Venkatesh, "Pseudo Color Region Features for Plant Disease Detection", 2020, IEEE International Conference for Innovation in Technology (INOCON)