RESEARCH ARTICLE OPEN ACCESS

Plant Diseases Detection Rate Improvement with Enhanced SVD Technique

Amit Pandey*, Amrit Singh**
**(Centre for Development of Advance Computing, Mohali*
*** (Centre for Development of Advance Computing, Mohali*
Corresponding Author: Amit Pandey

ABSTRACT
In modern era, agriculture plays one of the most essential role for growing habitat. Flora provides major source of energy and also helps to reduce global warming. Agricultural plants face various diseases in different stages of its life. Remote sensing techniques are used to explore multi and hyper spectral pictures. It employs digital image processing to monitor health and diseases related with plants. For general production practice, observation through naked eye gives severity and subjective results. Higher disease detection accuracy can be achieved efficiently through advance digital image processing techniques. In the existing work, back propagation (BP) and principal component analysis (PCA) algorithms were usually used for plant diseases detection. These are neural network based learning and supervision algorithms. Much higher accuracy can be achieved using Single Value Decomposition (SVD) algorithms. This paper represents implementation of SVD along with BP and PCA for disease detection. It also shows that better accuracy is achieved with enhanced SVD in contrast to these three algorithms individually.
Keywords: Back Propagation; Principle Component Analysis; SVD; Plant diseases; Pattern recognition

---

Date of Submission: 13-09-2017 Date of acceptance: 09-09-2017

I. INTRODUCTION

Image Processing, a technique to convert an image into its digital form and to get an enhanced image and extract useful information from it by performing some operations. Image processing is processing of a 2D picture by a computing device [1].

1.1 Plant Diseases in Image Processing:

There are various plants diseases that affect plants and cause social, ecological and economical losses. So it becomes crucial to detect and diagnose accurately about plant diseases.

Several techniques are available to detect pathologies of plants. In initial stage some diseases don't have any human eye visible symptom but it may appear when it is too late and can't cure. In such cases, complicated analysis is necessary, which is usually performed by means of powerful microscopic analysis [3]. There exist many cases, in which the symptoms are not visible to human eye but can only be detected in particular range of electromagnetic spectrum. It is very difficult to detect those diseases for remote areas. One of the popular methods for remote detection of diseases is to use Remote Sensing (RS) Technology. Remote Sensing techniques often utilize digital image processing for such detection. Figure 1 shows basic steps to implement image processing in plant disease. Initially Input image is pre-processed after acquisition. Already defined or artificially achieved neural knowledge base is used in segmentation process. Segmented image is the represented based on some set of rules in knowledge base. Then with the help of some specific algorithms or calculations, the image is classified and shows as results.

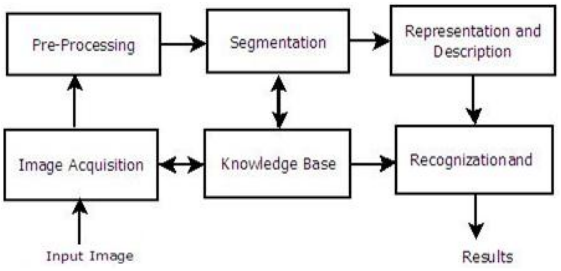

Fig. 1 Basic Steps to Detect Plant Disease

1.2 Neural Networks

Artificial neural network (ANN) is interconnection of artificial neurons. ANN is used to solve intelligence problems or to gain understanding of biological neuron without creating any artificial model. Biological neural network is interconnection of biological neurons that are connected or functionally related in nervous system. ANN has been motivated by the architect of human brain. It is faster than digital computer that exit in today's world [8].

II. LITERATURE REVIEW

Savita N et al. [4] presented a review on various classification methods which can be utilized for plant leaf diseases categorization. It dealt with the classification of every pattern in any of the unique classes. Leaves were classified on the basis of its various morphological characteristics. There have been a numerous techniques for classification like artificial neural network, k-Nearest Neighbor Classifier, Genetic Algorithm (GA), Probabilistic Neural Network (PNN), PCA and Fuzzy logic. Selection of classification technique has been a difficult job as the result quality can differ for the dissimilar input data. The k-nearest-neighbor technique is one of the easiest algorithms for the prediction of class of the testing example. A major drawback of the k-NN technique is the complexity in time for making predictions. In addition, neural networks even tolerated the inputs that were noisy. It was difficult to understand the framework of algorithm in the neural network. It was found that SVM was competitive with the finest existing machine learning algorithms for the classification of high-dimensional sets of data. The computational complexity was minimized to about quadratic optimization problems. The flaw of SVM is that it is not easy to decide the optimal parameters at the time when training data was not linearly distinguishable.

Prof. Sanjay B. et al. [5] introduced a technique for plant disease detection and its prevention. Many plant diseases are caused due to microbes, viruses as well as fungus. Fungus was recognized first and foremost based on their morphology along with emphasis laid on the structure of reproduction. Bacteria are painstaking much more prehistoric as compared to fungi and they usually possess simple life cycles. The proposed scheme consisted of four major steps: In first step color transformation framework for the contribution of RGB image was produced and it was then transformed to the Hue Saturation Intensity (HSI) for the purpose of color generation as well as color descriptor. After that green pixels were cloaked and discarded with the help of a particular threshold value. In the next step the image was segmented and only the important segments were retrieved. At last the texture statistic was computed with the help of Spatial Grey-level Dependence matrices (SGDM) and the presence of a disease on the leaf is recognized.

Mr. Pramod et al. [6] described a software solution in order to automatically detect and classify plant diseases using Image Processing. This paper addresses the difficulty with the objective of emerging image processing algorithms that can identify problems in crops from pictures, based on color, texture and shape to automatically detect diseases or other environments that might affect crops and give the fast and accurate solutions to the farmer with the help of Short Message Service (SMS). The plan and realization of these technologies will greatly aid in selective chemical application, dropping costs and thus leading to enhanced productivity, as well as improved produce.

Anand H. Kulkarni et al. [7] proposed a technique to detect plant diseases at an early stage with much accuracy with the help of various image processing methods and ANN. India is an agrarian country and farmers faced many difficult due to plant diseases. It is very difficult to detect disease with naked eye. The first step included capturing of images. Using Gabor filter image was filtered and segmented. Then color features and texture were retrieved from the resulting segmented region. The results of experiment showed that the classification performance achieved with ANN taking feature set was better as it provided an accuracy of approximately 91%. In the proposed technique the area of recognition of plant diseases has been developed Developing better classification schemes and accurate features was very significant to operate the system in a real time environment. Hence the proposed method got better results as well as good recognition rate of 91%. The ANN based classifier was adopted as it used the combination of various texture and color features for recognizing and classifying numerous diseases in plants.

Haiguang Wang et al. [9] proposed a technique to recognize the disease of two plants. This investigation has been done on two grapes plants and two wheat plants to improve accuracy using image processing techniques. After image preprocessing together with image compression, image cropping and image denoising, the disease images were segmented using K means algorithm. 4 shape features, 25 texture features and 21 color features were retrieved from the leaf images. The classifier utilized was Back propagation networks for identifying diseases in grapes and wheat. The results concluded that recognition of the diseases was efficiently achieved with the help of BP networks. While the magnitude of the feature data were not reduced by using principal component analysis the optimal results of recognition for diseases in grapes were retrieved as fitting and prediction accuracy were 100%. For wheat diseases fitting and prediction accuracy were also100%. While the dimensions of the feature data were reduced by using PCA, the optimal recognition result for grape diseases was obtained as the fitting and prediction accuracy was 97.14%, and that for wheat diseases was obtained as both prediction and fitting accuracy were 100%

III. PROPOSED METHODOLOGY

Pattern recognition through neural employs the neural computing paradigm that has emerged with neural networks. BPA and PCA have less

accuracy as compare to SVD. But when implemented with SVD, these algorithms become very efficient to plant diseases detection. Figure 2 shows the work methodology used in enhanced SVD detection. Training data set and image train declaration is given to find points or descriptors. For this purpose initially image is converted to the pyramid shape then scale space, feature point screening and detection has been done. After then feature point filtration along with feature vector descriptor has been determined. Filtering process is done to determine location of some not clear points. When direction of feature points which depends on angle has been completely done then comparison between right image and left image is done.

Threshold T (range 0.3 to 0.7) is used to create feature matching and plot histogram. It take the ratio of first nearest distance to second nearest distance and would be less than this threshold, then only it is a match and save that index. After matching image masking is done for healthy and diseased image. A mask image is simply an image where some of the pixel values id zero or some has non-zero value. The whole work has been implemented on MATLAB which is an efficient simulation tool.

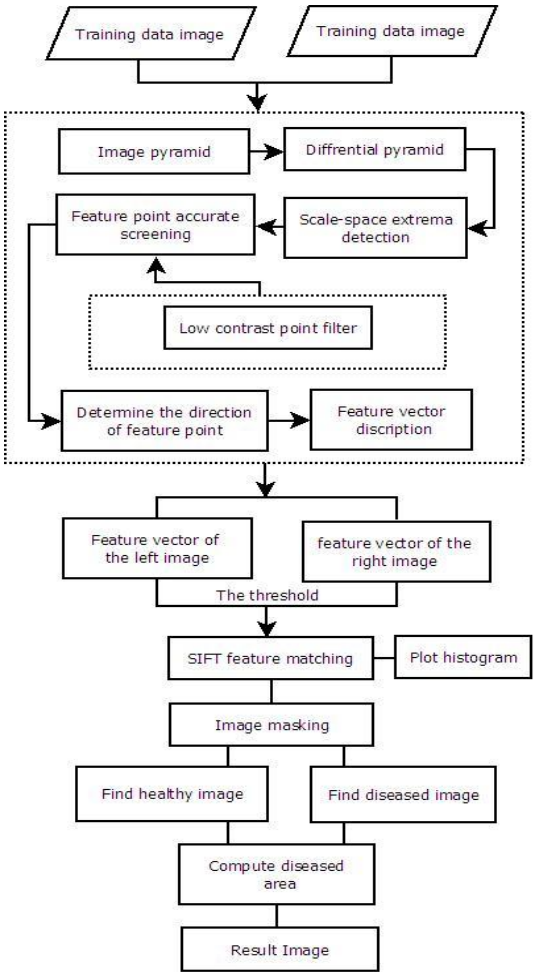

Fig. 2. Work Methodology

IV. IMAGE PROCESSING AND ANALYSIS

In this paper, Grape and Wheat diseases are used for image recognition with help of BP neural networks approach. Two types of accuracy: Predication accuracy and Fitting accuracy has been analyzed.

The set is taken which contain multiple pre defined images named as trained dataset. The second set is called train dataset contains some images. The images of the train dataset are used to match with the images of the trained dataset for the feature matching. Dataset is trained using BP and PCA. These data sets are used to define characteristics as segmentation for physical parameter, color, intensity, density, spots and pattern classification of images for various steps. As shown in figure 3, leaf whose features are matched will be extracted using SIFT algorithm.

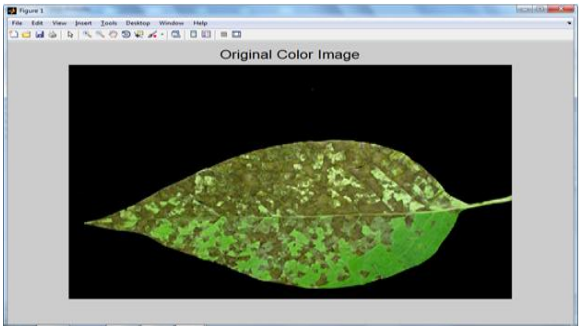

Fig. 3. Infected Plant Leaf

As shown in figure 4, the black background from the leaf will be extracted to know that how much portion of the leaf will be cut.

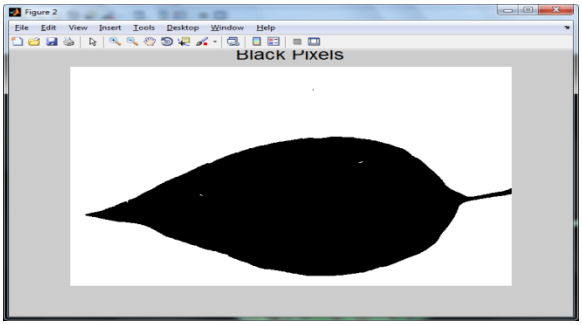

Fig. 4. Infected Plant Leaf

In the figure 5, leaf whose features are matched will be extracted image. Infected image is analyzed as per trained dataset. The HUE value of infected leaf will be calculated which helps to increase detected accuracy.

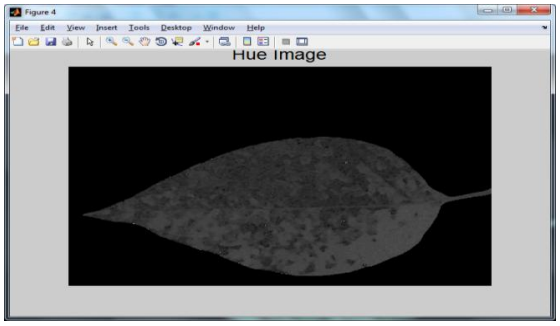

Fig. 5. Infected Plant Leaf

As shown in figure 6, the black background from the leaf will be extracted to know that how much portion of the leaf will be cut. The saturation value of infected leaf was calculated which helps to increase detected accuracy

.

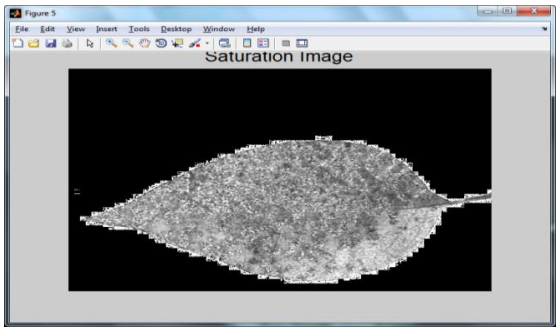

Fig. 6. Saturation Image

As the figure 7 shows, the enhanced SVM algorithm was applied which will separate the uninfected portion of the leaf.

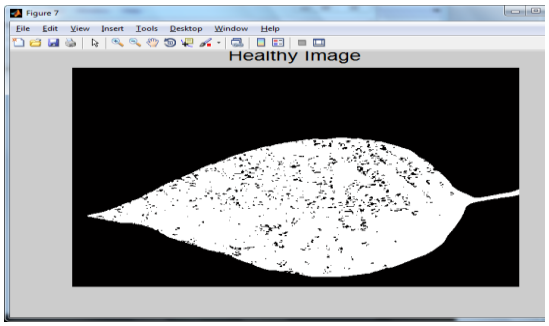

Fig. 7. Healthy Image

As shown in figure 8, the enhanced SVM algorithm was applied which will separate the uninfected portion of the leaf. The enhanced SVM algorithm will separate the infected part of the leaf. The SVM shows the portion that how much part is infected which is 5.54 %.

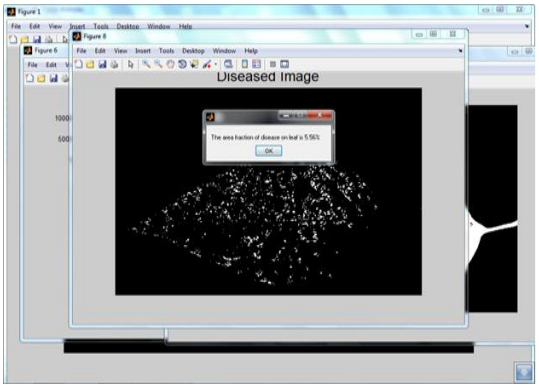

Fig. 8. Infected Plant Leaf

V. EXPERIMENTAL RESULTS

With the help of given data set some results had been achieved. These results had been analyzed and compared with previous results. Accuracy comparison chart between SVM and Enhanced SVM is shown in Table 1. It shows that better accuracy can be achieved with proposed enhanced SVM

Table 1. Comparison On Accuracy

Test Images	Accuracy using SVM (%)	Accuracy using Enhanced SVM (%)
T1	69	76
T2	72	79
T3	65	69
T4	68	70
T5	79	82
T6	82	85
T7	79.5	80.2
T8	66	67

Table 2 below depicts the comparison based on the time taken identifying the diseased area. As a result Enhanced SVM shows less time consumption.

Table 2. Comparison on Time

Test Images	Time using SVM (sec)	Time using Enhanced SVM (sec)
T1	2.3	1.9
T2	2.5	1.8
T3	2.2	1.7
T4	2.8	2
T5	2.9	2.5
T6	1.9	1.5
T7	2.95	2.54
T8	2.54	2.43

These results conclude that the proposed technique is more accurate and time efficient. It also

helps to calculate the area affected due to disease as shown in Table 3. Previous available technique cannot be used to calculate area of diseases

Table 3. Diseases Area Calculation

Test Images	Area of disease using SVM	Area of disease using Enhanced SVM (%)
T1	Do calculate	11.5
T2	-	12.5
T3	-	10.5
T4	-	9.11
T5	-	8.5
T6	-	11.65
T7	-	13.5
T8	-	13.5

The Figure 9 shows graphical representation of accuracy using SVM and enhanced SVM technique.

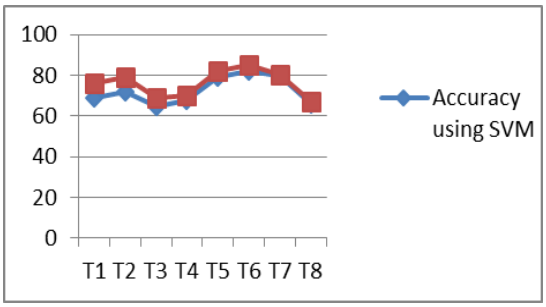

Fig. 9. Comparison based on accuracy

Decrease in disease detection time is shown in figure 10. It represents time using the Enhanced SVM technique with comparison to previous available SVM technique.

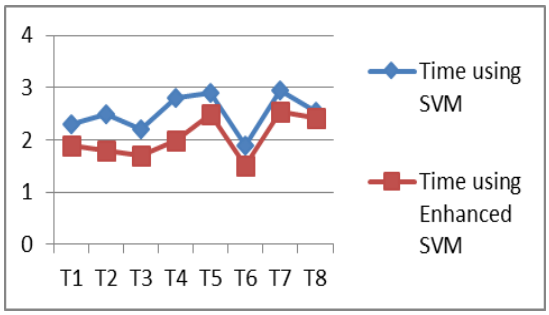

Fig. 10. Comparison based on time

VI. CONCLUSION

In this paper, three features: color, texture, shape and their combination was used to detect image using BP. Image recognition using BP network has been also conducted based on dimension reduced data obtained by PCA. PCA is used to reduce the dimensions of feature data of extracted images. By applying BP and PCA method, plant diseases can be identified at the initial stage itself and control can be obtained. The results obtained from the experiments are good and satisfactory. To enhance the results further more enhanced SVM technique is also implemented along with these. With this realization, approx 22% better results (less time consumption) with respect to time taken for image detection can be achieved and approx 4% better accuracy (approx average 76%) can be achieved. Enhanced SVM also enables us to calculate area under diseases which make proposed methodology significantly efficient. In future, DCT-DWT algorithms can be applied with enhanced SVD to improve its accuracy further more.

REFERENCES

[1]. Jayme Garcia Arnal Barbedo, "Digital image processing techniques for detecting, quantifying and classifying plant diseases", Springer Plus 2013

[2]. Dheeb Al Bashish, Malik Braik & Sulieman Bani Ahmad, "Detection and classification of leaf diseases using K-means-based segmentation and neural networks based classification", Information Technology Journal, Vol. 10, Issue 2, pp.267-275, 2011.

[3]. Smita Naikwadi, Niket Amoda, "Advances in Image processing for detection of plant disease", International Journal of Application or Innovation in Engineering & Management, volume 2 issue 11, 2013

[4]. Savita N. Ghaiwat & Parul Arora "Detection and Classification of Plant Leaf Diseases Using Image processing Techniques: A Review", International Journal of Recent Advances in Engineering and Technology, Vol. 2, Issues 3, 2014.

[5]. Sanjay B. Dhaygude & Mr. Nitin P. Kumbhar, "Agricultural plant Leaf Disease Detection Using Image Processing" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 1, Issue 2 , pp. 599-602, 2013.

[6]. Mr. Pramod S. & landge et.al , "Automatic Detection and Classification of Plant Disease through Image Processing", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue 7, 2013.

[7]. Anand H. Kulkarni & Ashwin Patil R. K, "Applying image processing technique to detect plant diseases", International Journal of Modern Engineering Research (IJMER), Vol.2, Issue 5, pp. 3661-3664, 2012.

[8]. Piyush Chaudhary, Anand K. Chaudhari, Dr. A. N. Cheeranand & Sharda Godara

"Color Transform Based Approach for Disease Spot Detection on Plant Leaf", International Journal of Computer Science and Telecommunications, Vol. 3, Issue 6, pp.65-69, 2012.

[9]. Haiguang Wang, Guanlin Li, Zhanhong Ma & Xiaolong Li, "Image Recognition of Plant Diseases Based on Back propagation Networks", IEEE 5th International Congress on Image and Signal Processing (CISP), pp. 894-900, 2012.

[10]. K. R.Gokulakrishnan & Kapilya, "Detecting the Plant Diseases and Issues by Image Processing Technique and Broadcasting" International Journal of Science and Research (IJSR), Vol. 3, Issue 5, 2014.

International Journal of Engineering Research and Applications (IJERA) is **UGC approved** Journal with Sl. No. 4525, Journal no. 47088. Indexed in Cross Ref, Index Copernicus (ICV 80.82), NASA, Ads, Researcher Id Thomson Reuters, DOAJ.

Amit Pandey. "Plant Diseases Detection Rate Improvement with Enhanced SVD Technique." International Journal of Engineering Research and Applications (IJERA) , vol. 7, no. 9, 2017, pp. 15–20.