# WHEAT DISEASE DETECTION USING SVM CLASSIFIER

Er.Varinderjit Kaur , Dr.Ashish Oberoi
Student Deptt. Computer Science Engg, Prof.& Head, Deptt of C.S.E
R.I.M.T University ,Mandi Gobindgarh
Punjab,India

**Abstract**

There are many types of diseases which are present in plants. To detect these diseases pattern are required to recognize them . There are many types of pattern recognition algorithm which gives detection of disease with accuracy. Image processing Techniques for Wheat Disease Detection most important research areas in computer science for last few decades. Based on literature review ,We conclude that the engineering and research community is doing lot of work on Wheat disease detection, but the application of this techniques to solve practical agricultural This paper presents a survey on SVM Classifier method that use digital image processing techniques to detect, quantify and classify plant diseases from digital images in the visible spectrum.

**Index Terms: PCA, B.P,SVD ,2-D,3-Dimages**

**I. Introduction** Agriculture has become much more than simply a means to feed ever growing populations. Plants have become an important source of energy, and are a fundamental piece in the puzzle to solve the problem of global warming. There are several diseases that affect plants with the potential to cause devastating economical, social and ecological losses. In this context, diagnosing diseases in an accurate and timely way is of the utmost importance.

There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of remote sensing techniques that explore multi and hyperspectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals. However, due to their many peculiarities and to the extent of the literature on the subject, they will not be treated in this paper. A large amount of information on the subject can be found in the papers by Bock et al. (2010), Mahlein et al. (2012) and Sankaran et al. (2010).

Most diseases, however, generate some kind of manifestation in the visible spectrum. In the vast majority of the cases, the diagnosis, or at least a first guess about the disease, is performed visually by humans. Trained raters may be efficient in recognizing and quantifying diseases, however they have associated some disadvantages that may harm the efforts in many cases. Bock et al. (2010) list some of those disadvantages:

- Raters may tire and lose concentration, thus decreasing their accuracy.
- There can be substantial inter- and intra-rater variability (subjectivity).
- There is a need to develop standard area diagrams to aide assessment.
- Training may need to be repeated to maintain quality. Raters are expensive.

- Visual rating can be destructive if samples are collected in the field for assessment later in the laboratory.
- Raters are prone to various illusions (for example, lesion number/size and area infected).

Besides those disadvantages, it is important to consider that some crops may extend for extremely large areas, making monitoring a challenging task.

Depending on the application, many of those problems may be solved, or at least reduced, by the use of digital images combined with some kind of image processing and, in some cases, pattern recognition and automatic classification tools. Many systems have been proposed in the last three decades, and this paper tries to organize and present those in a meaningful and useful way, as will be seen in the next section. Some critical remarks about the directions taken by the researches on this subject are presented in the concluding section.

**Types Of Disease** There are varieties of disease spots which tend to resemble each other and can easily be confused with one another by inexperienced people. Misunderstanding one spot for another can be quite catastrophic as application of the wrong fungicide will result in loss of money without the plant being treated and allowing more time for the disease to spread further. 1) Red Rot: The disease first appears as red bright lesions on mid rib of leaves and shows itself as drooping and changing of color of upper leaves. Withering of the leaves proceed downwards. Usually third or the fourth leaf from the top is affected and shows drying at the tip. The pith becomes red and later on brown.

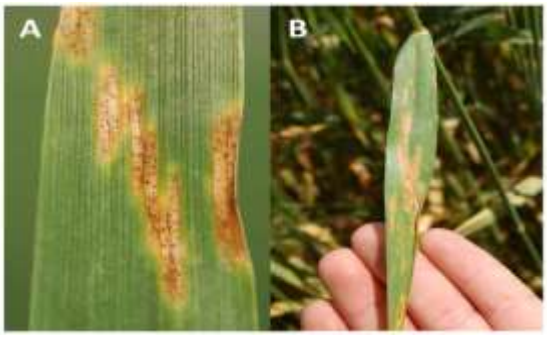



Fig 1.1 Red Rot Fig 1.2 Leaf Spot

2) Leaf Spot: The disease may be characterized itself on leaves as small lesions, which gradually enlarge along mid rib and assure dark red to brown color. In severe infection, the leaves become dry affecting photosynthesis. 3) Sugarcane Mosaic Virus: Mottling of young crown leaves showing a definite pattern of alternating dark and light green colored patches of varying size and run parallel to the midrib of leaf.

Fig1.3 Virus effect on wheat leaf Fig1.4 Brown Spot

4) Yellow Spot: There exist two types of Yellow Spot. The first type of spot is yellow in color. However, in certain varieties of sugarcane with red stalks, the spots appear as red. Despite the color, both types have the

same physical characteristics. They are irregular in shape and dimension. They can vary from minute dots to spots attaining 1 cm in diameter. 5) Brown Spot: Brown spot causes reddish-brown to dark-brown spots on sugarcane leaves. The spots are oval in shape, often surrounded by a yellow halo and are equally visible on both sides of the leaf. The long axis of the spot is usually parallel to the midrib. This spot often tends to be confused with the Ring Spot.

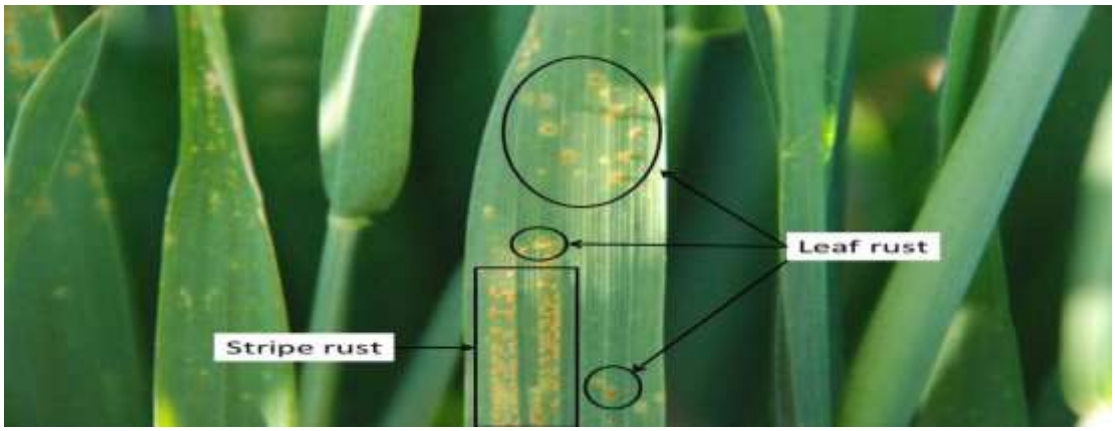



Fig 1.5 Diseases in wheat leafs

ease symptoms can manifest in any part of the plant, only methods that explore visible symptoms in leaves and stems were considered. This was done for two main reasons: to limit the length of the paper and because methods dealing with roots, seeds and fruits have some peculiarities that would warrant a specific survey

**1.1Existing Techniques for Wheat Disease Detection**

This section will discuss some of the popular classification techniques that are used for plant leaf classification. In plant leaf classification leaf is classified based on its different morphological features. Some of the classification techniques used are Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis.

**Support Vector Machine:** Support Vector machine (SVM) is a non-linear Classifier. This is a new trend in machine learning algorithm which is used in many pattern recognition problems, including texture classification. In SVM, the input data is non-linearly mapped to linearly separated data in some high dimensional space providing good classification performance. SVM maximizes the marginal distance between different classes. The division of classes is carried out with different kernels.SVM is designed to work with only two classes by determining the hyper plane to divide two classes. This is done by maximizing the margin from the hyper plane to the two classes. The samples closest to the margin that were selected to determine the hyper plane is known as support vectors .Fig below shows the support vector machines concept. Multiclass classification is also applicable and is basically built up by various two class SVMs to solve the problem, either by using one-versus-all or one versus-one. The winning class is then determined by the highest output function or the maximum votes respectively [18] [19] [20].

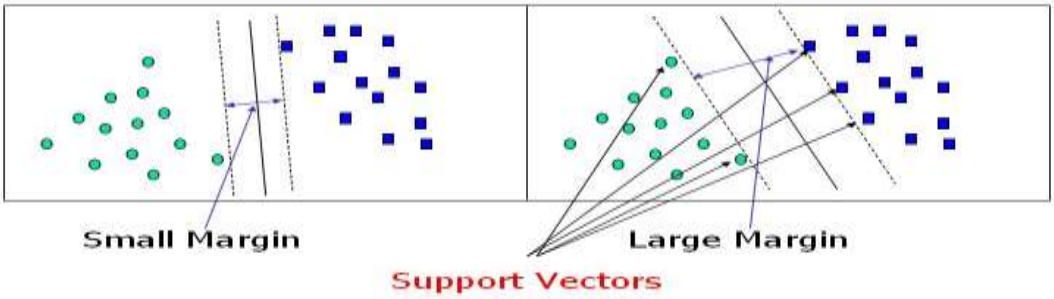



Fig 1.6 Support vector machine

**Main advantages of SVM are:** □

- Its prediction accuracy is high. □
- Its working is robust when training examples contain errors.
- Its simple geometric interpretation and a sparse solution. □
- Like neural networks the computational complexity of SVMs does not depend on the dimensionality of the input space.

**Drawbacks of SVM are:** □

- This classifier involves long training time. □
- In SVM it is difficult to understand the learned function (weights). □
- The large number of support vectors used from the training set to perform classification task.

**Artificial Neural Network (ANN)**: An Artificial Neuron is basically an engineering approach of biological neuron.ANN consists of a number of nodes, called neurons. Neural networks are typically organized in layers. In neural network each neuron in hidden layer receives signals from all the neurons in the input layer. The strength of each signal and the biases are represented by weights and constants, which are calculated through the training phase. After the inputs are weighted and added, the result is then transformed by a transfer function into the output. The transfer functions used are Sigmoid, hyperbolic tangent functions or a step. Backpropagation is a neural network learning algorithm (Rumelhart and McClelland, 1986) is used in layered feed-forward Artificial Neural Networks. Backpropagation is a form of supervised training [21][17]. Originally, ANNs started in the form of a single neuron, proposed in the McCulloch and Pitts model in the 1940s (McCulloch & Pitts, 1943). In 1958, frank Rosenblatt proposed Perceptron, is the simplest single layer networks whose weights and biases could be trained to produce a correct target vector when presented with the corresponding input vector.

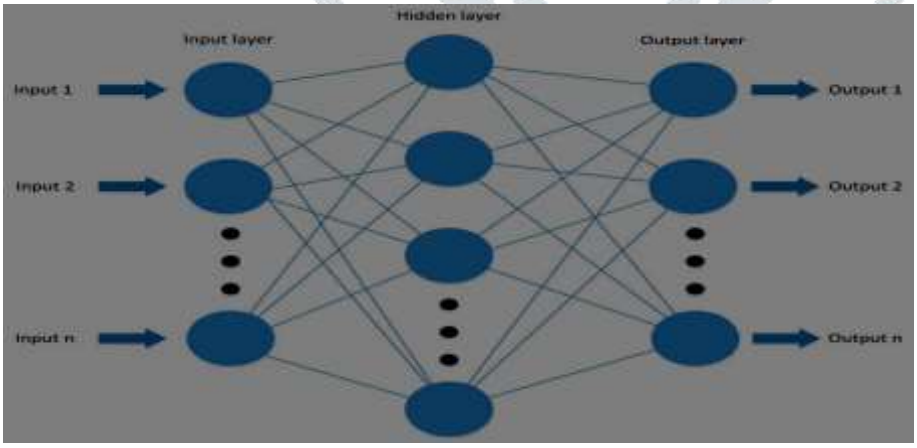



Fig1.7 Multilayered Artificial Neural Network

**1.2 BASIC STEPS INVOLVED IN DETECTION ,QUANTIFICATION AND IDENTIFICATION OF PLANT DISEASES** In this section, the basic steps for plant disease detection, quantification and classification using image processing are discussed as shown in Fig1.7

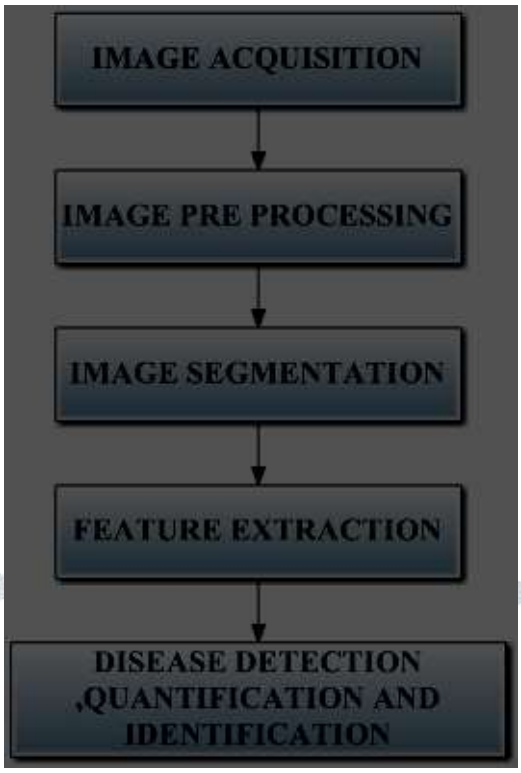



Fig 1.8 Basic steps in disease detection

**1.2.1 Image Acquisition** This is the first stage of any vision system. Image must be captured by a camera and transformed into a manageable entity. This process is known as image acquisition. Images have been collected by high resolution and low resolution digital cameras in visible bands in literature. **1.2.2 Image Pre-Processing** The goal of the Pre-Processing stage is to improve the quality of the acquired image. Possible algorithms during this stage include contrast improvement, brightness correction, noise removal and color space conversion.**1.2.3 Image Segmentation** Image segmentation is the first step and one of the most vital tasks of image analysis. It is used either to discriminate objects from their background or to divide an image into the related regions. It produces at its output a number of labeled regions or sub images [15]. In literature segmentation has been performed at two levels firstly segmenting the leaf from the rest of the original image and then segmenting leaf spots within the leaf. Automatic image segmentation is one of the most challenging tasks in a machine vision system. There are different methods used for image segmentation. K means clustering method has been used in [12]. Fuzzy c means segmentation has been used in [8, 23]. Otsu segmentation method has been utilized in [11, 22] **1.2.4 Feature Extraction** The purpose of the feature extraction phase is to reduce image data by measuring certain features or properties of each segmented region such as color, shape and texture [16]. In this step, pictorial information has been transformed into quantitative attributes.**1.2.5 Disease Detection, Quantification and identification** It is the last step of any image analysis system. The above described methods include not only disease detection but also disease severity and identification. There are very less methods which focus on only disease detection. Methods described in [11, 12, 24] are for disease quantification. The disease quantification may be done either by color and texture of the diseased spots or by estimating the area of diseased spots. The disease classification disease detection and quantification methods. All extracted features are feed into different type of classifier. Some popular classifiers are neural networks, support vector machines, fuzzy classifier, self-organizing maps, discriminant analysis and minimum distance classifier

## II Literature Survey .

**Savita N. Ghaiwat, Parul Arora, [1]** They present survey on different classification techniques that can be used for plant leaf diseases classification. A classification technique deals with classifying each pattern in one of the distinct classes. A classification is a technique where leaf is classified based on its different morphological features. There are so many classification techniques such as k-Nearest Neighbor Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic. Selecting a classification method is always a difficult task because the quality of result can vary for different input data. Plant leaf disease classifications have wide applications in various fields such as in biological research, in Agriculture etc. This paper provides an overview of different classification techniques used for plant leaf disease classification. The k-nearest-neighbor method is perhaps the simplest of all algorithms for predicting the class of a test example. An obvious disadvantage of the k-NN method is the time complexity of making predictions.

**Prof. Sanjay B. Dhaygude and Mr. Nitin P. Kumbhar, [2]** In this paper they introduced the detection of plant leaf is a very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research topic. Most plant diseases are caused by fungi, bacteria, and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein.

**Mr. Pramod S. la ndge, [3]** The Author proposed and experimentally evaluate a software solution for automatic detection and classification of plant diseases through Image Processing. Farmers in rural India have minimal access to agricultural experts, who can inspect crop images and render advice. Delayed expert responses to queries often reach farmers too late. This paper addresses this problem with the objective of developing image processing algorithms that can recognize problems in crops from images, based on color, texture and shape to automatically detect diseases or other conditions that might affect crops and give the fast and accurate solutions to the farmer with the help of SMS. The design and implementation of these technologies will greatly aid in selective chemical application, reducing costs and thus leading to improved productivity, as well as improved produce.

**Anand.H.Kulkarni and Ashwin Patil R. K, [4]** They introduced a methodology for detecting plant diseases early and accurately, using diverse image processing techniques and artificial neural network (ANN). Farmers experience great difficulties in changing from one disease control policy to another. Relying on pure naked-eye observation to detect and classify diseases can be expensive various plant diseases pose a great threat to the agricultural sector by reducing the life of the plants. the present work is aimed to develop a simple disease detection system for plant diseases. The work begins with capturing the images. Filtered and segmented using Gabor filter. Then, texture and color features are extracted from the result of segmentation and Artificial neural network (ANN) is then trained by choosing the feature values that could distinguish the healthy and diseased samples appropriately. Experimental results showed that classification performance by ANN taking feature set is better with an accuracy of 91

**Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, [5]** In this paper they proposed to achieve automatic diagnosis of plant diseases and improve the image recognition accuracy of plant diseases, two kinds of grape diseases (grape downy mildew and grape powdery mildew) and two kinds of wheat diseases (wheat stripe rust and wheat leaf rust) were selected as research objects, and the image recognition of the diseases was conducted based on image processing and pattern recognition. After image preprocessing including image compression, image cropping and image denoising, K_means clustering algorithm was used to segment the disease images, and then 21 color features, 4 shape features and 25 texture features were extracted from the images. Backpropagation (BP) networks were used as the classifiers to identify grape diseases and wheat diseases, respectively. The results showed that identification of the diseases could be effectively achieved using BP networks. Accuracy and the prediction accuracy were both 100%.

**Piyush Chaudhary, Anand K. Chaudhari, Dr. A. N. Cheeranand Sharda Godara [6]** They proposed an algorithm for disease spot segmentation using image processing techniques in plant leaf is implemented. This is the first and important phase for automatic detection and classification of plant diseases. Disease

spots are different in color but not in intensity, in comparison with plant leaf color. So, we color transform of RGB image can be used for better segmentation of disease spots. In this paper, a comparison of the effect of CIELAB, HSI and YCbCr color space in the process of disease spot detection is done. Median filter is used for image smoothing. Finally, threshold can be calculated by applying Otsu method on color component to detect the disease spot. An algorithm which is independent of background noise, plant type and disease spot color was developed and experiments were carried out on different ".

## III.Results and Discussion

The SVM Classifier for the plant disease detection based on feature detection and classification. The PCA algorithm is applied for the feature extraction. The clustering is applied for the image segmentation and SVM algorithm is applied for the disease classification. The Data set of about 25 images is taken as input to prepare the training set. The results are analyzed in terms of certain parameters which are described below:-

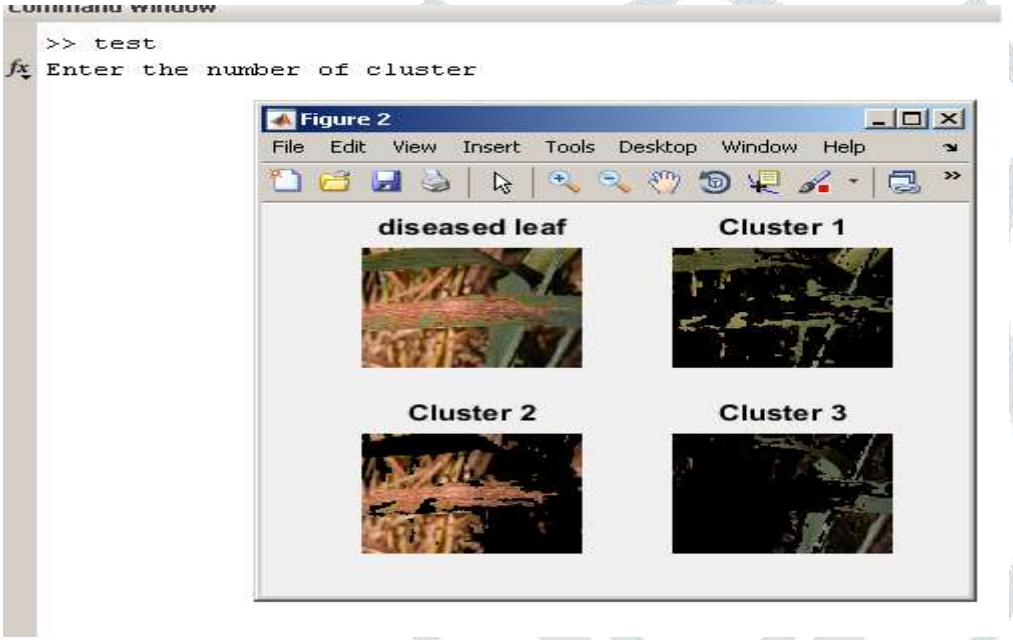



Fig1.9 Clusters Generated from Selected Image

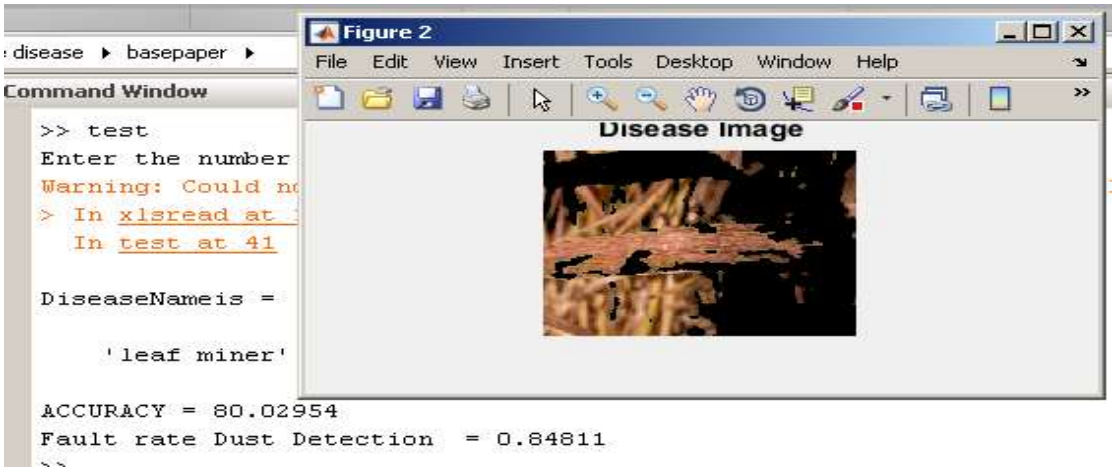
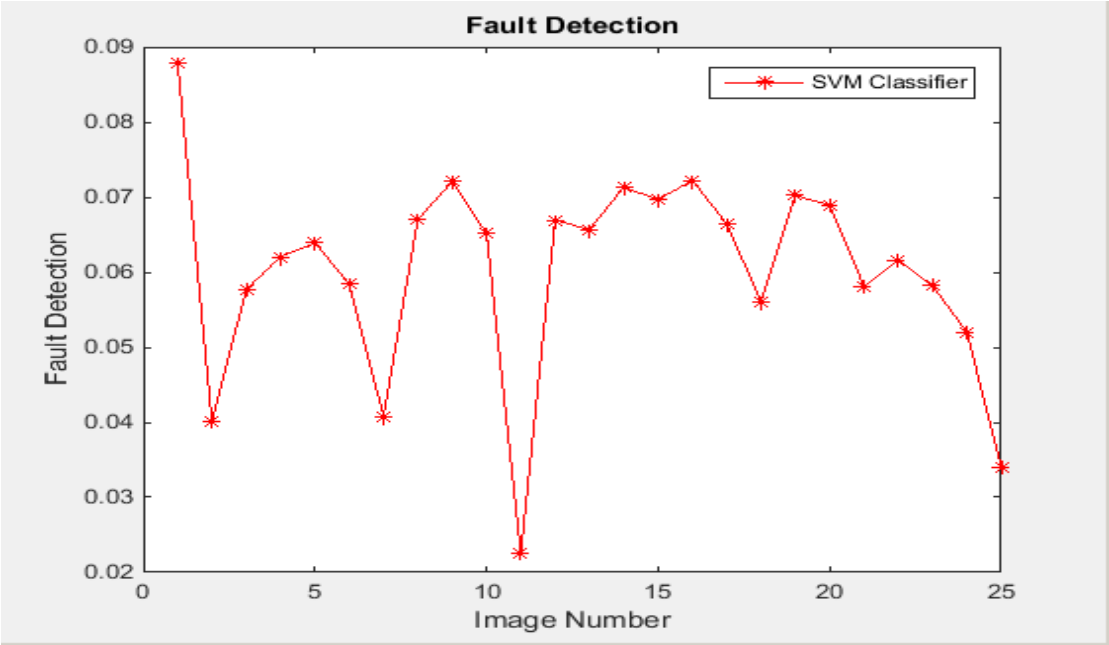
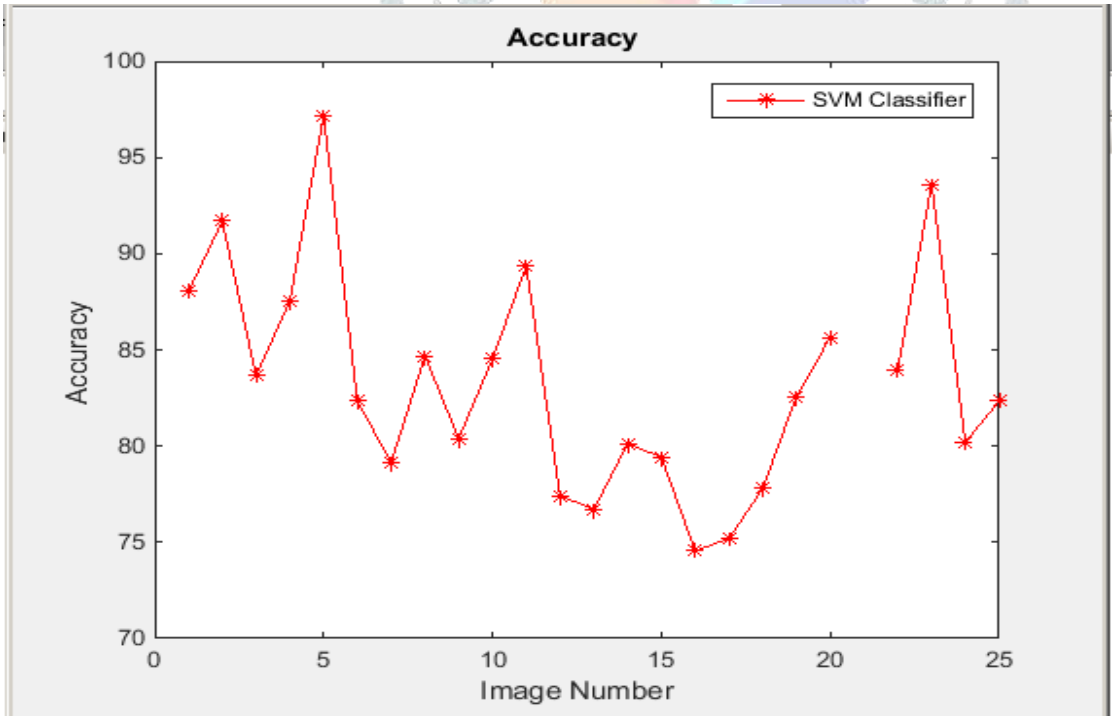


Fig 1.10 Results by SVM Classifier and Disease image




As shown in Fig. 1.11, The accuracy of the existing SVM technique. It is analyzed that accuracy of the Classifier is average .




As shown in Fig.1.12, The fault detection of the SVM algorithm for the performance analysis.

**REFERENCES**

[1] 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 (3) ,2014.

[2] Prof. Sanjay B. Dhaygude and Mr. Nitin P. Kumbhar, "Agricultural plant Leaf Disease Detection Using Image Processing" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, (4), 2013.

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

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

[5] Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, "Image Recognition of Plant Diseases Based on Backpropagation Networks", 5th International Conference on Image and Signal Processing (CISP 2012) 2012,

[6] 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, (6), 2012.

[7] Krystian Mikolajczyk and Cordelia Schmid "A performance evaluation of local descriptors", Pattern Analysis and Machine Intelligence", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 27, (10), pp 1615 – 1630, 2005.

[8] R. Yusnita, Fariza Norbaya, and Norazwinawati Basharuddin, "Intelligent Parking Space Detection System Based on Image Processing", International Journal of Innovation, Management and Technology, Vol. 3,(3), June 2012.

[9] Karsten Bems Riidiger Dillmann Roland Hofstetter "An Application of a Backpropagation Network for the Control of a Tracking Behavior" BEE International Conference. on Robotics and Automatim Sacramento, California, 1991.

[10] Mark Weber, Paul B. Crilly, Senior Member, IEEE, and William E. Blass "Adaptive Noise Filtering Using an Error- Backpropagation Neural Network" IEEE Transaction on Instrumentation and Measurement, Vol. 40, (5),1991.

[11] Muhammad Faisal Zafar, Dzulkifli Mohamad, Muhammad Masood Anwar "Recognition of Online Isolated Handwritten Characters by Backpropagation Neural Nets Using Sub-Character Primitive Features", Informatics Complex, FSKSM University Malaysia, IEEE ,2006.

[12] Pranab Mohanty, Sudeep Sarkar, Rangachar Kasturi, "Subspace Approximation of Face Recognition Algorithms: An Empirical Study" IEEE Transaction on Instrumentation and Measurement and Security, Vol. 3, (4), 2008.

[13] Akira Hirai, Satoshi Yamane, Masaki Miyazawa, and Kenji Ohshima "Application of Multi-layered Fuzzy" IJCSE, Vol.4, (5), 2007.

[14] S. Sankaran, A. Mishra, R. Ehsani and C. Davis," A Review of advanced techniques for detecting plant diseases", International Journal of Computer Electron and Agriculture, Vol.72, (1), pp.1-13,2010.

[15] A-KMahlein, U.Steiner, H-WDehne and E-COerke," Spectral Signatures of sugar beet leaves for the detection and differentiation of diseases". Vol.11.(4), pp.413-431,2010

[16] C.E Rasmussen and C.K Williams, "Gaussian process for Machine learning ", Dhaka university. Press Group Limited ,2006

[17] R.Yusnita , Fariza Norbaya, and Norazwinawati Basharuddin, "Intelligent Parking Space Detection System Based on Image Processing", International Journal of Innovation, Management and Technology, Vol. 3, (3), June 2012

[18] Mark Weber, Paul B. Crilly, Senior Member, IEEE, and William E. Blass "Adaptive Noise Filtering Using an Error- Backpropagation Neural Network" IEEE Transaction on Instrumentation and Measurement, Vol. 40, (5). 1991.

[19] Davoud Ashourloo, Hossein Aghighi, Ali Akbar Matkan, Mohammad Reza Mobasheri and Amir Moeini Rad "An Investigation into Machine Learning Regression Techniques for the leaf Rust Disease Detection Using Hyperspectral Measurement", IEEE Journal of Selected Topics in Applied Earth Observation and Remote Sensing .2016.

[20] Y. Bu and J. Pan, "Stellar atmospheric parameter estimation using Gaussian process regression", monthly notices Roy.astron.soc., Vol.447, (1), pp.256-265,2015.