Wheat Leaf Detection and Prevention Using Support Vector Machine

Sumit Nema

Department of computer engineering
Global nature group of sangathan group of institution
Jabalpur, India
nema.sumit@gmail.com

Aarju Dixit

Department of computer engineering
Global nature group of sangathan group of institution
Jabalpur, India
aarjudixit31@gmail.com

Abstract—**Agriculture is an ancient occupation. Machine learning technique is used for wheat leaf disease detection. Disease is restricting the growth of wheat plant. Quality and quantity of wheat plant is also reduced by it. For color space lab color space is used. Wheat leaf image is captured by the digital camera. After it the captured image is processed to determine the diseased and un-diseased status of each test leaf. To identify the clusters of wheat leaf k-means clustering method is used. The classification technique support vector machine is used to perform action on different wheat leaf samples. Support vector machine contains two datasets; one is training dataset and testing data. Comparison result shows the diseased and un-diseased leaf from the test data. Test results verified by terms; mean, standard deviation, variance, median and mode.**

Keywords—*Image processing technique; disease detection; clustering; machine learning method; segmentation.*

I   INTRODUCTION

India is an enlightened country. All human beings basic need is food. Large amount of India needs proper amount of food production. Enormous amount of Indian inhabitants lives in rustic ranges. Source of revenue is basically hinge on agriculture. That's why Indian citizens mostly hinge on cultivation. From now growing excellence construction has converted essential increasingly. Some diseases cannot be detected with naked eyes for identified those diseases image processing method were developed [37]. In initial existences, the intensive care and investigation of wheat leaf plant ailments were done physically by the knowledge being in that ground. It needs unbelievable quantity of effort and also needs extreme dispensation time. The wheat leaf sickness intensive care is very difficult. In most of the cases disease indications are seen on the greeneries [14]. Later, wheat leaf disease detection is used in image processing. Illness recognition contains the steps like image acquisition, image pre-processing, image segmentation, feature extraction and SVM classification also. This paper deliberated the technique used for the discovery of wheat leaf image. This paper also discussed segmentation method k-means and classification algorithm support vector machine (SVM) cast-off in the wheat leaf illness discovery [14]. Cultivation is the asset of Indian reduced among various leaves, wheat leaf is considered to be one of the most appreciated wheat foliage flowers. Scientific name of wheat is called Tritium [16]. Classifying disease from the images of the wheat leaf is one of the stimulating investigation parts in computer and agriculture ground. We apply our study and education to suggest and project our effort on the discovery and organization of wheat leaf disease [6]. In wheat leaf plant different types of diseases occur like pink snow mold, powdery mildew, tan Spot, septoria [5]. A mechanical scheme for intensive care the development of wheat leaf can be done with suitable classifications. Such kind of material can be valuable for formers, botanists, manufacturers, food engineers and surgeons. Total 81 samples have been taken. Testing is done over these samples. The scheme turns pre-dispensation and feature extraction techniques on the image before a pattern matcher compares the material from this image with the ones in the folder in order to get possible competitions. The different features that are extracted and compared are the color, texture and shape of the wheat leaf [1]. Image processing is the education of any algorithm that receipts an image as contribution and revenues an image as production [37]. This message is prearranged as follows. Section I, Introduction of the wheat leaf disease detection. Section 2, the literature review of this daily is discussed and the impartial of this letter is accessible. Section 3 offerings the proposed work, investigational setup and data collection. Section IV, the results based on the industrialized index is explained in detail, and section V, the assumption is given.
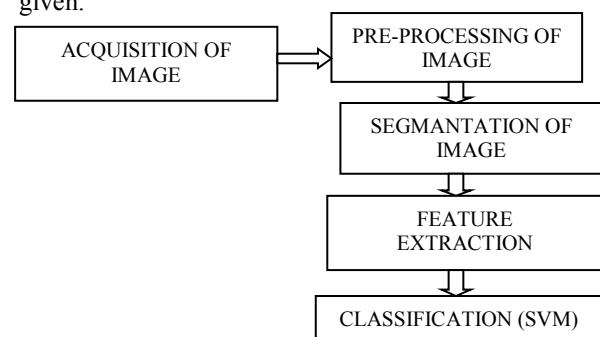

Fig. 1 *Wheat leaf disease detection steps*

II   LITERATURE REVIEW

Agriculture is the primary sector of food providence in India, and it's a growing entity progressively [13]. Segmentation is a technique for distributing and classifying image into several parts of the area n, where each area has similarity attributes but the result of attributes are not the same. The segmentation process is completed through k-means clustering technique [25]. There various papers describing to detecting the diseases and methods suggesting the implementation ways as shown and consulted here.

Moshou, Bravo and west (2004) [18]: the alteration in spectral reflectance amongst healthy and diseased wheat plants was examined at an initial phase in the expansion of "yellow rust" illness. Though the use of neural network and more exactly multilayer perceptron's, the classification presentation is rises 95% to 99% and accurate the leaf spectra for evaluating of both diseased and healthy spectra.

Nidhya and Sundaram (2011) [22]: Decision tree comes under the learning algorithms by using C4.5 decision trees algorithm wheat leaf disease is detect. Decision tree is unbearable the standards of material gain; improvement ratio and gain index and find the percentage of it by using all the learning algorithms.

Vala and Baxi (2013) [20]: Image segmentation methods are best approaches for thresholding is its simple calculation. OTSU is an involuntary threshold selection district grounded segmentation technique. As judgment to other threshold approaches OTSU performs well.

Shanwen and Chuanlei (2013) [23]: A supervised orthogonal non dimensionality discount algorithm, called orthogonal nonlinear dimensionality reduction (OLDP) presented aimed at plant disease recognition. The planned algorithm goal to discovery a prominent matrix by dragging the data numbers between different classes as far as imaginable. The new results on real maize disease leaf images validate that the proposed method is actual and possible for the detection of leaf plant disease.

Thangadunai and Padumavathi (2014) [24]: Gray image is easy to procedure and tool for various applications since they obligate better clarity and suited for examination than RGB images. Histogram equalization is used to enhance the contrast of images and delivers clear image to human eyes. Histogram equalization is castoff to realize better excellence images in gray scale which is used in numerous medical application, biological sub missions etc.

Sarayloo and Asemani (2015) [17]: Enterprise a classifier for fungal disease detection in wheat plants through pattern recognition method. A radial basis function (RBF) neural network was employment to categorize wheat disease rendering toward the consequences. The planned technique might successfully detect then classify wheat diseases and the method stretches correctness of 98.3%.

Sarangdhar and pawar (2017) [19]: This paper offering a system for discovery and regulatory of diseases on cotton leaf length ways with soil excellence monitoring. The effort suggests a support vector machine founded regression scheme intended for documentation and organization of 5 cotton leaf diseases through android app. The general classification correctness of this planned organization remains 83.26%.

Khan, Akram, Naqvi, Haider (2018) [21]: To build up a procedure for automatic detection of various plant diseases by utilizing a cascaded unsupervised learning segmentation technique and to identify the lightness and darkness of the image by using two lab color space techniques CIELAB and RGB are used.

III   PROPOSED WORK

The key diseases of wheat leaf are viral, fungus and bacterial disease similar Alternaria, Anthracnose, bacterial spot, canker, etc. The viral disease is happened by green changes, fungus disease is happened by the attendance of fungus in the leaf and bacterial disease is due to presence of origins in leaf. The planned outline is identifying fungus wheat leaf disease detection in Tan spot, Septoria, Pink snow mold and Powdery mildew. Segmentation technique is done by K-means clustering algorithm. The Red Green Blue color space is converted into the Lab color space. The disease is detected in the form of L*a*b color space. The Lab color model is composed of three elements: such as L shows luminosity layer and a*b shows chromaticity layer. It's important to detect diseases on wheat leaf appropriately. When they are infected by diseases, there is change occurred in the shape, size and color. These suggestions can be patterned mechanically but not in appropriate amount. Hence there are support vector machine image processing algorithm is used to detect disease on wheat leaf plant. Using image processing method appropriate amount of disease founded on color, texture or shape alteration of leaf can be recognized.

A.   K-means clustering:

It's set of objects into grouped called clusters. There are two types of clustering soft clustering and hard clustering. K-means is one of the clustering algorithms. Clustering three-dimensional apprehensions is an important element, which competitions alliance of comparable spatial data items into a cluster has high similarity than spatial clusters which are not comparable. [9]

K-mean is the simplest un-supervised learning algorithm that serves the well-known clustering problem. K-mean clustering is used when you have unable data (i.e. data without define categories and groups). K-mean partition is defined in the initial stage. The center of the cluster is pre- defined. The process is continuously executed if there is no change in cluster center. Output of this method is depends upon the selected cluster centroids.

B.   Support Vector Machine:

A supervised learning algorithm is support vector machine. It's used as a classification tool. The training algorithm of SVM maximizes the margin between the training data and class boundary. A hyper plane in create between the data sets to indicate which class it belongs to it is the main concept of

support vector machine [12]. A camera captured the picture of wheat leaf imageand analyzed in the MATLAB software. Image processing scenario, firstly, the images are captured by the camera and after that the image is processed by using k-means clustering for segmentation of the image. [*1*]

A task too choosing a good function is not an easy. It takes a lot of training time for making a large datasets. SVM work phenomenally with unstructured and semi structured data like text, Images and trees. The real strength of SVM is kernel.by using an appropriate kernel function we can solve every kernel problem. Llike in neural networks; SVM is not solved the problem of llocal optima. With the high dimension of data it scales well. SVM models have generalization in practice; in SVM the risk of over fitting is less. There are so many software tools that are available for SVM implementation. For text classification SVM is really so good. SVMs are good at finding the best linear separator. The SVMs non-linear learning algorithms are made by his kernel trick.

IV MATERIAL AND METHODS

A. Description of wheat leaf disease:

Wheat leaf disease is alienated in some groups fungal, bacterial, and viral. From this study certain of the wheat fungal diseases are inspected for enterprise a classifier that holds: tan spot, pink Snow mold, septoria and powdery Mildew. Where, 21 samples of pink snow mold, 19 samples of powdery mildew, 29 samples of septoria and 21 samples of tan spot are taken for the correct result. We create a large training data for wheat leaf detection. After creating a large database one by one every image is tested.

B. Overview of System:

The two main portions scheme contains of such as the digital camera and the software apparatuses. The first portion of the scheme is to take photographs of wheat leaf. Picture need to be taken in a solo image of wheat leaf. While taking the picture the background of the wheat image is taken black so that the disease is easily detected. The second part of the scheme is to take matlab software that shows the results.

For images acquisition of wheat disease digital camera is used. The backgrounds of all taken images were black and the images stowed in JPEG format. Expect JPEG the image is saved in BMP, TIF and PNG format also. Fig. 2 shows firstly the original color of pink snow mold than it shows the hue image and at last shows the diseased part of pink snow mold wheat leaf. Fig. 3 shows the original, hue and diseased part of powdery mildew. Fig. 4 shows the original than hue and diseased part of septoria wheat leaf and Fig. 5 are also shows the original than hue and diseased part of tan spot wheat leaf.

Fig. 2, *Hue and diseased leaf of pink snow mold*

Fig. 3, *Hue and diseased leaf of powdery mildew*

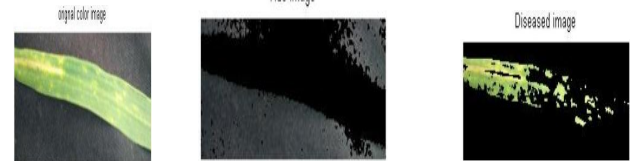Fig. 4, *Hue and diseased leaf of Septoria*

Fig. 5, *Hue and diseased leaf of tan spot*

V RESULT AND DISCUSSION

Every pixel shows a different size over different category of diseased wheat leaf. Detecting the diseases on wheat leaf plant the features such as color, texture and edge is needed to extract. The assignment is performed on total 81 samples of wheat leaf and these all are diseased leaf samples. All the wheat leaf samples are tested. The histogram chart shows the comparison between the diseased and un-diseased test data. Every category of wheat leaf shows the different test data results. As comparison to all 4categories of wheat leaf pink snow mold, powdery mildew, septoria and tan spot the disease ratio of septoria leaf is very high. Fig. 6, 7 8 and Fig. 9 shows the comparison ratio results.
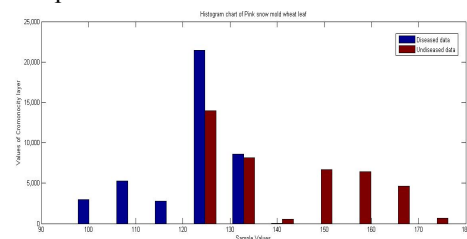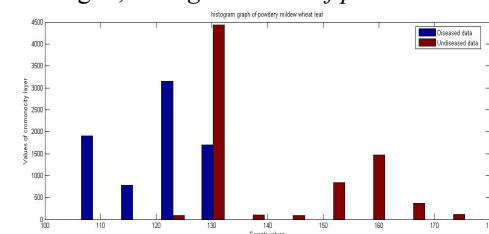

Fig. 6, *Histogram chart of pink snow mold leaf*

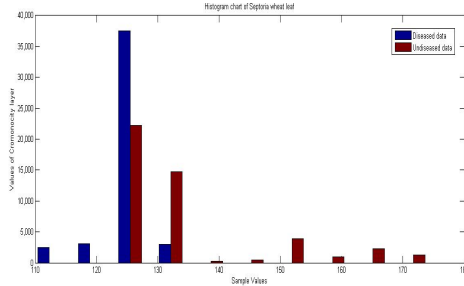Fig. 7, *Histogram chart of powdery mildew leaf*
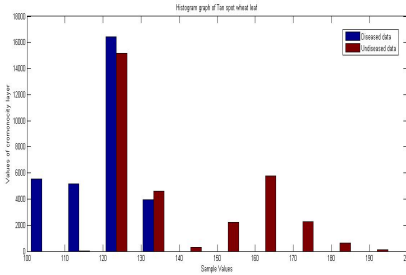
Fig. 8, *Histogram chart of septoria leaf*

Fig. 9, *Histogram chart of tan spot*

Septoria wheat leaf is having highest disease. Whereas, the other samples of leaf is having less diseased data. Also, using support vector machine for classification the wheat leaf test data shows the results of mean, variance, standard deviation, median, mode and cluster samples.

Mean is also called as the average. The mean is originated by addition up all of the data and in-between by the number of data entries. The median is the middle number. Firstly the number arranged from lowermost to highest most, than find the central number by passage off the numbers until reach to the intermediate. Mode is that number that happens most often. Mean means average of the given data. You are used to, where you add up all the numbers and then divide by the number of numbers. The median is the middle value in the list of numbers. If no number in the list is repeated, then there is no mode for the list. The variance symbolized by (S^2) and standard deviation the square root of the variance, symbolized by (S). Variance is a measure of how extent out a data set is. It is calculated as the average squared deviation of each number from the mean of a data set. Table I. shows the sample results of some wheat leaf.

After the detection of wheat leaf disease the prevention is done by foliar fungicides it is effective in controlling the disease present in pink snow mold, powdery mildew, septoria and tan spot leaf. By increasing the possibility of a better sand disease is reduce. By reduce seed pathogens, such as smut. Plant recommended varieties which have most resistance. By better planting the chances of having a disease is less. Fertilize early and higher rate of fertilizer are using its beneficial for disease prevention. With the help of bio- chemical product the disease prevention is possible. In, market there is so many chemical products are available through which the disease prevention is possible.

TABLE I. RESULTS OF TEST DATA

Disease type	Cluster Samples	Mean	Median	Mode	Variance	Standard deviation
Pink Snow Mold (leaf 1)	3	131.8179	128	128	247.1605	157.7213
Powdery Mildew (leaf 2)	3	130.6570	128	126	223.8335	14.9611
Septoria (leaf 3)	3	129.9156	128	128	104.4113	10.2182
Tan Spot (leaf 4)	3	130.1990	127	126	311.3749	17.6458
Pink Snow Mold (leaf 5)	3	130.6240	129	128	160.9694	12.6874
Powdery Mildew (leaf 6)	3	130.4681	128	126	214.4173	14.6430
Septoria (leaf 7)	3	129.4152	128	128	86.0252	9.2750
Tan Spot (leaf 8)	3	131.6468	128	156	460.1906	21.4521

V   CONCLUSION

This paper describes SVM technique of image processing for detecting disease of wheat leaf plant and gives prevention concepts also. In future, for other plants this method can be applied and detect the disease of that plant. From this method, using this image processing technique we can easily identify and classify various plant diseases. Using processor and communiqué machineries, an automatic scheme can be built which can deliver initial announcement of disease. From the similar direction, we strained to deliver our charities in image processing and machine learning features of such scheme. A mixture of image processes and machine learning systems can give occasions to researchers to speech difficulties in numerous domains that disturb to civilization straight or circuitously.

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