Wheat Leaf Disease Detection Using Machine Learning Method- A Review

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Abstract: - This paper is highlighting the outliers about the wheat leaf disease detection. India is the second larger producer of wheat after china. The wheat diseases are harmful to wheat production, but there are algorithms that can effectively identify common diseases of wheat leaves. The wheat diseases are generally viral, bacterial, fungal, insects, rust etc. There are many types of disease which are presents in wheat leaf. Recently, wheat disease detection through leaf image and data processing techniques are used extensively and in expensive system especially for assisting farmers in monitoring the big plantation area. Machine learning techniques are described for wheat leaf disease detection and its classification also. The key issues and challenges in wheat leaf disease detection are also highlighted. A vast collection of papers, books and standards are listed in the reference list, which gives useful information to the researchers and farmers in agriculture.

Keywords: - Wheat disease detection, Machine learning, SVM (Support Vector Machine), Segmentation, clustering, classification.

I. INTRODUCTION

India is the land of diversity not only in culture but also in foods. India is an agriculture country, where 70% of Indian population is relay on agriculture [1]. Wheat is the good source of trace minerals such as selenium and magnesium. Some nutrients are essential for good health [3]. This paper focuses more on the scale of single leaf based disease detection rather than the scale of whole plant [10]. Rust is the foliar disease of wheat. Leaf rust damages the wheat leaf most. Fungal disease, viral disease and there are so many. Image processing and machine learning technique over support vector machine have been extensively explored for plant disease study for their merits of invasive, rapid, continuous and precise measurement capacities[2]. Characteristics of wheat diseases, it has been found that wheat disease mainly concentrates on the wheat leaves and can be identified by computer vision techniques. A formal image recognition process includes image preprocessing, segmentation, feature extraction and pattern recognition. Image segmentation is one of the key steps, and the precision of the segmentation directly influences the reliability of feature extraction and the accuracy of recognition. Clustering methods and segmentation methods are based on statistical pattern recognition [3]. SVM is one of the machine learning methods that contains two dataset; one is training dataset and train dataset. Firstly original image is captured and then that image is being used for processing [11]. This paper presents, inclusive detection of wheat leaf using SVM image processing technique. The basic steps to implement machine learning methods to detect the wheat diseases are given in section II and in section III. A literature review of recently used machine learning methods is described in section IV. In section V shows the key issues and challenges and finally in section VI gives the conclusion and future work.

II. WHEAT LEAF DISEASE DETECTION PROCESS

This process consist two main steps; 1) Image processing, 2) Machine learning algorithm. The block diagram of wheat disease detection process is given in figure 1.
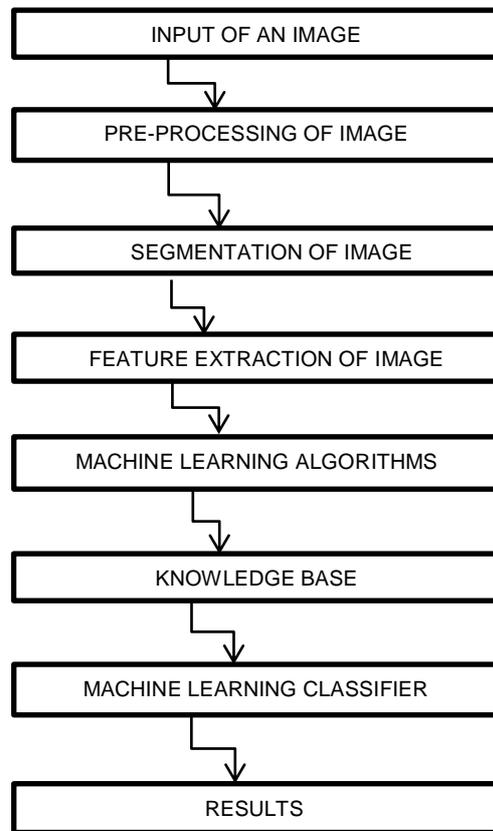
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Figure 1.Block diagram of wheat disease detection process

III. IMAGE PROCESSING TECHNIQUE

It is used by some researchers for detection and classification of wheat leaf disease. The steps of wheat leaf diseases detection and classification are given below.

1. Image acquisition.

2. Preprocessing.

3. Segmentation of infected regions.
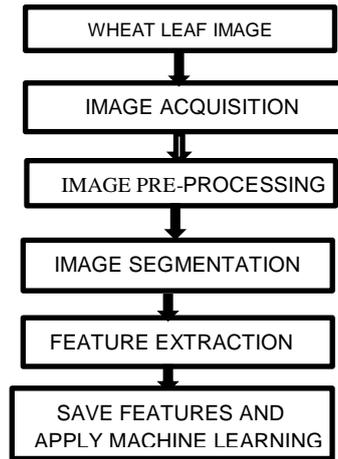
4. Feature extraction

5. Feature selection

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│  FEATURE EXTRACTION  │
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│ APPLY MACHINE LEARNING│
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Figure: 2 Block diagram of wheat disease detection.

IV. MACHINE LEARNING METHODS

Many classification methods are enlightened by researchers [18, 19]. Ordinarily support vector machine (SVM) have used for classification in diseased detection process in leaves. Neural network is one of the famous methods of regression used to diseased detection process in leaves. The block diagram of machine learning methods is shown in figure 3.
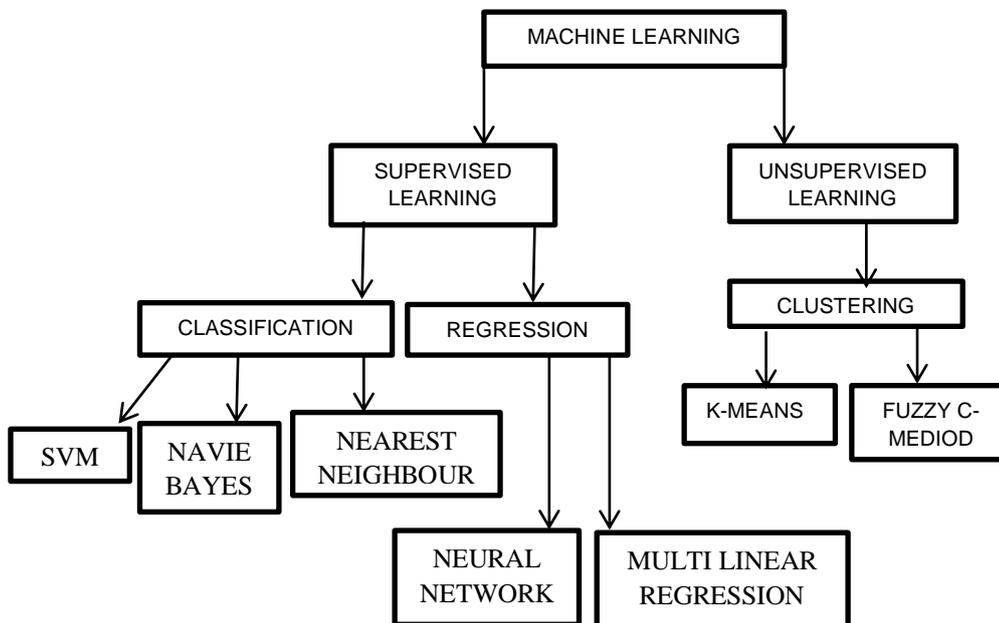
Figure 3   The block diagram of machine learning methods.

1). **Support vector machine:**   They were extremely popular around the time they were developed in the 1990s and continue to be the go-to method for a high-performing algorithm with little tuning. In machine learning, support vector machine are a set of supervised learning models with associated learning algorithms that analyses data used for Classification and regression analysis. When data are not labeled supervised learning is not possible. It constructs a hyper lane and a set of hyper lane which in a high and infinite dimensional space, which can be used for other task like outlier detection. Support vector

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machine is based on finding the hyper lane that gives the largest minimum distance to the training. The advantages of support vector machine are:

- Effective in high dimensional spaces.
- Still effective in cases where number of dimensions is greater than the number of samples.
- It is also memory efficient.
- Versatile.

The disadvantages of support vector machines are:

- If the number of features is much greater than the number of samples, avoid over-fitting.
- SVMs do not directly provide probability estimates.

Support vector machine (SVM) it analyses the data after that it classify that data and then the regression is done. Two main parameters accuracy and detection time in these two the disease is detect. The experiments on wheat leaf images with three common diseases proved the satisfactory performance of our method in terms automation, accuracy and efficiency. Segmentation will assist in following processes (such as feature extraction and identification) for disease detection and analysis of wheat leaf [3]. Support vector machines (SVM) increase the recognition rate [7].

2) Neural networks: - The disease detection techniques are based on two main neural network technologies: Self-Organising map and multilayer perceptron's (the most widely used architecture) [6]. Neural network is a system of hardware and/or software patterned after the operation of neurons in the human brain. Neural network also called artificial neural network.

V.WHEAT LEAF DISEASE DETECTION SYSTEM USING IMAGE PROCESSING TECHNIQUES: AN OVERVIEW

Many researchers had done research in this field. Following is related to literature review of proposed work. BTH protected wheat systemically against powdery mildew infection it affects multiple steps in the life cycle of the pathogen [13].
Here, we employ a machine learning method of support vector machine (SVM) for robustness. It focuses on providing information about wheat plant and their prevention method. If there is any disease occurs in wheat leaf so with the help of support vector machine (SVM) disease detection will cure. Support Vector machine is providing the extensive clues by which the identification is easy and it gets complete in a very early stage. All the leaf disease detection techniques are compared [20].

Rong et al. (2013) [2] Early cercospora leaf spot detection in sugar beet by using hybrid algorithms of template matching and support vector machine (SVM) and they adopt three stage frame work for achieving the accurate results. It is feasible for continuous quantization under natural daylight conditions which would be implemented to in-field situation for detection and qualifying the site specific plant disease.

Mewes et al. (2010) [5] presented a state-of-the-art regression approach is using by support vector machine has been applied to hyper spectral AISA-Dual data for derive the disease sensitivity that caused by leaf rust which is called (Puccinina recondita) in wheat. The result is shown by SVR that generally suitable for the derivation of continual disease severity values.

Meesha and Nidhi (2013) [1] have given the classification method of wheat by using two learning algorithms, that is support vector machine and neural network. After the comparison of both the algorithms, the result shows that neural network is better than support vector machine.

Xiaojing et al. (2014) [3] proposed an automatic and efficient solution with the use of k-mean clustering over the three common diseases they are powdery mildew, leaf rust and stripe- rust and the result 90% efficiency by using segmentation method. The segmentation task of wheat leaf scab images is based on lab color space.

Rajleen and Sandeep (2015) [11] the results on support vector machine and comparing that with neural network. The results are based on three parameters: accuracy, time and area detection. According to them, SVM classifier is the latest classifier as comparison to neural network and gives the accurate result.

Varsha and Vijaya (2017) [12] proposed a novel method to detect and classify the plant disease using neural network based classifier. Comparison is based on histogram method, neural network and support vector machine method. Support vector machine is given more accurate results as comparison to two other methods.

VI. KEY ISSUES AND CHALLENGES

Various machine learning techniques are reported in literature to detection of wheat leaf disease. However, some key issues and challenges of these techniques are as follows:-

1. To identify the affected area of wheat leaf, the images of various leaves are taken with a digital camera or similar device.
2. Winter and spring wheat leaf is to conduct the data measurement in the experimental field [4].
3. Shape, size and texture of every wheat leaf image tested by feature extraction.
4. There images of diseased wheat leaf will be captured with different shape and size. In the first step, all the wheat leaf samples were taken as the RGB images as so on [10].
5. Yellow rust is caused by *Puccinia striiformis Tritici*, which produces yellow colored spores on all the leaves during the winter and spring season [6].
6. BTH is a novel type of wheat leaf and plant protection. Its work is to inherent disease resistance mechanism. [13]
7. Seed borne diseases in wheat are not only the yield reductions but it also deteriorating marketable quality of grains in wheat. [14]
8. Several machine vision applications use color and geometric features for identification process. [14]
9. In KNN the classification i. e. to that category the given purpose is belongs relies on the calculation of the minimum distance between the given purpose and different points. It is not applicable for huge multiplicity of application [21]
10. Histogram equalization is used to enhance the contrast of the images. It provides clear image to human eyes. Histogram equalization is used to achieve better quality images in gray scale which is used in various medical applications, biological applications such as digital X-rays; wheat leaf disease, plant disease etc. [15]
11. Stripe rust and leaf rust with are the two important wheat diseases. Investigate a method to identify and assess the two diseases, the canopy hyper spectral data of healthy wheat, wheat in incubation period, and wheat in diseased period of the diseases were collected, respectively. After data preprocessing, support vector regression (SVR) models for disease index (DI) inversion were built. [16]
12. A radial basis function (RBF) neural network was employed to classify wheat leaf diseases. [17]

A Radial Basis Function (RBF) neural network has an input layer, a hidden layer and an output layer. The neurons in the hidden layer contain Gaussian transfer functions whose outputs are inversely proportional to the distance from the center of the neuron. RBF networks are similar to k-mean clustering RBF networks have a variable number of neurons that is usually much less than the number of training points.

VII. CONCLUSION

In conclusion, support vector machine performs its robust and feasible for wheat disease detection. The detection of wheat leaf has been developed using the different software. The main important characteristics of disease detection of wheat leaf are speed and accuracy. It allows the throughput and detection in wheat leaf disease. Wheat disease is detected by the SVM classifier. All the diseases and various methods are mentioned in this paper. It deals with various methods for wheat disease detection. For more accurate results different algorithms will be used.

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