

SVM And k-NN Based Classification of Wheat Leaf Disease

¹Mousumi Banerjee

¹Independent Researcher

Abstract: Agriculture is the primary source of livelihood in India for about 58 per cent of India's population. Protection of this source is main concerns. Preventing plants from different type of disease is a great challenge now. Automatic detection of infected plant can reduce the manual effort and the same time decrease processing time. Image Processing and Machine learning are the two main weapon, by which we can achieve this detection of infected plant. In this paper we mainly focused on Wheat Leaf disease classification by two machine learning approaches SVM and K-nearest neighbor.

IndexTerms – Support vector machine (SVM), k-nearest neighbor, image processing

I. INTRODUCTION

Agriculture is one of key part of India's economy. India's agriculture is composed of many different crops, but rice and wheat are foremost food staples. But protection of this source is one of the main issues. Sometimes farmers have very less knowledge about different type of disease those plants have. In some cases, simply that much manpower farmers cannot provide to regular check the plants health condition. Those cases automatic detection of infected plant can reduce the manual effort and at the same reduce the process time also.

This research is based on wheat, which is one of the principal food grains in India. Mainly some common fungal and bacterial disease which generally affect wheat leaf are Stem Rust, Bacterial Streak, Brown Spot, Leaf Smut, Wheat soilborne mosaic and Powdery mildew etc. In this research we are mainly focused on first three mentioned disease. Dataset is arranged from UCI machine learning repository. We have done some pre-processing of the disease infected leaf images before we start the classification. We have mainly focused and discussed about the result of two ML algorithm support vector machines and k-nearest neighbor algorithm to classify wheat leaf disease.

II. BACKGROUND STUDY

Already a good amount of research is done on detecting plant diseases using image processing and machine learning. But very few research works have been done on wheat leaf disease. Most researchers are focused on general leaf disease of plant. Some of research have done on tomato leaf [1], rice [2], coffee leaf [3] etc. S. Arivazhagan and his co-researchers [4] had focused on leaf disease detection using image processing and neural network. For classification purpose, they have used multi class SVM classifiers. Amos Gichamba and co researchers [5], their focus was also on leaf disease detection. Leaf rot disease detection of Betel Vine [6] also was done. Basavaraj Tigad et.al [7] have done research on Banana Plant Disease Detection and Grading Using Image Processing. In C. Arun Priya et.al work [8] an efficient leaf disease detection was done, an SVM and k-NN classifier were used to compare accuracy of the classifiers.

III. METHODOLOGY USED

The focus of this research is to find, among SVM and KNN which classification algorithm works better in wheat leaf disease classification.

Classification Algorithms Used:

1. **SVM Algorithm Support Vector Machines (SVMs):** In current machine learning world, support vector machines is a supervised learning model, that analyze data for classification purpose. SVM is not only use in image classification, it is applicable in different other ways too.






2. **k-Nearest Neighbor Classification (k-NN):** It is also another type of classification technique, whose application is also not restricted to image classification like SVM.

IV. PROPOSED WORK

Our most popular serial grain wheat, is affected by different type of disease. Here, we are considering only infected leaf of wheat.

The following table provides different type of wheat leaf disease with their image.

Fig 1.

Disease Name	Image
Stem Rust	
Leaf smut	
Wheat soilborne mosaic	
Powdery mildew	
Bacterial streak	



In our work we mainly dealt with Bacterial Streak, Brown Spot and Leaf Smut. With our chosen two classification algorithms we compare the result, to get the idea, which one is doing better to classify the above three type of disease.

V. RESULTS AND DISCUSSION

A synthetic image dataset was generated for 3 types of wheat leaf disease. Before classification operation we enhanced the image with Gaussian classifier. After that, 70% of data was reserved for training set, and rest was for testing the classifier. Some of the sample images for different type of wheat leaf disease are given below.

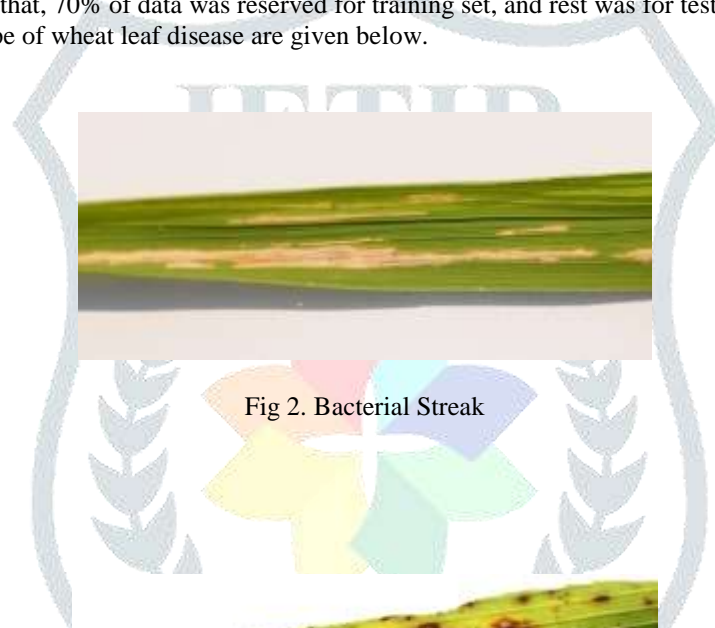


Fig 2. Bacterial Streak



Fig 3. Brown Spot



Fig4. Leaf Smut

We have used two classifier SVM and KNN and compare their result by calculating precision, recall and F1-score parameters.

$$\text{Precision} = \text{True Positive(TP)} / (\text{True Positive(TP)} + \text{False Positive(FP)})$$

$$\text{Recall} = \text{True Positive(TP)} / (\text{True Positive(TP)} + \text{False Negative(FN)})$$

$$\text{F1Score} = 2 * (\text{Precision} * \text{Recall}) / (\text{Precision} + \text{Recall})$$

Table 1

Using SVM	precision	Recall	F1-score
Bacterial Streak	0.91	0.83	0.87
Brown Spot	0.64	0.88	0.74
Leaf Smut	0.86	0.75	0.80

Table 2

Using KNN	precision	Recall	F1-score
Bacterial Streak	0.67	0.83	0.74
Brown Spot	0.50	0.75	0.60
Leaf Smut	0.78	0.44	0.56

From the above experiments, it is clear that, SVM gives better result for leaf classification in our research.

VI. REFERENCES

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