EasyChair Preprint

№ 5454

Criticality of Leaf Disease Detection for Better Crop Yield Using Machine Learning Techniques

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May 4, 2021

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Abstract

The crop disease is one of the main problem in agriculture sector which leads huge economic loss and also very big problem for the farmers in the form of low productivity and huge loss for them. The paper which includes the efficient approach to identify the healthy and diseased or infected leaf using image processing and machine learning techniques. The disease which causes the huge damage in the leaf which will be affected for the productivity of crop and that can be detected using image pre-processing, segmentation and classification using machine learning algorithms.

Keyword: Image processing, Machine learning, Segmentation and Classification.

I. Introduction

In today's modern digital world research are continuously trying to increasing the collectively of plants. They have archived by using developing the higher breed seeds and plants. But one problem is still exist in which it is a major concern of the cultivation of crop and that is crop diseases and the pesticides problem. Due to these problems, the cultivation decreases and hence all the farmers and it turn to the country the people who suffers a lot due to this lack pf cultivation of plant. Many of the time disease need to prevent at early stage, but it not happens then it damage the plants. Due to that whatever the investment need to do that also in loss, to avoiding all these need to detect disease at early at early stages. Sugarcane is cultivated in long duration that is 10 to 18 months, that leads to attack of many diseases. Fungi caused diseases in sugarcane are the most predominant disease that appears as spots on the leaves.

India is one of the developing country and also leads good production agriculture which is the backbone of the country. Agriculture field faces too many problems which includes the huge loss in the crop production. The agriculture has the implementation of the various technology to drive the solution in the present situation. The most of work is done through the experimentation by the experts. Now days, cultivate the data analysis which drives the solution and helping the problems which are occur in the field of the agriculture in the sense of disease. The disease which is cause huge loss in the farming field. The agriculture industry has started searching of new methods to improve the production of food because of improve the population, and changes in the weather and instability in politics. The paper which includes survey on different methods and techniques to identify the crop disease thorough various technology and algorithms with accurate rate result.

II. Literature Survey

Now days plant disease are the major problem in the world wide agriculture sector. So, earlier detection is the of disease is the best effort for reducing the economic losses and low productivity. In this paper, they proposes the localization of leaf method from the wide angle images with the deep learning technique. The main objective of this paper includes localize the system by using the fully leaf region to processed as input image. Here, using the trained CNN(convolution neural network) classifier to analyse the location leaf and non-maximum suppressions (NMS) it used to remove the overlapping bounding process. The method which can show the performance of detection in 78% accuracy[1].

The paper which provide the method to detect the disease by automatically classifying the rice plant by processing the photographs of the leaves. Here, the method can be used by image processing algorithms for detecting the leaves and also used for the induced the lesions in leaves. The classification is done by using the sequential minimal optimization(support vector machine) algorithm. The attributes can be used established the algorithm for classification and this method can be accessing using the public available database[2].

In this paper, the author focused on problem in degradation is due to quality and quantity of the crop is pest. This paper is aimed at developing the computer vision based automatic system for accessing the disease caused by pests in rice plant. This process includes 3 steps to detect the disease i.e., disease area of leaf, textural descriptor and colour moments are extract from the disease. Genetic algorithm can be used to detect the relevant feature to discard the redundant features. Here, the paper includes the artificial neural network(ANN) and support vector machine(SVM) are used to classification. The classification can be result in the accuracy of 92.5% of SVM and 87.5% of ANN[3].

In this paper, the author describing the developing an automated system to identify and classify the disease in different manner in an contaminated plant which are leads to the emerging research in agriculture. Identifying the result may depends on the quality and quantity loss in agriculture crops. In this paper, the rice is the most important crop in the india and which leads disease in badly and gave the bad impact on economy. They proposes the image processing techniques to give accurate result of disease caused by crop. Here, they uses the new technique to diagnose and classify the disease has been proposed in this paper. The feature of diseased crop can be extracted from the classified minimum distance classifier(MDC) and also uses the k-nearest neighbour classifier. The techniques used in this paper was give the better result by using k-NN of 87.02% and MDC of 89.23% accuracy[4].

In this paper, the author mainly consider the major disease in the rice crop is rice blast disease which is the very big problem in the country of agriculture sector. This disease which cause the huge economic loss in the agriculture field and also loss for the farmer. This can be detected and classifying using the machine learning algorithms to identify the symptoms of disease in the crop.

Here, the uses the techniques are image analysis algorithm and artificial neural network(ANN) to overcome from this disease by doing the automatic detection of plant disease through machine learning. The dataset can be divided into training and testing data for further classification. The training phase gives the accuracy of 99% and testing resulting of accuracy is 86% to 90% for infected and healthy images[5].

In this paper, the author described about the plant disease how they are harm the production of the crop and the market value that will lead to the huge loss economic. The leaf disease detection which play vital process in the field of agriculture. And it requires the huge man power, need the time of processing and which also need the good knowledge about the plant disease. This paper include the artificial neural network, classification of disease detection and support vector machine to access the disease of plants. And also the paper present the overview on the different kind of diseased plant and classification techniques in the machine learning[6].

In this paper, the author described about the nutrient content which is dependent while yielding the crops and also affect the health of the crop. The diseases crop can be classified into nitrogen, potassium, phosphorous deficiencies and healthy by neural network using the tensor flow model. Tensor flow is used to identify the deficiency using the set of images. The result can be access through the machine learning driven layer which will be estimate the deficiency level based on the quantitative. The paper mainly uses the k means-clustering algorithm to evaluate the rule matrix for developing the cropland yield[7].

In this paper, the author consider the image processing techniques in which that can be framework for the leaf inadequancy. Here, the author consider three main process for finding the disease as leaf image, extraction of features and classifying. Image processing consider the methodology called content based image retrieval(CBIR) for leaf classification. Considering the salient point from the image using the Local Binary Patterns(LBP) for computing the leaf disease and that also used to classify the features image of the diseased crop[8].

In this paper, the author consider the convolutional neural network method was developing to perform the detection of plant disease and also diagnosis the images of leaves in the form of healthy and diseased crop, this can be done using the deep learning techniques. This can be done using the open database of number of images with their different set of classes as plant and disease combination. This can be trained by the several architecture in the best result of performance[9].

In this paper, the author uses the deep learning techniques to detect the disease and pest in tomato plants. This can be done using the camera device of resolution using the images of plant disease. Here, mainly uses the three process i.e., faster region based convolution neural network(faster R-CNN), region based fully convolution network(R-FCN) and single shot multibox detector(SSD). Tomato disease and pests are the challenging images of disease and also include the inter and extra class variations which are classified as infection status and plant location[10].

III. Comparison of different method for crop disease detection.

Serial No	Title	Author and Year of Publication	Techniques	Drawbacks	Result
1	A Deep Learning Approach for on-site Plant Leaf Detection	Huu Quan Cap, Satoshi Kagiwada, Hiroyuki Uga and hitoshi Iyatomi[1] 2018	Deep Learning Convolution Neural Network	Increased of cost. Deep learning includes large amount of data. And it is also extremely expensive in dataset for training samples.	78% of performance.
2	Rice Disease Detection by Image Analysis	Sudarshan S. Chawathe[2] 2020	Image processing classification Machine learning	Its difficult to access the boundary of the leaf through the given method but it can be accessed from refined method	Image processing gives the good result of identify the disease of leaves.
3	Computer Vision Based Approach to Detect Rice Leaf Diseases using Texture and Colour Descriptors.	Bhagyashri S. Ghyar Gajanan K. Birajdar[3] 2017	Computer vision Gray level, Co-occurrence matrix(GLCM), Genetic algorithm, k-means clustering method and Support vector machine method, ANN	The k-means algorithm having the less consumption time and have average performance.	Accuracy between ANN and SVM is 87.5 and 92.5%.
4	Monitoring and Controlling Rice Diseases Using Image Processing Techniques	Amrita A. Joshi B.D.Jadhav[4] 2016	k-Nearest Neighbor classifiers, Minimum Distance Classifier, support vector machine	The SVM algorithm which does not support for the large dataset and it is also overlapping the classes of data.	Accuracy of two classifier of KNN and MDC is 87.02% and 89.23%.
5	Rice Blast Disease Detection and Classification using Machine Learning Algorithm	S. Ramesh D.Vydeki[5] 2018	Image analysis algorithm Artificial neural network(ANN)	Artificial neural network does not show the specific rule of the structured network. And it is difficult to show the problem to network.	Accuracy of 86% to 90%.
6	Machine Learning for Plant Leaf	L. Sherly Pushpa Annabel,	Artificial Neural Network Support Vector	SVM does not suitable for large database system	The supervised algorithm like fuzzy c-means

	Disease Detection and Classification	Annapoorani and P. Deepalakshmi [6] 2019	Machine		and KNN give better result in identifying the disease.
7	Crop yield prediction: two-tiered machine learning model approach	Sushila Shidnal, Mrityunjaya V. Latte and Ayush Kapoor [7] 2019	Image thresholding Neural network Tensor flow Ruled based matrix	The images should not accessed properly within the threshold level.	The prediction results in 76-77% of the identification of deficiency.
8	Classification of Rice Leaf Spot Disease using Local Binary Patterns	Sachin Kumar Amal Ghosh T A Sreekumar K [8] 2020	Local binary patterns Content based image retrieval	Recognize the leaf deficiency is the difficult task.	The LBP gives the better result and accuracy.
9	Deep Learning models for plant disease detection and diagnosis	Kanstantinos P. Ferentinos [9] 2018	Convolution neural network Plant disease detection Pattern recognition	CNN do not encode the object of position and orientation. Lack of ability invariant in input data.	This paper which provide best performance of 99.53%.
10	A Robust Deep-Learning -Based Detector for Real-Time Tomato Plant Disease and Pests Recognition.	Alvaro Fuents Sook Yoon Sang cheol kim Dong sun park [10] 2017	Deep convolution neural network Real-time processing	The CNN is slow in the case of operation and it takes lot of time while using number of layers continuously.	The CNN algorithm provide the better performance while identifying the diseased crop.

IV. CONCLUSION

The survey of the different papers studied have given special identification and classification techniques which have been summarized above. Each papers has its own methods in different manner, advantages and disadvantages by combining the various method have given the better results than others. As per the survey, we have analysed that the k-nearest neighbour classifier, support vector machine and artificial neural network methods having the good accuracy in detecting the plant disease thorough image processing. The different form of algorithm is to be used to identify and classified the disease through image. It also have review and comparison of various papers on plant disease detection. This comparison will help us to know the different form of methods to enhance the existing system and derive a new model to achieve the object of the system.

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