A Review of art about Leaf Disease Detection based on Deep Learning

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Abstract

Plant leaf diseases detection is the one of the major roles in the field of agriculture field. In traditional methods, the expert farmer was used to view the plant leaf and predict the diseases. Currently detection of plant leaf can be done by deep learning through image processing. This Paper will provide the details of plant leaf detection which consist of three major sections. First section describes about the plant leaf detection with definition. Second part describe about the classification of plant leaf detection with two types of diseases with image processing techniques. Third part consist of the various research describe about the technology used to determine the plant leaf diseases with appropriate of accuracy done through the experimental results. Finally, this paper provide the necessary details about the plant leaf diseases with various technology with deep learning algorithms.

Keywords: Plant Leaf Diseases, CNN, Deep Learning, Monocotyledonous, Dicotyledonous, CV, RP

Introduction

Leaf Disease Identification plays an important role in the field of agriculture and researcher started their research in order to develop agriculture field. Researcher mainly used various types of machines to capture the images of the leaf and determine the identification of leaf diseases which will be more help full for the farmers. This recent research based on machine learning technology will avoid the traditional methods followed by rural areas. Machine learning technology for prediction of leaf diseases can be either classified with image processing techniques or various classifier algorithm. This strategy usually makes a different aspect of algorithm of Leaf diseases with image processing techniques with appropriate light sources and the angle of shooting which will be helpful to obtain the images based on the illumination.

A Classical Algorithm design which reduces the complexity of fully constructed images which increase the cost of the applications. During the same situation, a environment based on natural with unrealistic to expect the algorithm designed based on the classical to eliminate the scene impact with results based on recognition. During the real time scenario, the environment based on the natural complex problem, plant leaf disease detection faced many challenges such as difference between area, contrast based on low, background and the image noise.

1. Definition of Leaf diseases

Plant Leaf Disease detection which act as one of the major kind of natural disaster which may affect the growth of the plant

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leaf and which may affects the death of the plant during the development of the process of plant from seed to seeding growth. Basic Definition of Leaf Plant diseases based on the machine learning techniques to be the aspects of experience of the human rather than definition of mathematical purely.

2. Classification of Plant diseases

The plant disease detection which is automated the system which recognize the various family which plant belongs. There are two types of plant family categories as shown in Figure 1.1
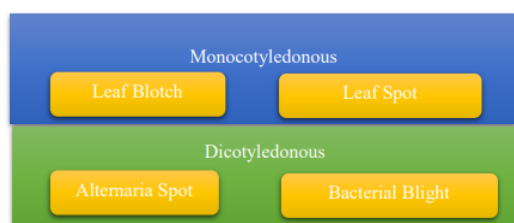

Figure 1.1 Types of Plant Leaf Diseases

a) Monocotyledonous plant family: Monocots the commonly characteristics were as follows
   a. One Cotyledon with seeds
   b. Parallel vein with narrow leaves
   c. Complex processes were arranged in the vascular bundles
   d. Plants leaves such as wheat, rice, onion, ginger belongs to these categories
b) Dicotyledonous plant family: The Dicot plant have common categories (N. N. P., 2016)are
   a. Two Cotyledons of the seed
   b. Nested veins with broad leaves
   c. Rings were arranged in the vascular bundles

d. Plant leaves such as rose, coffee, tomatoes and beans belong to this category

Different types of Plant leaves disease were discussed (B. S. Prajapati, 2016) in the following tables

	Leaf Blotch	Leaf Spot
Monocotyledonous Description		
	Brown Spots with regular/irregular with small oval	Gray Colour Bounded, Brown Colour Boundary
	Alternaria Leaf Spot	**Bacterial Blight**
Dicotyledonous		
	Small Irregular shape with brown color	Red spot with diameter of 1mm

Table 1.1 with classification of plant leaves.

From the following table described about the two types of plant leaf diseased with various categories based on their diseases.

3. Review of Plant Leaf Diseases

Yan Guo et.al (2020) Plant diseases (Guo, 2020)Identification is first step process to prevent the plant disease more effectively which preside in the environment made to be complex. Smart Farming techniques plays vital role in the field of agriculture were digitalized with data driven, which support the decision system with smart

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analyses during planning. This paper mainly focused with plant leaf disease detection with mathematical model along with deep learning using image processing techniques. These techniques which leads to improve the accuracy, efficiency with generality. The First Section of this paper proposed with "Regional Proposal Network (RPN)" used to recognize the plant leaf disease detection using image processing with the complex environment. These Image Processing techniques used to divide the image into segment based on the output of the RPN algorithm which contain symptom based on feature through Chan Vese (CV) formula. The Last section of this paper, the images which were segmented fed into the proposed algorithm which act as training learning model and the given dataset are trained with the given plant leaf disease with simple background. Hence the given model were determined by the rot with black colour, plaque contains bacteria and diseases based on rust. The Determined result proved with 83.57% of accuracy which compared with the traditional method. This process would lead the growth of crop yield by reducing the plant leaf diseases in the field of agriculture productions.

Akila et.al (2018) explain about Plant leaf diseases are a serious challenge in the agriculture sector. A quicker, more accurate prediction of these conditions can help initiate treatment more quickly and thus minimize economic losses. With the recent advancements in Deep Learning, researchers have been able to very improve the performance and accuracy of object detection and recognition systems. Using pictures of plant leaves from multiple plants to find leaf diseases, our goal is to identify and develop the appropriate deep learning methodologies for our task. Therefore, we

considered three main sets of using images of plant leaves. Faster "Region-based convolutional neural network (Faster R-CNN)", "Region-based totally convolutional network (R-FCN)" (Akila, 2018), and "Single Shot Multibox Detector (SSD)" were used for this work

Leaf diseases on plants can drastically reduce crop yields, so a sensor that's better able to detect the disease would be extremely beneficial. With recent advances in Deep Learning, plant leaf diseases are becoming easier to identify by computer with up to an 80% accuracy. This paper details how deep-learning-based methods helped solved this problem. The system accurately identified different types of disease and had an ability change complicated situations from a plant's environment.

Muhammad Hammad Saleem et.al (2020) Plant Leaf Disease Identification plays an impart role in the field of Monitoring system based on the crop. The Agriculture problem were determined by the digital world in the field of Computer Vision and techniques based on deep learning proved to be the fundamental art which address the agricultural problem. The main problem were researchers considered such as localization, classification of the plant leaf diseases which acts as a complex task. There are three techniques based on deep learning were applied in this paper to determine the meta architecture such as "Single Shot Multibox Detector(SSD),Faster Region Based Convolutional Neural Network (RCNN), and Region Based Fully Convolutional Network(RFCN)" (Saleem, 2020)applied with Tensor Flow Object used to detect the plant leaf detection. These Three Deep Learning model used to predict the trained /tested on environment with

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controlled dataset to the estimate the plant leaf disease.

The mean precision based on average were determined by the deep learning architecture through different optimizer techniques with deep learning. Adam Optimizer along with SSD Model were trained to produce the highest mean precision based on the average is 73.07% of map. The Identification with 26 different types of plant leaf disease were detected and healthy leaf with 12 types in a single framework with proposed work. Further, the proposed methodology to detect the plant leaf diseases which used to adopt the agricultural applications. The Generated plant leaf weight can be reused for real time detection under the controlled or uncontrolled environments.

Jun Liu et.al (2021) described about the major role in detection of plant leaf diseases. During the Recent decades various technology were introduced to detect the plant leaf disease in the field of agriculture. A Various successful application used to determine the plant leaf diseases using deep learning algorithm represented by Convolutional Neural Network. These deep learning algorithms used in various application like traffic signal, face recognition, medical image recognition, expression recognition and plant leaf detections.

Jun Liu proposed three types of methodology such as classification, detection and segmentation to detect the plant leaf diseases. Classification mainly focused with image category label in the grey pattern. Detection used to field the spot on the rectangle basis of plant leaf detection. Segmentation focused on plant leaf diseases by pixel by pixel. This paper proposed automatic learning with huge of data using CNN with high performance. This paper proposed (Liu, 2021)with three

types of deep neural network models such as "Deep Neural Network (DNN)", Deep Boltzmann Machine(DBM)", Stack Denoising autoencoder(SDAE)", and deep Convolutional neural network (DCNN)". Hence this proposed approach play an effective and efficient result in order to detect the plant leaf disease using convolutional neural network.

Vagisha Sharma et.al (2020) explained about the various classification techniques used to determine the plant leaf detection. The main objective of this paper (Sharma, 2020) to review the different classification techniques to estimate the detection of plant leaf diseases. This paper were classified into four section such that first sections provide a brief introduction about the plant leaf disease detection. Second section described about the important of plant leaf disease detection. Third section described about the methodology used to determine the plant leaf diseases. Final section used to address the proposed related work with the classification techniques described by the various researchers.

Yadav Nikita et.al (2021) explained about the important aspects of plant leaf disease detection in the agriculture field. Plant leaf diseases, the most common issues in reducing the quantity and quality of the plant leaf diseases. Detection and classification (Yadav, 2021)were the two process to detect the plant leaf disease, which improve the quantity and more productivity. The proposed research mainly focused with machine learning along with image processing techniques to detect plant leaf disease. This paper mainly focused with machine learning techniques such as Multilayer regression and regression algorithm. The main process of the proposed research work, plant leaf images which act as an input to the proposed

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research work. These images will be trained based on classification and detection to determine the plant leaf diseases.

Mohanty, Sharada P et.al (2016) described about the plant leaf disease, which acts as one of the main threats in security of the food productions. Mobile

devices (Mohanty, 2016)reduce the complexity task to determine the plant leaf disease using machine learning algorithm or deep learning techniques. This proposed research mainly focused with mobile application to determine the level of plant leaf disease detection using Deep learning algorithm. This proposed approach to train the image taken form the mobile which acts as an input and output will determined the percentage of plant leaf diseases.

Sandhu et.al (2019) explained about the major issues of plant leaf diseases which may affects the production, quality and quantity of the plant leaf in the agriculture field. This paper proposed with a review of plant leaf diseases. This paper proposed (Sandhu, 2019)a various techniques used in the image processing which includes four sections. The first section includes image acquisition which used to remove the unwanted noises from the images. The Second section which describes about image segmentation which used to extract the leaf part from the images. The Third section which includes feature extraction. The Final section used to determine the classification of image process. Hence four section used to determine the level of plant leaf diseases using deep learning with image processing.

From the review the following summary were generated from the tables

Author	Techniques/ Algorithm used	Outcome or accuracy Used
Yan Guo et.al (2020)	Region Proposal Network (RPN) Chan–Vese (CV)	Accuracy of the method is 83.57%, that is best than the standard methodology
Akila et.al (2018)	"Region-based Convolutional neural network (Faster R-CNN)", "Region-base Finally convolutional network (R-FCN)"	Identify by computer with up to an 80% accuracy.
Muhammad Hammad Saleem et.al (2020)	"Single Shot MultiBox Detector (SSD)", "Quicker Region-based Convolutional Neural Network (RCNN)", "Region-based totally Convolutional Networks (RFCN)"	Optimizer exhibited the very best "Mean Average Precision (mAP)"of 73.07%
Jun Liu et.al (2021)	"Deep Belief Network(DBN)", "Deep Boltzmann(DBM)", "Stack De-Noising autoencoder(SDAE)", "Convolutional Neural Network(CNN)"	Accuracy achieved 97.5% using Deep Learning methodologies.
Vagisha Sharma et.al (2020)	"Deep CNN"	Accuracy achieved 85.53% to 99.34%
Yadav Nikita et.al (2021)	"Multilayer Regressor", "Regression Algorithm"	Accuracy based on above 90% form the given data set
Mohanty Sharada P et.al(2016)	"Deep CNN"	The trained dataset with accuracy of 99.35% with Deep Learning
Sadhu et.al (2019)	Image Processing techniques using CNN	Image processing techniques with 99.66%

Table 4.1 : Review about the plant leaves diseases with deep learning

4. Conclusion

This paper conclude that a plant leave detection based on deep learning with conventional neural networks provides the necessary details with various algorithm and emerging technology. This technology of deep learning will play vital role to predict the plant leaf diseases which in turn useful to the farmer for their crop yield. This paper provides the details of the

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classification of leaf diseases and the definition of plant diseases with various research provided the details. This paper concludes to provide the necessary details of the plant leaf diseases with efficient usages of technologies.

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