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Using Artificial Intelligence for Plant Disease Classification Based on Convolutional Neural Network

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Abstract

The plant disease prediction is useful in increasing agricultural production. The plant disease diagnosis through deep learning is a branch of artificial intelligence (AI). It is very important to diagnose plant diseases to improve productivity in agriculture. The plant leaf disease analysis provides us a problem of plant leaf lowest accuracy. The plant for identifying plant disease is to prevent the yield loss of agricultural products. We have proposed a model to validate the data set of the various plants through image processing. The AI-based plant disease detection is very important for sustainable agricultural development. The diseased plant needs to be monitored manually. It requires a lot of work and too much expertise is needed to cope with the plant's disease in time. The proposed system Convolution Neural Network image processing is to predict the tomato plant diseases. Preprocessing is done in plant leaf image dataset image using Gaussian filter, and then data cleaning, data reduction, and classification are done in disease detection. This describes a method for predicting the disease of plants using the image of their leaves. Further, the algorithm used for the detection of plant diseases and final result of classification in plant disease prediction is described. This demonstrates the technical feasibility of CNN for plant disease classification and provides the accurate result for AI solutions.

Keywords: Artificial intelligence, Plant Disease Prediction and Convolution Neural Network

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Introduction

Phytopathology is the scientific study of the environmental conditions caused by pathogens and plant disease. Organisms that cause infections are fungi, bacteria, and virus and these organisms contain the viroid, protozoa, nematodes, and parasitic plant virus-like. In the present study, the aim is to develop technology in the agricultural field based on engineering technology. At present, crops are faced with many illnesses. Insect damage is one of the main causes of diseases. Because, insecticides are likely to be toxic to a particular bird and the insecticide has always not been proven effective. In addition to that, the food chain of the nature of the animal is destroyed. The usual practice normally adopted by plant scientists is to estimate the percentage of the diseased part of the plant (i.e., leaves and stems) based on the severity of the disease detected on a large scale with the naked eye. It will lead to artificial intelligence (AI) used disease processing methods to study plant diseases/traits. The method can reduce the errors made by a human expert to predict plant diseases.

The results of prediction and analysis diseased plant leaves have been used with the theory of engineering technology and mathematics. In the present study, the aim is to develop technology in the agricultural field based on plant disease that has some characteristics. Insect damage is one of the main causes of the disease. Particular effective destroy the food chain of the nature of the animal practice of plant scientists is to estimate the damage to the plant. The majority of the affected portion of the disease can be detected visually dry based on the leaves provides advanced technology for several methods to study plant diseases/traits using image processing. The study method, increased, can reduce the errors that a human expert has made to detect plant diseases. Here, we are using engineering and mathematical theory for analyze available results of affected leaf.

Related Work

A plant disease utilizing the tomatoes, and soon is an imaginative innovation that can improve the nation's quality and rural creation climate, soil, and because it is developed from the measure of sun-based radiation, like an assortment of factors, and Tomato plants won't stay away from the presence of the infection.[1] Lately, progress in vision will determine like tomato has gotten conceivable by profound learning. This investigation accommodates the prediction of proficient in tomatoes, which has built up an imaginative arrangement to recognize and the leaf tomato plant.[2]

Explicit assortments the reason for this framework are the infection. It is to discover the diggers and the objective mark of the leaf which has gathered under controlled conditions by utilizing an informational collection of leaves of the picture of the sores and sound tomato plants. The three sicknesses needs to be distinguished and a profound convolution neural organization needs to be developed. In cultivation, plant infections are the main criminal. Another tomato sickness can help agronomists and ranchers experience a strange phenomenon.[3]

Moreover, a few applications or frameworks are proposed by utilizing edge location innovations such as face acknowledgment,

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missing item locator, and the detection of the path ready for edge discovery which are significant highlights of an application or framework. Various classifications of dim qualities help distinguish the edge.[4] All in all, this examination utilizes the typical which executes the edge discovery calculation on a cloverleaf and present the yield to a screen. Symptomatic framework of leaf sicknesses is introduced in plants from color images using unaided neural organizations. The picture is handled utilizing the capacity of shading and surface.[5]

The framework chiefly comprises two stages. The element extraction interaction of the sickness dissects highlights with a dark level co-event grid, and surface component-based factual type. Strategies that can be utilized to forestall loss of the plant should be made possible by the ongoing plant illnesses.[6] The proposed model gives a mechanized technique to decide the sickness of the plant's leaves to the preparation by utilizing the picture informational index of leaves of the pomegranate. The test set is utilized to check whether the picture contribution to the framework includes the sickness. In this strategy, plant earthy colored spot illness is distinguished utilizing picture preparing and design acknowledgment strategies. Agrarian creation is extremely reliant on our nation's idea of the economy.[7]

It is perceived that the leaf is the answer for saving and diminishing the profitability of unfortunate harvests. It is the intention. Learning the leaf's sickness requires a great deal of work which is the limited measure of time needed for the expansion. The task's primary reason for existing is to screen the strength of the plant by empowering the programmed medication to pass the beagle bone dark plant to lessen the spread of the infection which depends on the surface of the leaves. It is to identify the leaves of the plant.[8] To shield and sicknesses, it is imperative to keep up the wellbeing and profitability of trees.

Plant infections are fundamental for illnesses for the executives in the ranch. In huge concession territories, the manual distinguishing proof is tedious due to subjectivity in deciding the conflicting examination.[9] Furthermore, the quantity of boundaries of the improved model is essentially more modest than that of the leaf structure.[10]

Materials and Methods

The proposed system conventional neural network (CNN) image processing is used to detect plant diseases. Prediction of diseases is done through several methods including image acquisition, image preprocessing, data cleaning, data reduction, and then classification. This describes a method for detecting the disease of plants using the image of their leaves. It also describes the algorithm functionality used in the prediction of plant diseases.

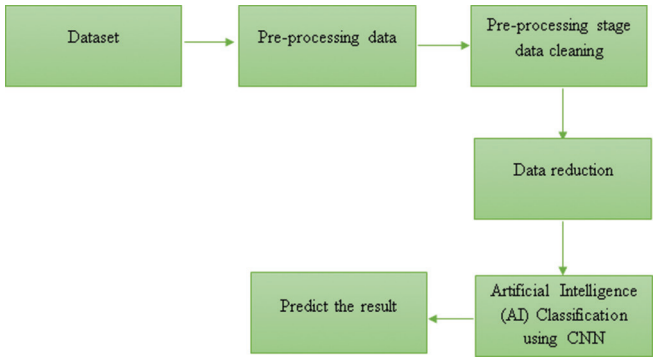

Figure 1: Proposed diagram

Figure 1 shows the analysis of the proposed diagram for detecting diseases, including image dataset, image preprocessing using Gaussian filter, data cleaning, data reduction, and classification. This describes a method for detecting the disease of plants using the image of plant leafs.

Dataset for Plant Leaf

The data set collection is the plant leaf disease image data collected from the information on the performance. Then, data cleaning and data reduction are done from the collected plant leaf dataset records. These data of the plant disease, plant leaf information for the leaf size, leaf color, quality, and then plant characters are collected from the dataset performance.

Process of Data Pre-processing using Gaussian Filter

There is usually no complete and consistent data in the real world, which cannot be used for direct data mining or the effect is not ideal. To improve the quality of data pre-processing, Gaussian filter is used data cleaning and data integration, data conversion, and data compression which are the many ways of preprocessing data. Before these methods, data processing technology is greatly used and the time required for actual image is to improve the quality of the result performance.

Process of Data Cleaning

The plant disease using correction data clearing process means identify the record set, table, database, incorrect, data inaccurate records, please replace, then replace, and delete data. This is divided that plant disease prediction analysis has been used in the process for the information theory in the plant leaf for change color and sizes that are divided into types which are to predict the data and descriptive data cleaning prediction deployed the data structure.

Data Reduction Process

The purpose is to reduce the data with a small compression volume data set, while maintaining its original integrity. This is an effective method but gives similar result, this is useful for data analysis and the data reduction can be used as a subset of the evaluation function by the classifier CNN algorithms which are used for the prediction of result. It takes advantage of the improved accuracy of selecting the functions related to the CNN algorithm performance.

Classification using CNN

The classification is performed using the proposed method CNN performance on the plant disease prediction. Prediction of diseases includes image data, data preprocessing, data cleaning, data reduction, and classification. This describes a method for detecting the disease of plants using the image of their levels. It also describes the algorithm and functionality used in the prediction of plant diseases. The plant leaf is to be classified for the prediction and classification. The result is input image dataset for preprocessing and data clean and reduction for the data performance. The final output is the plant disease prediction process which is used for disease identification in plant leaf.

Table 1: Analysis of accuracy performance

Number of data	*Existing SLR %*	*Existing RNN %*	*Proposed CNN%*
10	44	48	75
20	49	55	80
30	50	59	82
40	54	62	90

SLR: Support linear regression, RNN: Recurrent neural network, CNN: Conventional neural network

Table 2: Analysis of plant leaf prediction performance

Number of data	*Existing SLR %*	*Existing RNN %*	*Proposed CNN %*
10	44	52	65
20	46	55	70
30	49	59	80
40	50	63	93

SLR: Support linear regression, RNN: Recurrent neural network, CNN: Conventional neural network

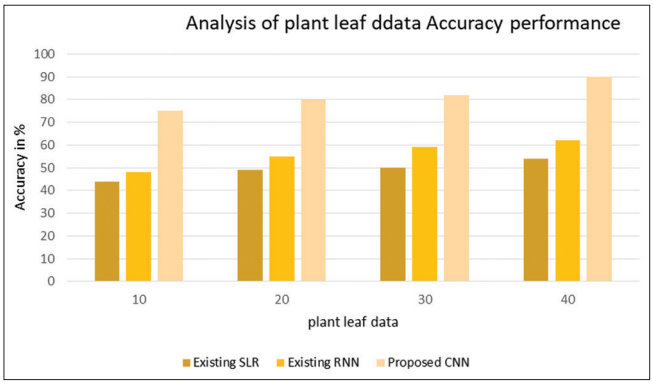

Figure 2: Analysis of accuracy performance

Algorithm Step

- Step 1: Initialization of the dataset
- Step 2: To collect the plant leaf dataset
- Step3: Then, data are pre-processed using Gaussian filter for datasets
- Step 4: The plant leaf data undergo cleaning and data reduction process
- Step 5: The proposed algorithm CNN is evaluated using AI for plant disease prediction performance
- Step 5: The result is successful.

Results and Discussion

The proposed system CNN for image processing is implemented for detecting a plant disease. Diseases detection include image dataset, image preprocessing, and classification. This describes a method for detecting the disease of plants using the image of leafs. Further, the algorithm is described for the detection of plant diseases.

Table 1 shows the analysis of accuracy level performance on the proposed algorithm CNN. Figure 2 shows the analysis of accuracy performance in the proposed algorithm CNN. The existing system support linear regression (SLR) provides 54 %, and recurrent neural network (RNN) provides 62%, and then, the proposed algorithm CNN provides 90% accuracy performance.

Table 3: Analysis of time complexity performance

Number of data	*Existing SLR (ms)*	*Existing RNN (ms)*	*Proposed CNN (ms)*
10	50	45	35
20	52	48	37
30	55	50	39
40	58	54	40

SLR: Support linear regression, RNN: Recurrent neural network, CNN: Conventional neural network

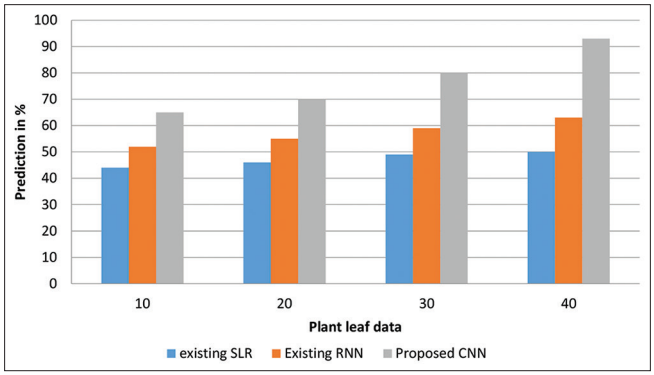

Figure 3: Analysis of prediction performance

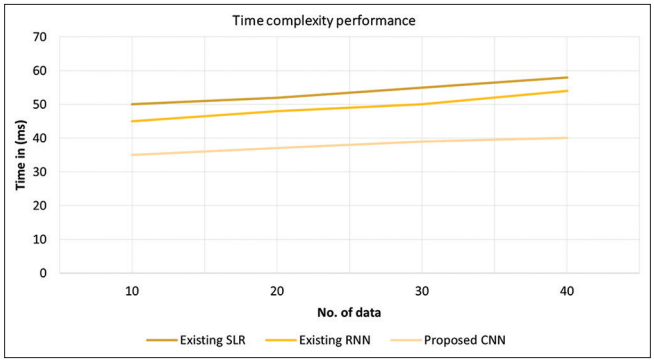

Figure 4: Analysis of time complexity

Table 2 shows the analysis of prediction level performance on the proposed algorithm CNN. Figure 3 shows the analysis of prediction level performance in the proposed algorithm CNN. The existing system SLR provides 50%, and RNN provides 63%, and then the proposed algorithm CNN provides the prediction performance of 93%.

Table 3 shows the analysis of time complexity level performance of the proposed algorithm CNN. Figure 4 shows the analysis of time complexity performance of the proposed algorithm CNN. The existing system SLR produces 58 (ms), and RNN produces 54 (ms), and then, the proposed algorithm CNN produces lowest time performance of 40 (ms).

Conclusion

The above information on the prognosis of plant diseases has been retrieved from the dataset. The AI is some statistical tests to find the possibility of the built-in data set, and the output prediction compared to the technology with the help of a data set. While comparing the technology make other technology, it is good. However, the accuracy of the sample is different taken from the data set. The AI-based plant

disease prediction is very important for sustainable agricultural development. The diseased plant needs to be monitored manually the plant disease prediction using CNN algorithm using for classification of performance. The proposed algorithm CNN result is 90% accuracy performance. The result is 93% prediction performance, (CNN) lowest result is 40 (ms) time performance.

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