Plant Leaf Diseases Prediction and Classification Using Optimization Based Convolution Neural Network

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Abstract - Plant leaf diseases and ruinous bugs are a significant test in the horticulture area. Quicker and an exact forecast of leaf diseases in plant could assist with building up an early treatment strategy while extensively decreasing financial misfortunes. Current progressed advancements in profound learning permitted analysts to amazingly improve the presentation and exactness of article identification and acknowledgment frameworks. A profound learning-based way to deal with recognize leaf illnesses in various plants utilizing pictures of plant leaves. The picture handling ventures for plant ill recognizable proof incorporate obtaining of pictures, pre-preparing, division and highlight extraction. Focus in predominantly on the most used order systems in ill location of plants, for example, Convolutional Neural Network, Support Vector Machine, KNearest Neighbor, and Artificial Neural Network. It has been seen from the examination that advancement Convolutional Neural Network approach gives better precision contrasted with the customary methodologies. Optimization based CNN convolution neural network the proposed framework can viably recognized various sorts of diseases with the capacity to manage complex situations from a plant's region.

Keywords – Deep learning, Convolutional Neural Network, Artificial Neural Network, Particle Swarm optimization (PSO)

1. Introduction
Agriculture is a significant wellspring of job in India. Greater part of the nation's populace is straightforwardly or in a roundabout way connected with the farming area. Henceforth, delivering top notch yield is significant to continue the nation's monetary turn of events. To get crops with better quality and efficiency the ranchers choose the correct items by observing and controlling the essential temperature, light and mugginess prerequisites [1]. Besides, the rural business has begun to search for better approaches for disease diagnosis and treatment. In any case, there are difficulties, for example, early ID of sicknesses in plants that the ranchers are battling with. To notice the sort of infection on the plant's leaf through unaided eyes is preposterous constantly, so a computerized master framework that will help recognize the sickness convenient would be very valuable. The headway in innovation, explicitly the utilization of picture handling in blend with the AI approach would help the ranchers regarding finding the plant illness in the underlying stages [2].

Deep learning establishes an ongoing, current method for picture handling and information examination, with exact outcomes and huge potential. As deep learning has been effectively applied in different spaces, it has as of late entered likewise the area of agrbusiness. So we will apply deep figuring out how to make an algorithm for robotized location and characterization of plant Leaf illnesses. These days, Convolutional Neural Networks are considered as the main technique for object identification.

2. Related work
In [3] have zeroed in principally on two CNN models for example AlexNet and Google Net and the training systems that have been utilized are move taking in and preparing without any training. The images utilized are from Plant Village dataset and around 54,306 images of various plants with 38 classes of diseases were taken. All the images in the dataset were downscaled into 256 × 256 pixels, and model optimization and forecasts were performed on the resized images.

The [4] have proposed a model for illness location of rice utilizing deep convolution neural organization. They have utilized 500 images caught with a camera from a field and 10 normal sicknesses in rice plants have been distinguished. The outcomes have been analyzed for various pooling (mean, max and stochastic pooling), distinctive convolution channel sizes (5X5, 9X9, 16X16, 32X32) and for various algorithms (CNN, BP, SVM, PSO).

In [5] proposed a framework dependent on two distinctive CNN designs for example Commencement v3 and MobileNets. They have utilized 56,000 images with 38 classes of harvests from the Plant Village dataset. A deep Convolutional generative ill-disposed organization (DCGAN) has been utilized for the increase of restricted images in the dataset.

The [6] have utilized various models of CNN, for example, AlexNet, OWTBn, Overfeat, AlexNet, VGG, and Google Net that were prepared utilizing different boundaries. The training and testing of these models were executed utilizing, which is a computational structure for AI. Around 87,848 images of Torch7Plant Village dataset having 25 plant species in 58 unmistakable classes of illness were utilized in this work. VGG and AlexNetOWTBn structures had the most noteworthy achievement rates when contrasted with others.

In [7] have incorporated Convolutional neural network (CNN) with auto encoders for discovery of diseases in harvests. The creators have used a dataset with 900 images of three yields with five distinct kinds of diseases, for example, early curse and late scourge for potato, leaf shape and yellow leaf twist for tomato and rust illness for maize
crop. The convolution channels of size 2 X 2 and 3 X 3 have been utilized and broke down exactness changes for various convolution channels for various numbers of ages [11 -12]. For misfortune decrease and improved exactness while preparing, Adam optimization agent has been utilized.

3. Existing System
Plants are considered as energy flexibly to humanity. Plant sicknesses can influence the farming which can be come about in to colossal misfortune on the harvest yield [8]. Along these lines, leaf diseases recognition assumes a crucial function in farming field. Nonetheless, it requires huge labor, additionally handling time and broad information and aptitudes about plant diseases. Subsequently, AI comes in play in the discovery of sicknesses in plant leaves as it breaks down the information from different regions, and arranges it into one of the predefined set of classes [9]. The highlights and properties like tone, power and measurements of the plant leaves are considered as a significant actuality for arrangement and the different kinds of plant diseases and diverse grouping strategies in AI that are utilized for recognizing illnesses in various plants leaf.

4. Proposed Work
The proposed work for plant diseases detection and classification using optimization-based convolution neural network

**Picture Pre-preparing:** To eliminate commotion in a picture, distinctive pre-handling methods are utilized. Cutting of leaf picture is applied to remove the district of the picture in which we are intrigued. The extricated plant leaf picture is moved to a computerized framework to eliminate the superfluous regions. Some basic strides of pre-preparing are: Resizing the picture, Noise expulsion from the picture, upgrade and smoothing of the picture [10].

**Image Segmentation:** This strategy for picture handling is utilized to parcel a picture into huge segments as indicated by comparable attributes. Different strategies are accessible for picture division, for example, limit and spot discovery algorithm, district and edge-based strategies, Otsu's strategy, thresholding methods and k-means grouping, and so forth.

**PSO based CNN classification**

The propose a novel algorithm dependent on particle swarm optimization (PSO), prepared to do fastconvergence when contrasted and others transformative methodologies, to naturally look for important deep Convolutional neural network (CNNs) designs for image characterization assignments, named optimization-based CNN.

The general structure of the proposed technique is outlined the dataset is part into a training set and a test set, and afterward a little subset of the training set is randomly inspected from the training set, which will be passed to the PSO developmental cycle. Moreover, the little subset is utilized during the PSO developmental cycle. The essential explanation of utilizing a little subset of the training set for wellness assessment is to decrease the computational expense since given CNN design; it takes less effort to prepare it and requires less memory when the dataset is more modest.

The primary target of this paper is to address the issue of looking for CNN models for picture characterization with a decent harmony between looking through speed and arrangement exactness. Hence, we present our own usage of PSO to address such an issue, which is called here as PSOCNN. Our main commitments are the flowing:

1. A novel PSO algorithm is suggested that can look for ideal designs in deep Convolutional neural network utilizing variable length particles with for all intents and purposes no size impediment. Particles are permitted to fill in size without an upper bound.

2. A novel differenceoperators is introduced that permits two particles with an alternate number of layers and boundaries to be contrasted and permits particles' speed with be refreshed without utilizing genuine esteemed encoding plans.

3. Anovel speedoperators is conceived that can be utilized to modify a given CNN engineering to take after the worldwide best individual in the multitude or its own best setup. This speed administrator permits us to utilize a practically standard PSO algorithm for looking, staying away from the utilization of multi-dimensional PSO algorithms.

4. A fasteralgorithm to discover important CNN structures than beforehand accessible ones. PSO has been appeared to meet rapidly than hereditary algorithms. By joining its quick intermingling with the capacity to look for CNN designs, the proposed algorithm can surpass best in class results taking less time than contending algorithms.

5. Results and Discussion
On the Plant Village dataset, the use of the proposed strategy was completed. It includes roughly 4930 images 986 images were saved for testing out of the 4930 images and 3944 images were utilized for preparing. To improve the informational index, Automatic information enlargement strategies were utilized. Figure 1 shows the plant diseases detection and classification using optimization based neural network.

**Performance measurements**

Precision, Specificity and affectability are determined to break down the presentation of the framework. These boundaries are determined utilizing genuine positive, genuine negative, bogus positive and bogus negative qualities. The boundaries are determined by Equations (1), (2) and (3). Table 1 shows the performance measurement.

\[
\text{Accuracy} = \frac{(TP + TN)}{(TP + TN + FP + FN)}
\]  
\[
\text{Specificity} = \frac{TN}{(TN + FP)}
\]  
\[
\text{Sensitivity} = \frac{TP}{(TP + FN)}
\] (1)  
(2)  
(3)
6. Conclusion
In this propose a novel algorithm to look for deep Convolutional neural network (CNNs) designs dependent on particle swarm optimization (PSOCNN). A tale straightforwardly encoding system is likewise proposed in which a CNN architecture ourresult show that PSOCNN can rapidly discover an optimization CNN design for any given dataset at last presume that PSOCNN would have the option to discover proficient exactness, accuracy and review contrasted with other existing algorithms.

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