Research and Reviews: Journal of Agriculture and Allied Sciences
e-ISSN: 2347-226X
p-ISSN: 2319-9857

Artificial Intelligence (AI) based Chilly Crop Disease Detection System

Nived Mangji, Gaurav Shet, Sameer Rane, Rajaram Parab*, Harish Velingkar, Chaitali Karekar, Laxmikant Bordekar, Vrushali Prabhudesa

Department of Electronics and Communication Engineering, Agnel Institute of Technology and Design, Assagao, Goa, India

Editorial

Received: 22-Jul-2023, Manuscript No. JAAS-23-107770; **Editor assigned:** 25-Jul-2023, PreQC No. JAAS-23-107770(PQ); **Reviewed:** 08-Aug-2023, QC No. JAAS-23-107770; **Revised:** 15-Aug-2023, Manuscript No. JAAS-23-107770(R); **Published:** 22-Aug-2023, DOI: 10.4172/ 2347-226X.12.2.003

***For Correspondence:**
Rajaram Parab, Department of Electronics and Communication Engineering, Agnel Institute of Technology and Design, Assagao, Goa, India
E-mail: 20lec07@aitdgoa.edu.in

Citation: Mangji N, et al. Artificial Intelligence (AI) based Chilly Crop Disease Detection System. J Agri Allied Sci. 2023;12:002.

ABSTARCT

The major cause for decrease in the quality and production of agricultural productivity is because of plant diseases. The detection and control of plant diseases pose significant challenges for farmers. Therefore, timely and accurate diagnosis of these diseases is crucial to enable farmers to take appropriate measures and prevent further losses. Early detection allows for prompt action, and thus, it is essential for farmers to be able to identify and diagnose plant diseases at the earliest possible stage. The work focuses on the approach based on deep learning for detection of diseases of chilly plants for two main leaf diseases i.e. curl leaf disease and bacterial leaf spot. This work proposes an Android application which will help farmers to detect chilly diseases by uploading leaf images to the system. The system has a set of algorithms which can identify the type of diseases and provide the necessary remedies for that particular disease. Input image given by the user undergoes several processing steps to detect the disease and results are returned back to the user *via* android application.

Keywords: Convolutional neural network; Leaf curl diseases; Chilly diseases; Bacterial leaf spot; Artificial intelligence; Diseases detection; Deep learning

e-ISSN: 2347-226X
p-ISSN: 2319-9857

EDITORIAL NOTE

Chilly plants play a significant role in many countries as a source of food, spices, and income. However, various diseases can impact the growth and productivity of these plants, leading to significant losses for farmers and the agricultural industry [1]. To mitigate these losses and support sustainable agriculture, early detection and management of diseases in crops is crucial [2]. The use of CNNs in plant disease classification has achieved excellent results in recent years [3].

The goal of this work is to develop an automated system for the detection of diseases in chilly plants, which can improve the efficiency, accuracy, and accessibility of disease detection and support farmers in making informed decisions about their crops. In this work two types of chilly diseases are taken i.e.

Leaf curl disease

It is a type of fungal infection that can result in the upward curling of leaf edges and a decrease in leaf size. The disease may also cause swelling of leaf veins and a reduction in the length of inters nodes and petioles. Older leaves become leathery and brittle, leading to stunting of plants with small- sized fruit clusters. If plants get infected with the disease at the beginning of the season, it will affect their growth and cause them to become stunted, leading to a substantial decrease in the amount of produce that they are able to yield. The presence of leaf curl infection in plants can be identified through various symptoms such as the leaves curling upwards, a wrinkled and folded appearance, decrease in the size of the leaves, blistering in between the veins, banding on the veins, shortening of stems and the spaces between leaves, leaves growing in a bunch, and severe stunted growth of the plant [4].

Bacterial leaf spot

Bacterial leafspot, caused by *Xanthomonas campestris pv. vesicatoria*, is the most common and destructive disease for peppers. Bacterium that can survive in seeds and plant debris from one season to another. Early symptoms show up as water-soaked lesions on leaves that can quickly change from green to dark brown and enlarge into spots that are up to 1/4 inch in diameter with slightly raised margins.

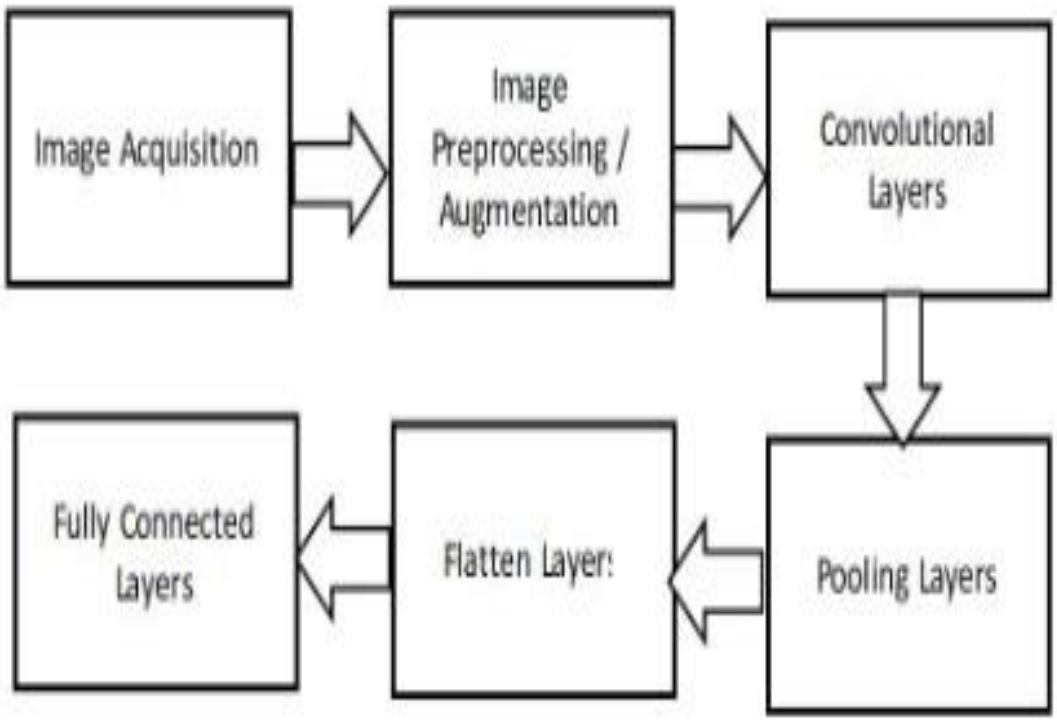
Over time, these spots can dry up in less humid weather, which allows the damaged tissues to fall, resulting in a tattered appearance on the affected leaves The aim of this study is to develop an automated system that uses deep learning techniques to identify diseases in plants. Deep learning is a category of machine learning that will be utilized in this study. A computer vision based system known as the plant disease detector has been developed for automated plant disease diagnosis, which utilizes deep learning techniques to accurately identify both healthy and diseased plants as well as the specific type of disease present. To accomplish this, a deep learning neural network such as the Convolution Neural Network (CNN) can be used to extract features from images, including horizontal and vertical edges, RGB values, and other visual characteristics [5]. CNN is considered the most suitable deep learning network for extracting visual features from images [13].

e-ISSN: 2347-226X
p-ISSN: 2319-9857

Design and implementation

Detection of diseases in chilly plants using deep learning involves the use of Convolutional Neural Networks (CNNs) or other machine learning algorithms to analyze images of chilly plants and identify any signs of disease. This is typically done by training the model on a large dataset of labeled images, where each image has been manually annotated with information about the presence or absence of a particular disease. Once the model has been trained, it can then be used to classify new images of chili plants and determine if there is any evidence of disease present. This can help farmers to quickly identify and treat diseased plants, reducing the spread of the disease and improving overall crop yields (Figure 1).

Figure 1. Block diagram of the process.



Data augmentation

It is a technique of artificially increasing the training set by creating modified copies of a dataset using existing data. It includes making minor changes to the dataset or using deep learning to generate new datapoints. Augmentation makes the model robust with better performance [6-8].

Data preprocessing

It is the preparing the data to be in a format that can be accepted by the neural network is a common initial step in deep learning workflow. preprocessing refers to the various manipulations and modifications that are carried out on the original data prior to its use as input for the deep learning algorithm.

Convolutional layers

Multiple convolutional layers are used to extract features from the input images. Each convolutional layer has multiple filters, and the output of each filter is passed through an activation function.

Pooling Layers: After each convolutional layer, a pooling layer is used to reduce the spatial size of the feature maps while preserving the most important information [9-11].

Flatten layer

After the final convolutional layer, a flatten layer is used to convert the 3D feature maps into a 1D vector.

Fully connected layers

Multiple fully connected layers are used to classify the input image. Each fully connected layer has multiple neurons, and the output of each neuron is passed through an activation function.

Table 1 shows that, out of the 180 images of bacterial leaf spot disease, the model has correctly identified 174 images, which represents a detection accuracy of 97.2%. Similarly, out of the 180 images of curl leaf spot disease, the model has correctly identified 177 images, which represents a detection accuracy of 98.8%. The model was trained on a dataset of 3211 images and achieved an accuracy of 97.2% in detecting Bacterial leaf spot and 98.8% in detecting Curl leaf [12,13]. The results of disease detection in chilly plants using deep learning can be depending on several factors such as the quality of the dataset, the complexity of the model, and the validation technique used. Generally, deep learning models have shown promising results in accurately detecting diseases in chilly plants (Table 1).

Table 1. Results obtained for samples detected.

Disease	Samples	Detected	Error	Efficiency
Bacterial leaf spot	180	174	6	97.20%
Curl leaves	180	177	3	98.80%

CONCLUSION

To prevent losses, farmers are dependent on a timely and accurate crop disease diagnosis. An app for detecting plant diseases was the end output. This service is free, simple to use, and only needs an internet connection and a smart phone overall; this study is conclusive in demonstrating how CNN may be applied to empower farmers in their fight against plant disease. The app can be used to detect diseases at early stages. The model can also be train to detect other kind of diseases.

REFERENCES

1. Patel A, et al. A survey on the plant leaf disease detection techniques. Int J Adv Res Comput Commun Eng. 2017;6:229-231.
2. Brahimi M, et al. Deep learning for tomato diseases: classification and symptoms visualization. Appl Artif Intell. 2017;31:299-315.
3. Husin ZB, et al. Feasibility study on plant chili disease detection using image processing techniques. IEEE xplore. 2012:291-296.
4. Singh R, et al. An analysis of deep learning techniques for plant leaf disease detection. Int J Comput Sci Inf Technol Secur. 2019;17:73-80.

e-ISSN: 2347-226X
p-ISSN: 2319-9857

5. Harte E. Plant disease detection using CNN. IEEE Xplore. 2020:1-8.
6. Chohan M, et al. Plant disease detection using deep learning. Int J Recent Technol Eng. 2020;9: 909-914.
7. Naik BN, et al. Detection and classification of chilly leaf disease using a squeeze-and-excitation-based CNN model. Ecol Inform. 2022;69:101663.
8. Atila U, et al. Plant leaf disease classification using EfficientNet deep learning model. Ecol Inform. 2021;61:101182.
9. Kessentini Y, et al. A twostage deep neural network for multi-norm license plate detection and recognition. Expert Syst Appl. 2019;136:159-170.
10. LeCun Y, et al. Deep learning. Nature. 2015;521:436-444.
11. Wahab A, et al. Detecting diseases in chilly plants using k-means segmented support vector machine. IEEE Xplore. 2019;27.
12. Lad K, et al. Review of dieases detection and classification for chilly Leaf using various algorithams. IEEE Xplore. 2019;20.
13. Razavian AS, et al. CNN features off-the- shelf: an astounding baseline for recognition. IEEE Xplore. 2014:806-813.