International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 02 | Feb 2023 www.irjet.net p-ISSN: 2395-0072

EARLY BLIGHT AND LATE BLIGHT DISEASE DETECTION ON POTATO LEAVES USING CONVOLUTIONAL NEURAL NETWORK

Dr. T. Praveen Blessington[1], Bhargav Krishnan[2], Yash Bharne[3], Kartiki Khoje[4], Prathamesh Padwal[5]

Department of Information Technology, Zeal College of Engineering and Research, Pune-41, Maharashtra, India

---

Abstract - *In order to provide the basic demands of food for the growing population worldwide, agriculture is a crucial industry. The growth of grains and vegetables, meanwhile, is essential to human nourishment and the global economy. As a result of their reliance on manual monitoring of grains and vegetables and their lack of correct knowledge and disease detection, many farmers cultivate in distant places of the world and incur significant losses. Digital farming techniques might be an intriguing way to swiftly and readily identify plant leaf diseases. This research suggests a method for identifying plant leaf diseases and taking preventive action in the agriculture sector utilizing image processing and Convolutional Neural Networks (CNN) in order to address these concerns. Automatic plant disease detection is growing in popularity as a field of study. It benefits the huge crop fields' surveillance and aids in spotting disease symptoms when they appear on the leaves. Here, a strategy for detecting plant diseases using CNN has been suggested. Techniques for image processing can be used to find plant diseases. Disease symptoms are typically visible on the fruit, stem, and leaves. The plant leaf is taken into consideration for disease identification since it exhibits disease signs. Deep learning has been used to utilize existing models that have been trained on a more general disease identification problem, and the results have been quite good.*

Key Words: **Disease Detection, Plant Leaf, Image Processing, Deep Learning, CNN**

1. INTRODUCTION

India is a developed nation where agriculture supports around 70% of the population. Farmers can choose from a wide variety of eligible crops and choose the right insecticides for their plants. Therefore, crop damage would result in a significant loss in productivity, which would have an impact on the economy. The most vulnerable component of plants, the leaves, are where disease symptoms first appear. From the very beginning of their life cycle until they are ready to be harvested, the crops must be inspected for illnesses. A variety of strategies have been used in recent years to produce automatic and semi-automatic plant disease detection systems, and automatic disease detection by simply observing the symptoms on the plant leaves makes it both simpler and more affordable. As of now, these methods have proven to be quicker, less expensive, and more precise than the conventional approach of manual observation by farmers. Many initiatives have been created to stop crop loss from diseases. Integrated pest management (IPM) tactics have replaced traditional methods of applying insecticides widely over the past ten years. Whatever the method, the first step in effective illness management is accurate disease identification when it first manifests. Deep learning (DL) algorithms are now primarily employed for pattern recognition because they have successfully identified various outlines. DL makes feature extraction automated. The DL achieves a high accuracy rate in the classification task and, when compared to other conventional machine learning methods, reduces error rate and computational time. With the assistance of Convolutional Neural Networks (CNN), the primary goal of our job is to identify plant illnesses and offer treatments for them. As a result, adopting technology and digitalization is essential for the agricultural sector to benefit both farmers and consumers. One can recognize diseases at their very earliest stages and remove them by using technology and routine monitoring. A higher crop production is desired. Deep learning has significantly outperformed conventional methods in the field of digital image processing in recent years. The use of deep learning in plant disease recognition can minimize the drawbacks associated with the artificial selection of disease spot features, make the extraction of plant disease features more objective, and accelerate the pace of technological advancement.

1.1 Risk Analysis

Image size: The size of the image affects how secure the program is. Smaller images give us less alternatives for choosing pixels, which cuts down on the time needed to extract the key from the image. In an image having a height of h and a width of w, there are w*h pixels in total. To extract the key from the image, the intruder or attacker must test all possible combinations of the pixels they choose. We can improve the security of the application by enlarging the image.

2. LITERATURE REVIEW

A previous study [1] uses a CNN model to classify the different plant diseases obtained from the Plant Village dataset. The AlexNet architecture which will distinguish the

different types of diseases of the plant into 38 various unique classes. Also, the proposed system gives a good solution to predict the diseases in the plant and can help in early identification of them. In the future, it is possible to work on different learning rates on the proposed system. [2] It focused how image from given dataset (trained dataset) in field and past data set used predict the pattern of plant diseases using CNN model. The system will cover the most sorts of plant leaves imaginable, allowing farmers to learn about leaves that may have never been cultivated and provide a list of all potential plant leaves, which aids them in choosing which crop to produce. In [3] the working model uses convolutional neural networks and transfer learning to classify different plant leaf diseases. CNN is a type of deep learning neural network and has good success in image-based classification. The proposed system is faster and more accurate than the conventional way of manual observation of each plant leaf. The CNN model is used to predict different plant diseases correctly. The model's testing is done using performance evaluation metrics such as accuracy, precision, recall, and F1 score.[4] The proposed system of Classification of Pomegranate Diseases Based on Back Propagation Neural Network which mainly works on the method of Segment the defected area and color and texture are used as the features The image captured is usually taken with a plain background to eliminate occlusion. For accuracy, the algorithm was compared to other machine learning models.

3. PROPOSED SYSTEM ARCHITECTURE

The conceptual model that describes a system's structure, behavior, and other aspects is called system architecture. A formal description and representation of a system that is set up to facilitate analysis of its structures and behaviors is called an architecture description. System architecture can be made up of designed subsystems and system components that will cooperate to implement the whole system. In this section, we'll examine the many procedures that must be followed in order to develop and use various classifiers and obtain the most likely outcomes. We will use the model that produces the best results and accuracy for detecting leaf disease out of all the varied results and accuracies produced by different models.

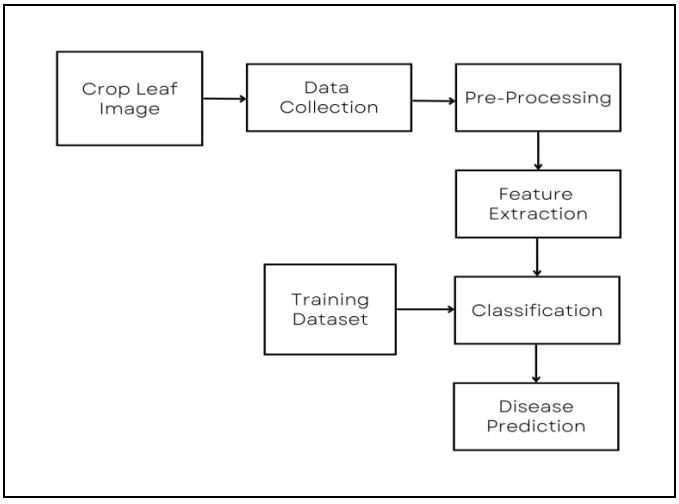


Fig 1: Proposed System Architecture

Preprocessing and data cleaning: Preparing data for analysis entails eliminating or changing any information that is inaccurate, lacking, irrelevant, duplicated, or formatted incorrectly. However, as we already indicated, it is not as straight forward as rearranging certain rows or deleting data to make room for fresh information. To prepare raw data in a format that the network can accept, preprocessing data is a typical first step in the deep learning workflow.

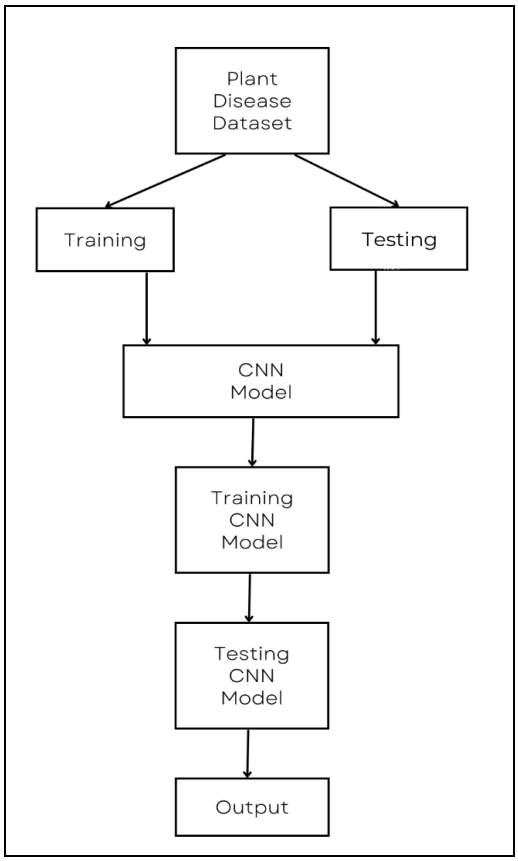


Fig 2: Classification System Architecture

4. PROJECT DESIGN

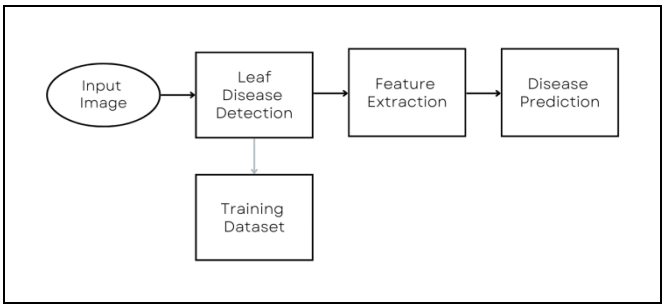
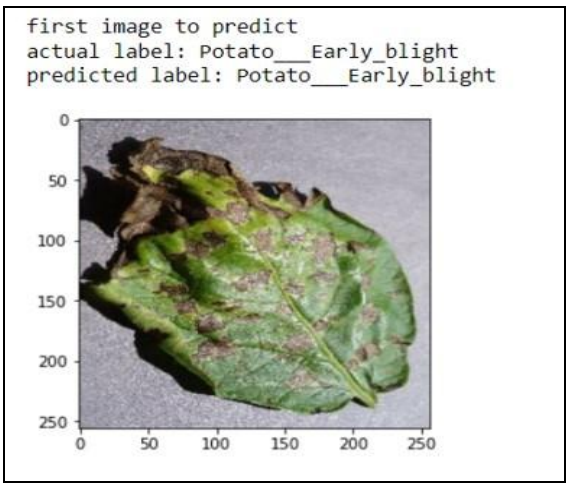


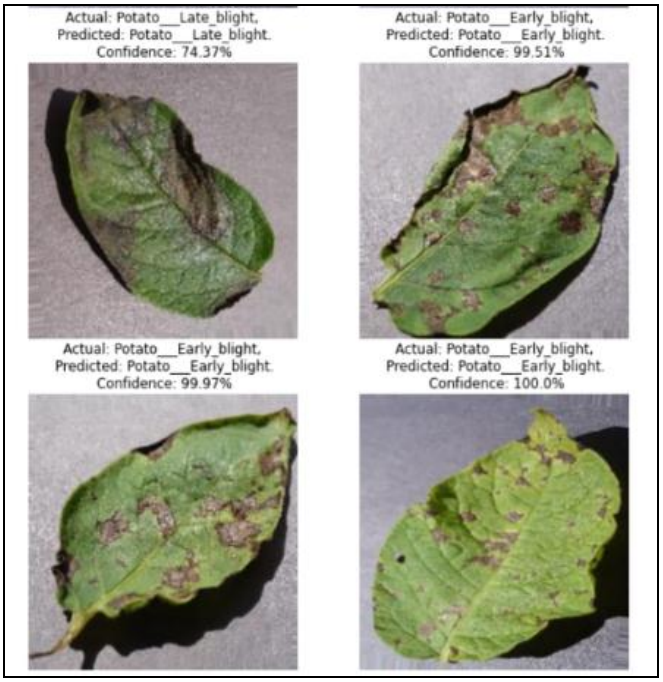
Fig 3: Data Flow Diagram

Here, training dataset is used to test the input image initially. Features are extracted from the image after testing. Following that, the classifier received these traits as input along with the knowledge of whether the image depicted a healthy or diseased leaf. The classifier then discovers the connection between the features that were retrieved and the likelihood that a disease is present. The following stage involves comparison of input image with the dataset's pre-existing images and on the basis of comparison, the leaf disease is identified.

5. EXPERIMENTAL RESULTS

The Trained model is used for prediction of the disease by which leaf of plant is affected. The np.argmax function of the numpy library is used for finding the highest probability from the batch prediction of the disease having the highest probability in order to provide the more accurate results. The actual and the predicted label of the image is compared to calculate the confidence. The results are displayed with their respective actual and predicted values along with accuracy or confidence after the code block.





6. IMPORTANT LIBRARIES/PACKAGES

Keras: The open-source software program known as Keras offers a Python interface for artificial neural networks. Keras offers the TensorFlow library interface.

TensorFlow: A machine learning and artificial intelligence software library called TensorFlow is open-source and cost-free. Despite being applicable to a wide range of activities, deep neural network training and inference are given particular emphasis**.**

ResNet: This design developed the Residual Blocks concept to deal with the vanishing/exploding gradient issue. In this network, we use a technique called as skip connections. The skip connection skips a few levels between them to connect the activations of one layer to the next. Consequently, a block is left over. To form ResNets, these leftover blocks are layered.

7. CONCLUSION

Image processing and machine learning methods are used to detect and identify leaf diseases. The discovery makes it easier to identify plant illnesses at an early stage, preventing crop loss and the spread of disease. This algorithm's goal is to detect anomalies on plants in their natural or greenhouse environments. To avoid occlusion, the image is typically taken with a plain background. The convolutional neural network is used to identify plant diseases with greater precision. When trained on a large number of photos and adding additional local features, accuracy can be improved.

REFERENCES

[1] "Recognition of Plant Diseases using Convolutional Neural Network" | G. Madhulatha, O. Ramadevi | Proceedings of the Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) | IEEE 2020

[2] "Detection of Plant Leaf Diseases using CNN" | S.Bharath, K.Vishal Kumar, R.Pavithran, T.Malathi | IRJET 2020

[3] "Plant disease classification using deep learning" | Akshai KP, J.Anitha | 3rd International Conference on Signal Processing and Communication (ICPSC) | IEEE 2021

[4] "Plant Disease Detection Using Machine Learning" | Mr. P V Vinod, Mr. Ramachandra Hebbar, Niveditha M, Pooja R, Prasad Bhat N, Shashank N | International Conference on Design Innovations for 3Cs Compute Communicate Control | IEEE 2018

[5] "Machine Learning for Plant Leaf Disease Detection and Classification – A Review," | L. Sherly Puspha Annabel, | International Conference on Communication and Signal Processing | IEEE, 2019.

[6] "Detection of Potato Diseases Using Image Segmentation and Multiclass Support Vector Machine," | Monzurul Islam, Anh Dinh, Khan Wahid, | CCECE, IEEE, 2019.

[7] "A Review on Machine Learning Classification Techniques for Plant Disease Detection" | Mrs.Shruthi U, Dr.Nagaveni V, Dr.Raghavendra B K | ICACCS, IEEE, 2022.

[8] "Detection and Classification of Groundnut Leaf Diseases using KNN classifier" | M. P. Vaishnnave, K. Suganya Devi, P. Srinivasan, G. ArutPerumJothi | IEEE, 2019.

[9] "Machine Learning for Plant Leaf Disease Detection and Classification – A Review," | L. Sherly Puspha Annabel | International Conference on Communication and Signal Processing | IEEE, 2019.

[10] "Plant Disease Detection Techniques: A Review," | Gurleen Kaur Sandhu, Rajbir Kaur | ICACTM, IEEE, 2019

BIOGRAPHIES

[1]Dr. T. Praveen Blessington
Professor, IT Department, Zeal College of Engineering and Research, Pune. He is having 17 years of experience in teaching and research. His areas of interest are VLSI Design, IoT, Machine Learning and Blockchain technology. He has published 25 research papers so far.

[2]Bhargav Krishnan
Pursuing Bachelor of Engineering in Information Technology from Zeal College of Engineering and Research, Pune-41.

[2]Yash Bharne
Pursuing Bachelor of Engineering in Information Technology from Zeal College of Engineering and Research, Pune-41.

[4]Kartiki Khoje
Pursuing Bachelor of Engineering in Information Technology from Zeal College of Engineering and Research, Pune-41.

[5]Prathamesh Padwal
Pursuing Bachelor of Engineering in Information Technology from Zeal College of Engineering and Research, Pune-41.