

The Utilization of DenseNet121 for Analyzing and Classification of Leaf Image

Geluvaraj B¹, Anil Kumar K N² and Vishveshvaran R³

^{1,3}Department of Computer Science and Engineering, New Horizon College of Engineering, Bangalore, India
Email: geluvaraj999@gmail.com, rvishwa248@gmail.com

²Department of Information Science and Engineering, Rajeev Institute of Technology, Hassan, India
Email: akanilgowda@rithassan.ac.in

Abstract—Now the issue of agriculture has become a significant concern in our modern times. The growth of crops and plants is hindered by numerous challenges, and one of the most pressing concerns is ensuring their health. Agriculture plays a pivotal role in human life and the economy, and poor management practices can lead to significant losses in agricultural output. To address this problem, a deep neural network approach for detecting plant leaf diseases has been developed as an alternative to the Densenet121 neural network. This can easily detect the disease of plant leaf. First select the plant village dataset and apply into pre-processing method. In this part it is very useful to identify the disease, then it will process into model selection and classification. In classification it will train the dataset and the disease can analyse and show the status of plant leaf that is healthy or unhealthy. The disease can be detected in the image of plant leaf. In this study, a publicly available dataset of both healthy and diseased plants is employed to classify crop species and identify the presence of various illnesses across different classes. To achieve this, Densenet121 is utilized. The predicted result based on accuracy.

Index Terms— Plant Leaf Disease Detection, Deep Learning (DL), Densenet121, Accuracy, Symptoms, Conventional neural network (CNN).

I. INTRODUCTION

The leaves of plants are very significant part and tend to expose defect behavior at the early stage. It is essential to monitor crops for diseases at the earliest of their growth life until they are ready to be cultivated. Previously farmers used the naked eye method of observation traditionally, which was done by experts and time-consuming for monitoring the crops. However, nowadays, several methodologies are being developed to enhance detection system which does not require human help. By using this technology by just seeing the plant leaves it detects the defects, making the process effortless and less price. Such methodology has been found to be speed, less cost and then the traditional technique of manual detection by farmers this gives precise results. Disease symptoms in most of the cases are visible on the fruit, leaf and stems. Farmers often lack complete knowledge about the crops and the diseases that can affect them. Therefore, this research can effectively be utilised by farmers to increase profit by identifying and detecting diseases using image processing technologies.

A new system is proposed here that uses a feature-based approach to detect diseases in plant leaves. The goal is to improve accuracy and portability to mobile devices, which previous work has struggled with.

The system is based on a Plant Village database with 38 classes, and is able to identify healthy and diseased

leaves, categorizing the latter into known diseases from the database.

To identify new symptoms or diseases, they need to be added to the database and the system retrained. The system aims to find the affected part of the plant using CNN in a cost-effective manner. The solution considers five fundamental categories of plant leaf disease, including Bacterial Blight, leaf spot, and Healthy Leaves, which are all types of fungal, viral, or bacterial diseases [1]. The system also identifies the percentage of affected area and the specific disease present. Additionally, the system provides a direct link to an e-commerce website where users can purchase the appropriate medicine for the detected disease by comparing rates and following the provided directions.

The primary objective is to identify the affected area of the plant. For this purpose, convolutional neural networks have been employed to classify the diseased part. The goal is to detect the diseased part efficiently and cost-effectively [3]. The focus of this study is on five key categories of plant leaf disease, including good leaf, spot of the leaf, bacterial leaf. All of this defect comes under bacterial, viral, and fungal. The percentage of the defect area and finding the disease is proposed.

II. RELATED WORK

The research conducted by Rishi Kranth, Lalitha, Basava, and Anjali focuses on forecasting leaf diseases by making use of ML methodology. The study used a dataset consisting of eleven columns and three hundred and ten rows. The researchers utilized various methodologies, such as DSC, NB, CNN and created distinct plots such as plot box and plot bar [5]. These methodologies are performed here to point out possible result of the forecasting some statistical tests are carried out by making use of some datasets which are inbuilt and with the use of dataset methodologies are compared. By comparing methodologies, other methodologies might be weak or strong. From each one of the sample availed the accuracy differs from dataset. This research has an advantage of identification of defects affected upon plants is method of automation is one of the significant observation areas because it shows many advantages in fruit saving.

Disadvantage of this observation is to determine size of the fry when utilizing DL, there are various type of fish but their posture of stage of the growth and structure are different slightly, for collection data and training of DL this are highly required.

G. H. Agarwal, Prof. S. H. Galandie, Shailaka R. Loundhe research on “Leaf disease Detection and Climatic Parameter Monitoring of Plants Using IoT”.

Indicating usage for IoT they have developed an architecture used for common climatic parameters observation conditions by technique for less work effort, detecting framework effectively accessible [10]. The interlinking modules developing estimation of solid of parameters by transmission and knowledgeable sensors of information via network is displayed in direct localism. They realised that there is need to advise herder by surveying previous researches regarding wellbeing status of field through web all results are directly sent to agriculture expert via letters sending charge Matlab.

This research has an advantage of this architecture naturally detects the defects of side effects when grow on plants and controlling considerable zone of profits.

Disadvantage of this research is they rely heavily on the internet and are unable to function effectively without it.

R.E.Scaphire research on “The boosting approach to machine learning: An overview” in estimation of Nonlinear and classification provides an introduction to boosting, a method for improving the accuracy of learning algorithms [12]. The main focus is on the AdaBoost algorithm, and the chapter provides an overview of recent research on boosting. This includes analysis of generalization error and AdaBoost's training error, the linkage among linear programming and game theory for multicast categorization problems techniques for aligning with knowledge of human into boosting, and applied work and testing using boosting.

Non-parametric classifiers, including neural networks, have multiple benefits than parametric separators discriminant researches. In this research, authors compared the accuracy, model building time, and required training dataset size of three neural network models [7]. However, a common issue in automatic diagnostics is the need for fast and accurate algorithms that can produce correct results without lengthy processing times.

Ben-Hur, D. Horn, Siegelmann, Vapnik research on “Support vector clustering”.

In this method, points of the data are transformed onto a high-dimensional functionality space using a Gaussian kernel, and to discover the minimum enclosing sphere in this particular space is the aim [14]. By mapping the sphere back to the original data space, the data can be separated into several distinct clusters. The methodology for determining the cluster are direct, with the Gaussian kernel width determining the measure of the data analysis and the constant of soft margin used to address issues of overlapping clusters and outliers.

The authors explored by varying 2 parameters the skeleton of a dataset, while balancing a minimum points of support vectors to ensure boundaries of the cluster to be smooth.

One unique benefit of this methodology is its ability to generate arbitrary shape of the boundary's groups, as opposed to other methodologies that rely on a geometric representation of the shapes, which are usually hyper-ellipsoids.

Disadvantage of this research is the whole adjacency matrix does not compute, but only adjacencies with support vectors.

III. FLOW DIAGRAM

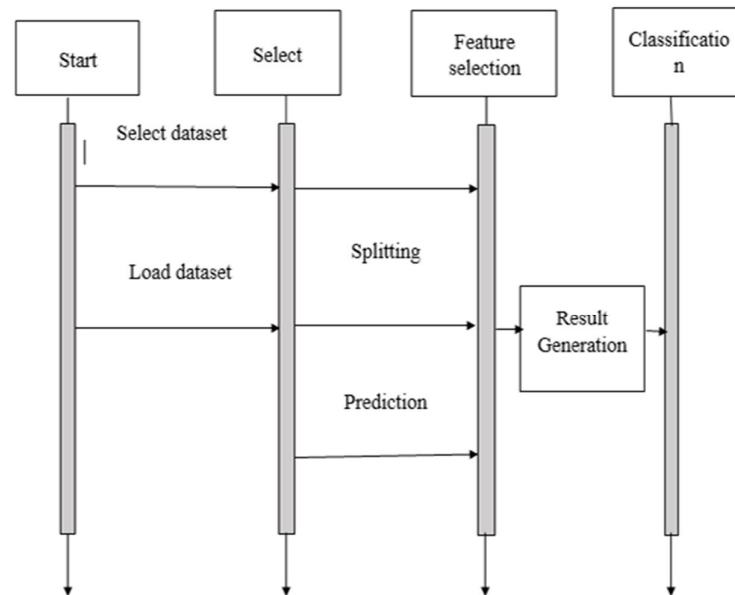


Fig 1: Workflow Diagram

A. Loading and Data Selection

- The process of selecting the data for PLANT VILLAGE dataset is known as data selection.
- In this research, LEAF digital images are used to classify the disease.
- The dataset which contains the information about the plant leaf disease digital images.

B. Data Preprocessing

- Image Data pre-processing is the method of obtaining from the dataset is called rescale data.
 - ❖ Resizing the image dataset
 - ❖ Getting data inputs
- Resize image dataset: Rescale the leaf digital images size into 64*64.
- Acquiring data involves understanding that categorical data is represented by variables that have a finite set of values. Furthermore, it is important to note that input and output variables are essential for deep learning techniques array format.

C. Splitting Dataset into Train and Test Data

- Splitting of data refers to the process of dividing existing data into 2 parts, often for cross-validation.
- One of the data part is utilized to enhance a forecasting model, while the rest of them is used to assess the performance of the model.
- When evaluating image processing models, it is essential to separate image data into sets of testing and training.
- In general, most of the image data is commonly utilized for training purpose, while a minimum portion of the data is used for research purposes.

D. Classification

The DenseNet121 architecture is designed to make deep learning networks by making use of minimum connections between layers is high handful to train. Each one of the layers in this CNN are linked to all rest of the layers that are extensive in the network, allowing for maximum information flow. To preserve the network of the feed-forward, from all the previous layers each layer retrieves inputs and own feature is passed and to all the layers that come after it are mapped. DenseNet121 is optimized to go even deeper than other architectures, such as ResNet, by reducing the number of required parameters while maintaining high accuracy.

E. Prediction

- Through using dataset, a prediction of the leaf disease is developed.
- By optimising the total prediction outcomes, this project will successfully forecast the data from the dataset.

F. Result Generation

Based on the entire prediction of predict and classification, the final output will be obtained. Making use of some metrics the usefulness of the strategy suggested such as,

- Accuracy

IV. SEQUENCE DIAGRAM

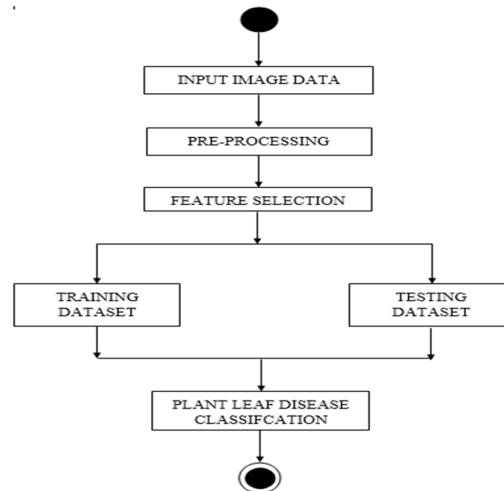


Fig 2: Sequence Diagram

Step 1: Starting with input image data for the system to process it.

Step 2: Pre-Processing is processing the input image into format that is effectively processed in data mining, machine learning. This step is used to ensure the accurate results.

Step 3: A feature represents each column in the dataset. To make sure that only the essential features are used for training an optimal model. The model will capture irrelevant pattern and train from noise. Feature selection is the method of choosing the important parameters.

Step 4: Training dataset is the process which teaches how the expected output looks like. To deeply understand its characteristics the model analyses the dataset and adjusts itself for better performance.

Step 5: Another subset of original dataset is the test dataset, which is not dependent of training dataset. Some similar types of features and class probability distribution. Once the model is trained completely this test dataset then uses it as a benchmark for evaluation of model.

Step 6: Classification of plant leaf diseases after the complete analyses of the input image data.

V. RESULT

The classification method is used to analysis the remote sensing scene from images. Based on accuracy of the result of the deep learning technique of DENSENET121 is used and predicted. The accuracy has been seen between 97-98%.

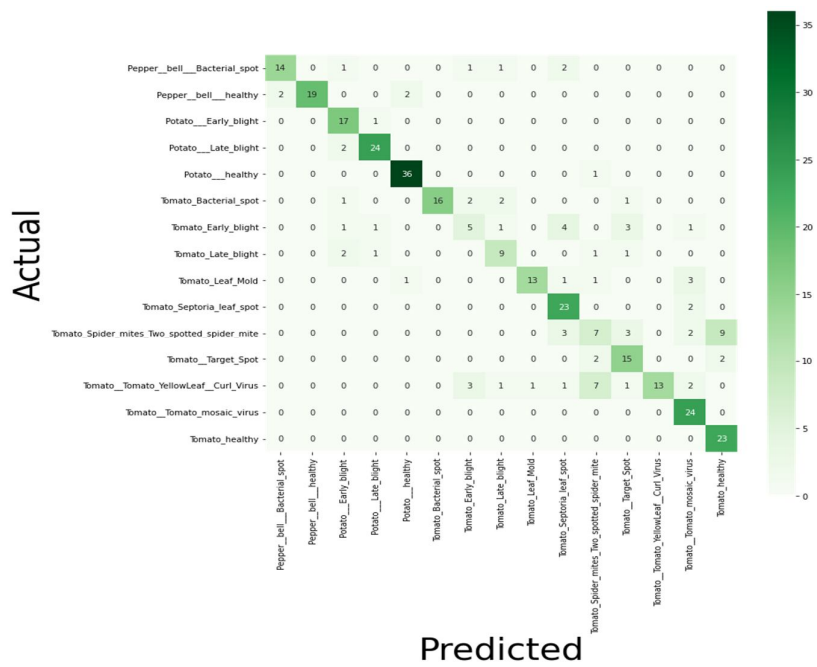


Fig 3: Result 1

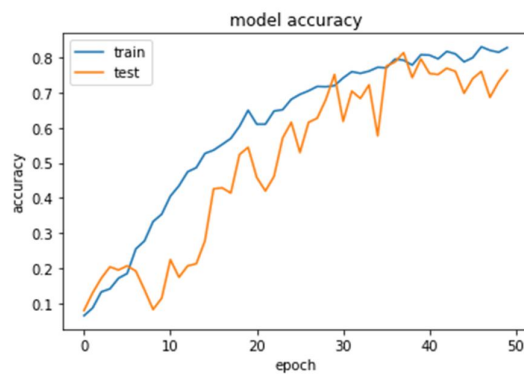


Fig 4: Result 2

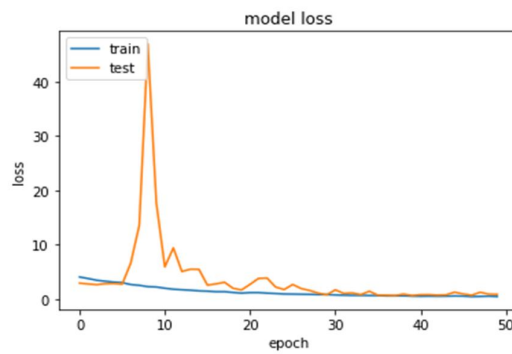


Fig 5: Result 3

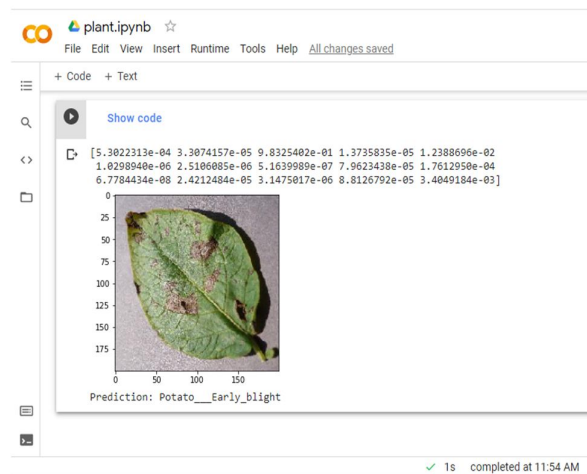


Fig 6: Result 4

VI. CONCLUSION

The aim of this research is to analyze plant leaf disease images using a deep learning classifier. To achieve this, we use the PLANT VILLAGE dataset as input data, which undergoes a pre-processing method. The images size are altered during pre-processing and changed into arrays. Subsequently, the dataset is separated into testing and training datasets and processed using a feature selection method. After that all the images size are altered and convert into array. Finally, the classification method is used to analysis the remote sensing scene from images. Based on accuracy of the result of the deep learning technique of DENSENET121 is used and predicted.

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