Plant Disease Identification using Densenet Architecture

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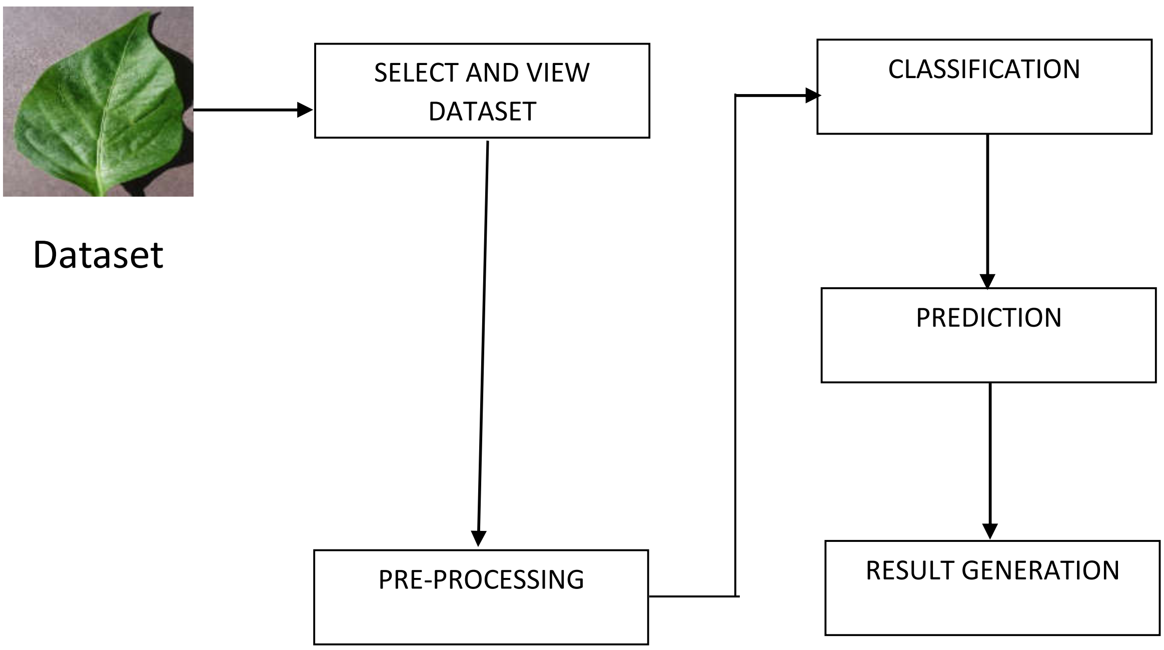
Abstract:

Last year during monsoon season, plants in our house were affected regularly and we were not able to identify what kind of disease it was. So, we decided to develop a project to overcome this difficulty. The main aim of this project is to identify the type of disease affected in the plant using the Plant Village Dataset, The objective of this project is to find out what kind of plant it is and to check whether the plant is healthy or not healthy. If it is unhealthy then it will detect what kind of disease the plant is affected. The software used is Anaconda-Spyder and DenseNet architecture is used to achieve higher accuracy for classifying different plant images. The images are pre-processed and it gets classified and the outcome will be whether the leaf is infected or not. If it is infected it classifies what kind of disease the plant is affected. This project can be further improvised by reducing the run time, and also the accuracy can be further improved.



1.Introduction:

Plant diseases are a major threat to food security, but their rapid identification remains difficult in many parts of the world due to the lack of the necessary infrastructure. Due to the Advancement in computers it has been made possible by deep learning using various architectures. Using a public dataset of 39,443 images of diseased and healthy plant leaves collected under controlled conditions, we can train a deep convolutional neural network to identify 9 crop species and 24 diseases.

Leaves being the most sensitive part of plants show disease symptoms at the earliest. The crops need to be monitored against diseases from the very first stage of their life-cycle to the time they are ready to be harvested. Initially, the method used to monitor the plants from diseases was the traditional naked eye observation that is a time-consuming technique which requires experts to manually monitor the crop fields. In the recent years, a number of techniques have been applied to develop automatic and semi-automatic plant disease detection systems and automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper. These systems have so far resulted to be fast, inexpensive and more accurate than the traditional method of manual observation by farmers In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is considered which shows the disease symptoms. There are many cases where farmers do not have a fully compact knowledge about the crops and the disease that can get affected to the crops.

S.No	Class	Disease	No.of normal images	No.of unhealthy images
1	Apple	3	1645	3000
2	Cherry	1	1000	1052
3	Corn	3	1162	3192
4	Grape	3	1000	3639
5	Peach	1	1000	2297
6	Pepper Bell	1	1478	997
7	Potato	2	1000	2000
8	Strawberry	1	1000	1109
9	Tomato	9	1500	11372

Considering our South Indian culture we have taken Potato ,Tomato and Pepper Bell in our project as these plants are suitable for growing in our climatic conditions.

2.Existing Methodology:

In existing system propose a Long Short Term Memory neural network algorithm to accomplish the leaf disease classification task. Plant disease recognition is an interesting and practical topic. However, this problem has not been sufficiently explored due to the lack of systematically investigation and large-scale dataset. The most challenging step in constructing such a dataset is providing a reasonable structure from both the agriculture and image processing perspective.

2.1. Disadvantages:

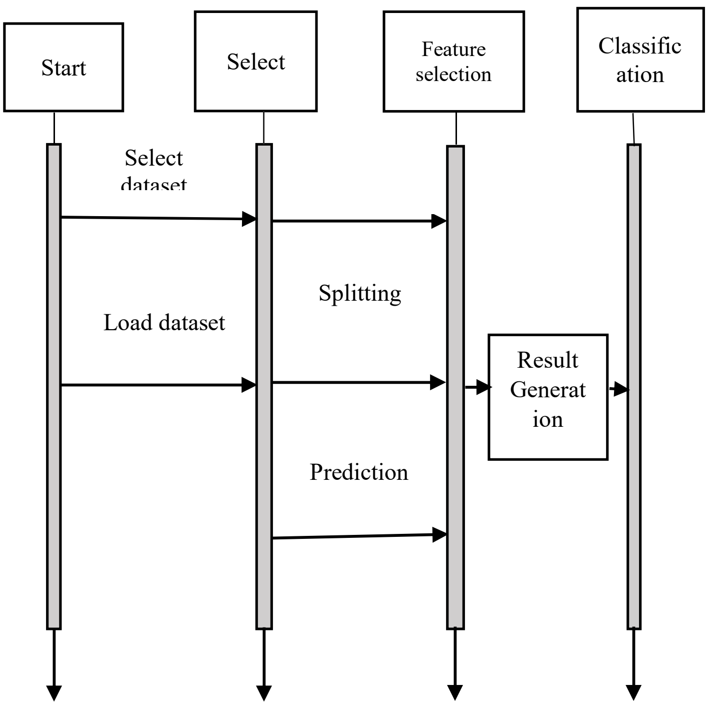
- It convert the images as a data frame and predict using data mining technique.

- LSTMs are prone to over fitting and it is difficult to apply the dropout algorithm to curb this issue.
- Dropout is a regularization method where input and recurrent connections to LSTM units are probabilistically excluded from activation and weight updates while training a network.

3.Proposed Methodology:

The proposed model is introduced to overcome all the disadvantages that arise in the existing system. This system will increase the accuracy of the neural network results by classifying the leaf disease digital image dataset using Deep learning algorithm. It enhances the performance of the overall classification results. Predict the leaf disease image is to find the accuracy more reliable.In deep learning algorithm we are using DENSENET121 which improves the screening accuracy using digital images and also uses a less time duration to identify the disease from the leaf images.

3.1 Sequence Diagram:



3.2 Modules Description:

DATA SELECTION AND LOADING:

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

DATA PREPROCESSING:

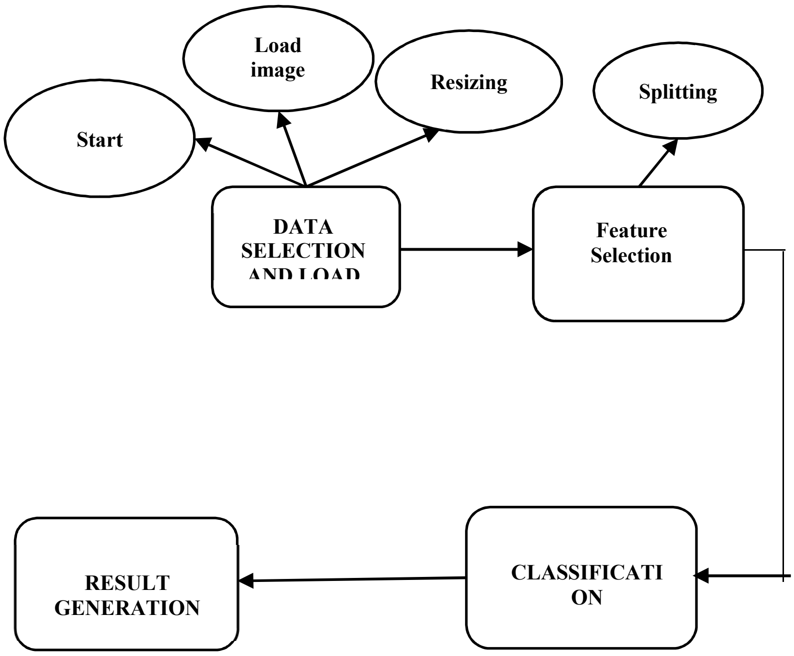
- Image Data pre-processing is the process of getting rescale data from the dataset.
- Resize image dataset: Rescale the leaf digital images size into 64x64.
- Getting data: That categorical data is defined as variables with a finite set of rescaled values. That most deep learning algorithms require array input and output variables.

SPLITTING DATASET INTO TRAIN AND TEST DATA:

- Data splitting is the act of partitioning available data into two portions, usually for cross-validate purposes.
- One Portion of the data is used to develop a predictive model and the other to evaluate the model's performance.

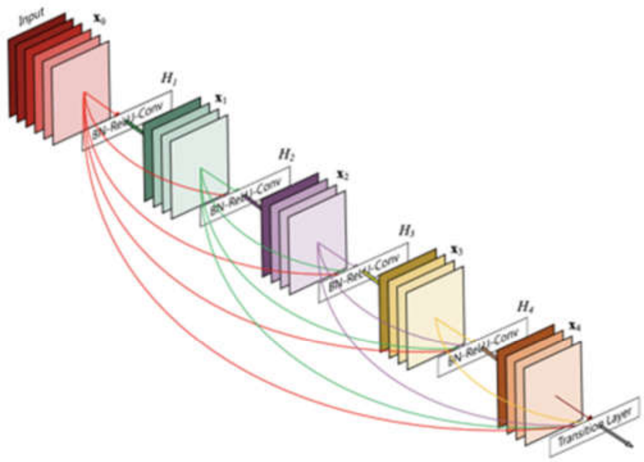
- Separating image data into training and testing sets is an important part of evaluating image processing models.
- Typically, when you separate a data set into a training set and testing set, most of the image data is used for training, and a smaller portion of the data is used for testing

Entity Relationship Diagram:



3.4.DENSENET121:

DenseNet121 (Dense Convolutional Network) is an architecture that focuses on making the deep learning networks go even deeper, but at the same time making them more efficient to train, by using shorter connections between the layers. DenseNet121 is a convolutional neural network where each layer is connected to all other layers that are deeper in the network, that is, the first layer is connected to the 2nd, 3rd, 4th and so on, the second layer is connected to the 3rd, 4th, 5th and so on. This is done to enable maximum information flow between the layers of the network. To preserve the feed-forward nature, each layer obtains inputs from all the previous layers and passes on its own feature maps to all the layers which will come after it.



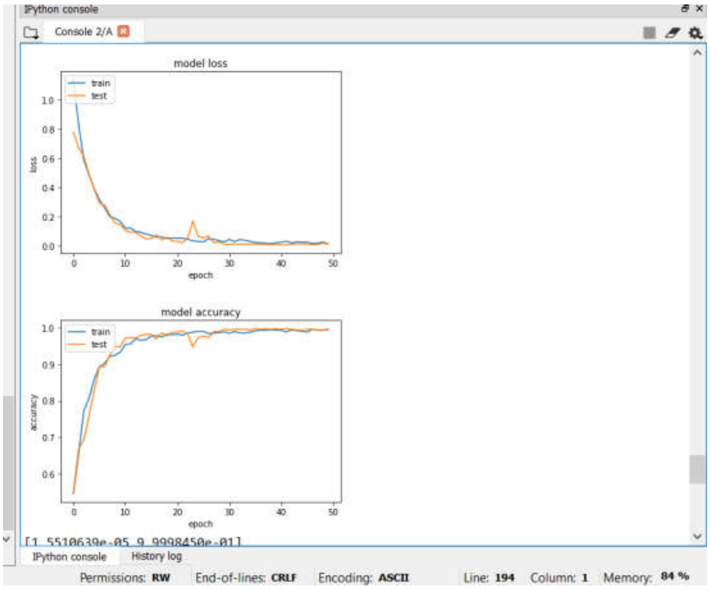
DenseNet Structure

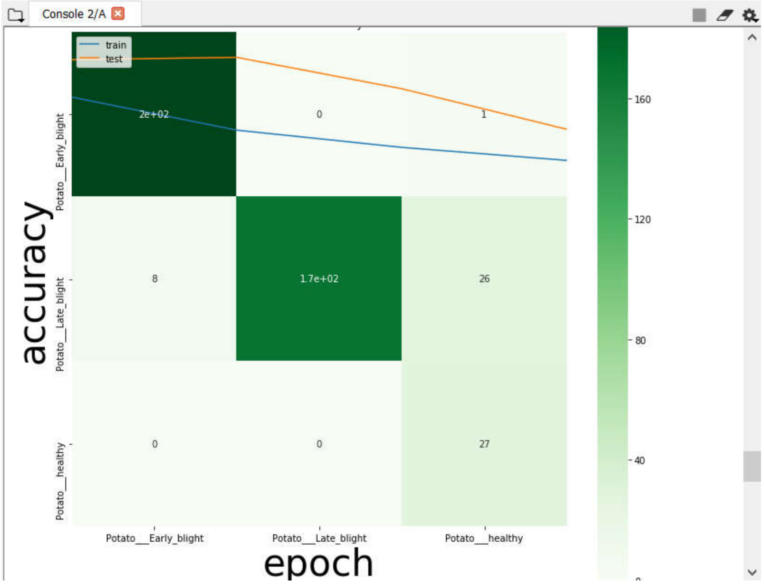
$$a^{[l]} = g\left([a^{[0]}, a^{[1]}, a^{[2]}, \ldots\ldots\ldots\ldots, a^{[l-1]}]\right)$$

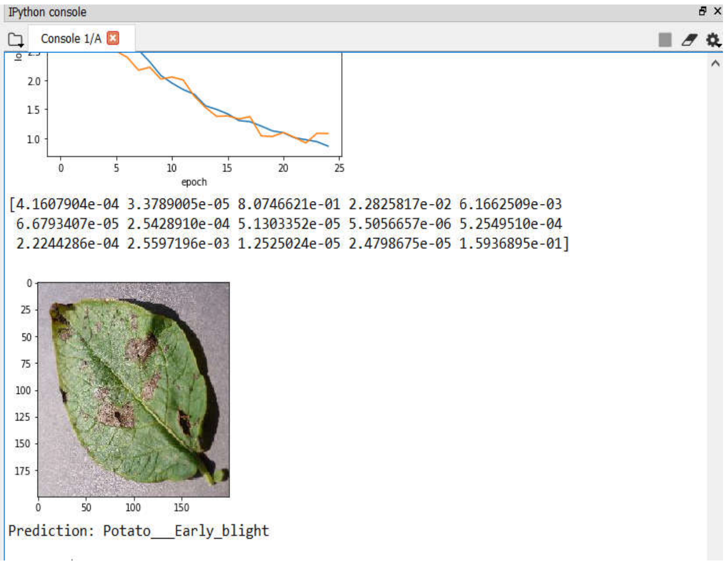
4.Experimental Results:

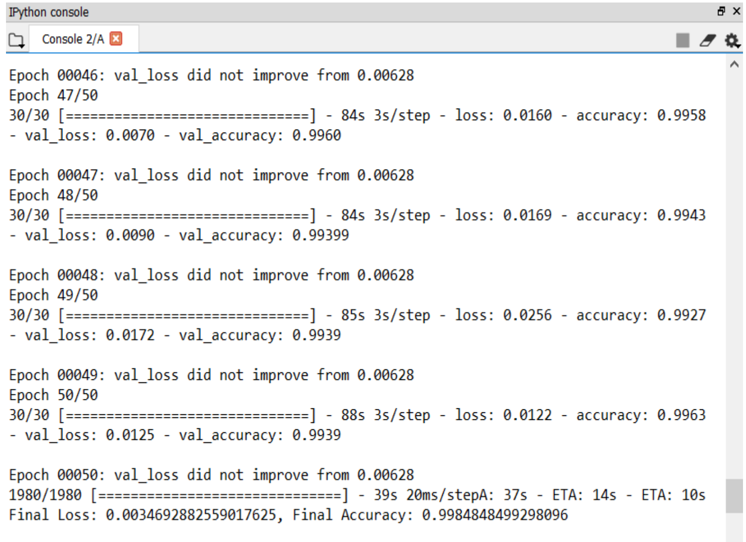
The Experiment is carried out using Plant village dataset and following images are from the output using densenet121 algorithm and their accuracy is classified in a tabular column and it predicts the leaf disease from the dataset and the final result will be generated based on the overall classification and prediction and the final accuracy will be displayed.

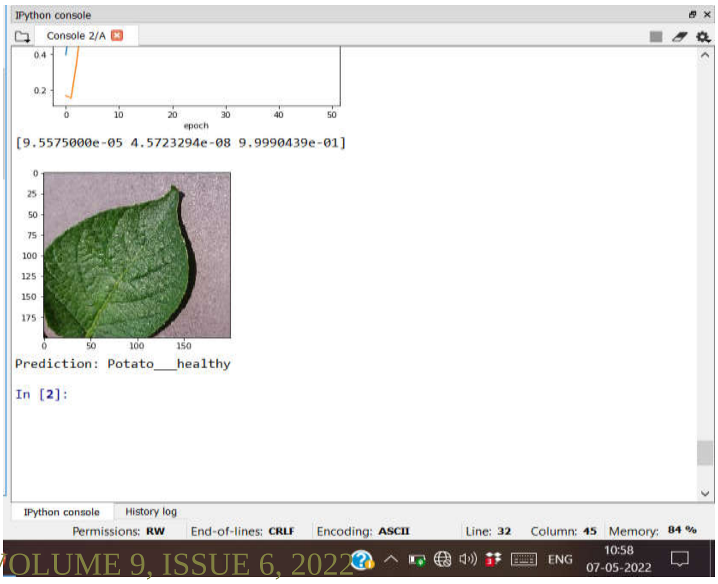
4.1 Output for Potato:

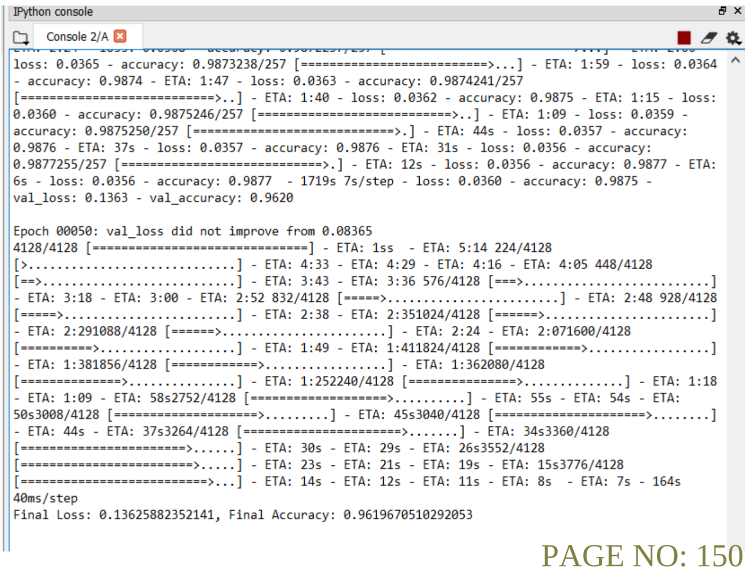




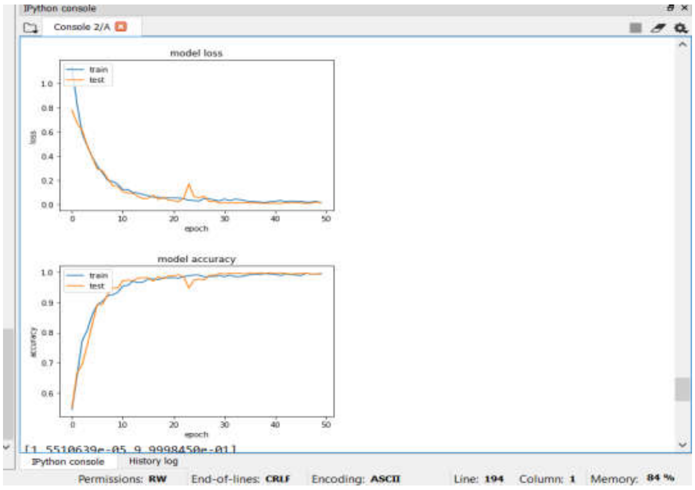


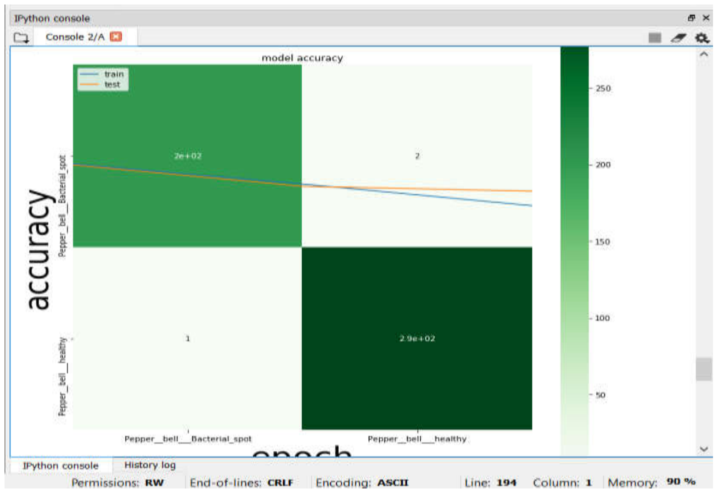


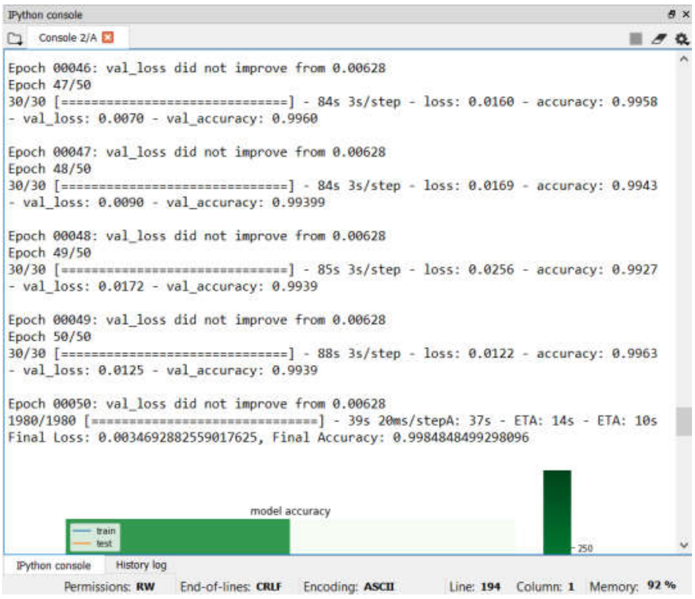


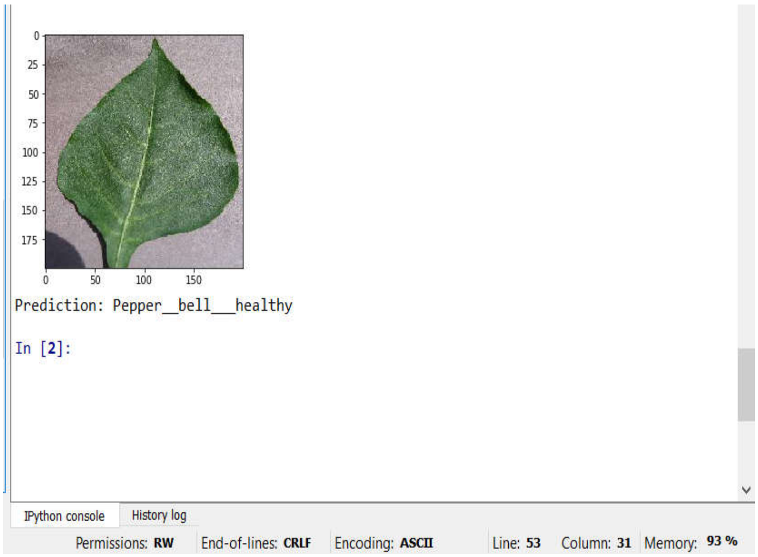


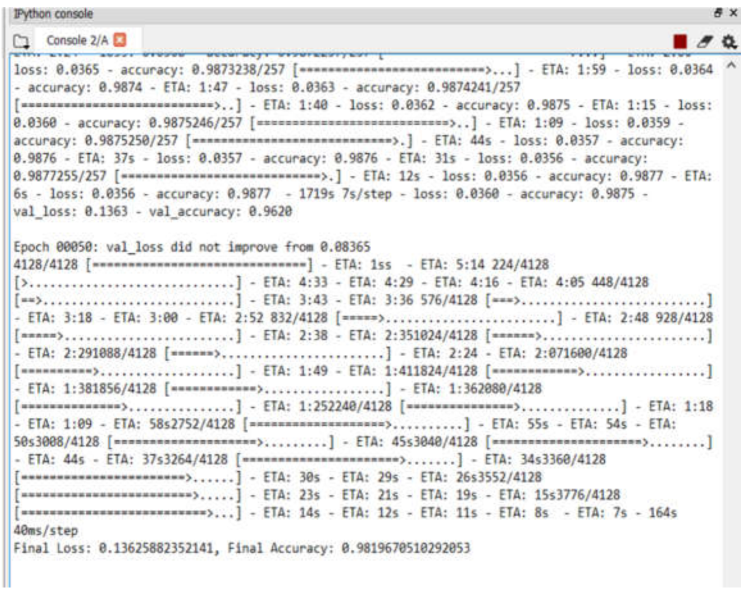
4.2 Output for Pepperbell:



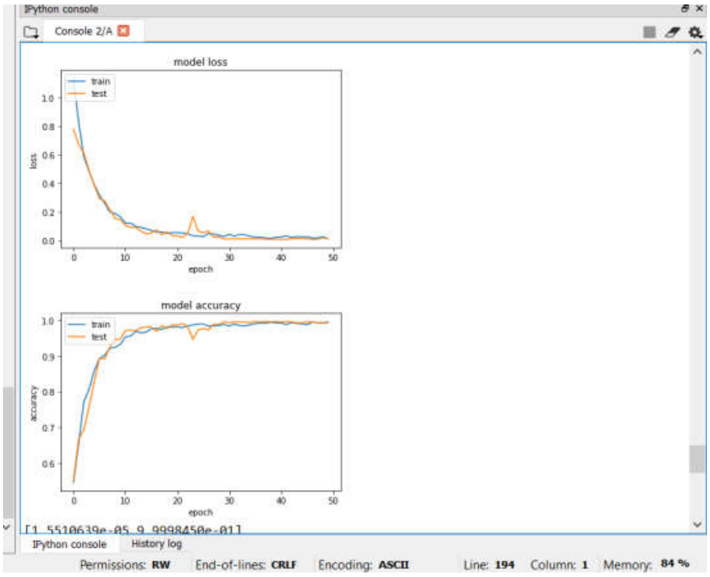


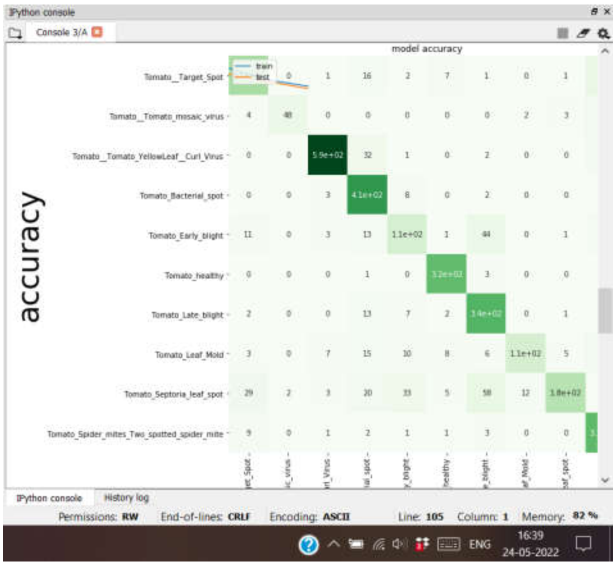


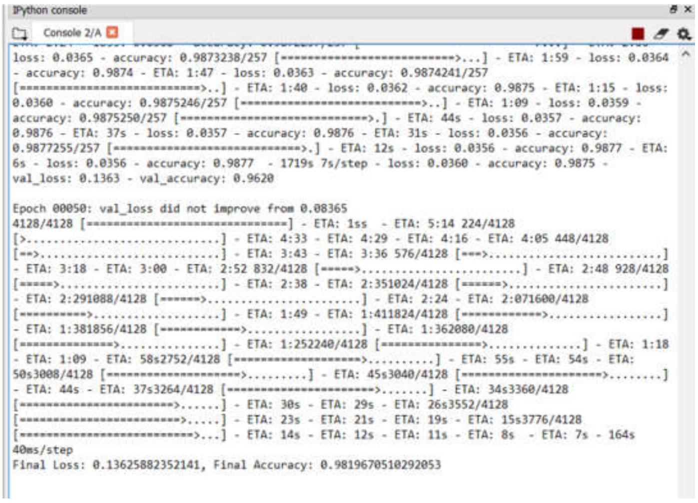




4.3.Output for Tomato:







5.Accuracy Classification:

Train/test ratio	Classes	Classwise classification accuracy (%)	Average classification accuracy
50-50	Pepper bell bacterial spot	98	98.9
	Pepper bell healthy	99.8	
50-50	Potato Early blight	98.5	
	Potato healthy	99	
50-50	Tomato healthy, Tomato Spider mites Two spotted spider mite	97.5	97.5

6.Conclusion:

In this study, the deep learning classifier is analyse the plant leaf disease images. The PLANT VILLAGE data is taken as input data and applied into pre-processing method. In pre-processing method the images are resized and converted into array. Then it processed into feature selection method, in this method the dataset is split into training dataset and testing dataset. After that all the images are resized and convert into array. Finally the classification method is used to analysis the remote sensing scene from images. Deep learning algorithm of DENSENET is implemented and predict the result based on accuracy.

7.Future Enhancement

In feature, the implementation of work is enhance in web application or graphical user interface model. And it is easy to identify the diseased leaf images and provides the quick and better result by using this model.

8.References:

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