

PYTHON BASED CONVOLUTION NEURAL NETWORK TO DETECT LEAF DISEASE -AN IMPLEMENTATION

¹MR.A.ASHOK BABU, ²R.CHANDRAMOHAN ³M.V.GANESWARA RAO
⁴G PRASANNA KUMAR, ⁵G.N.SOWJANYA ⁶KURRA UPENDRA CHOWDARY

¹Asst.Prof. Dept. of ECE, PVP Siddhartha Institute of Technology, Vijayawada, Andhra Pradesh, India.

²Department of CIVIL Engineering, R.V.R & J.C College of Engineering, Guntur, Andhra Pradesh, India.

³Department of ECE, Shri Vishnu Engineering College for Women, Bhimavaram, A.P, India.

⁴ECE Department, Vishnu Institute of Technology, Bhimavaram, Andhra Pradesh, India

⁵CSE Department, Koneru Lakshmaiah Education Foundation, Vaddeswaram, A.P, India

⁶Department of ECE, R.V.R& J.C.College of Engineering, Guntur, A.P, India.

Email: ashokbabu@pvpsiddhartha.ac.in

ABSTRACT

In the area of image categorization, the most recent convolution neural networks (CNNs) have shown excellent results. In this research, deep convolution networks will be used to develop a novel method of classifying leaf images in order to recognise plant diseases. Innovative training methods and the methodology employed make it simple and quick to apply the system in real-world settings. With the capacity to differentiate between plant leaves and their surroundings, the created model can identify nine distinct forms of plant illnesses from healthy leaves. To our knowledge, this approach to identifying plant diseases is the first one to be put out. All essential steps required for implementing this disease recognition model are fully described throughout the project, starting from gathering images in order to create a database, assessed by agricultural experts. The experimental results on the developed model achieved precision between 91% and 98%, for separate class tests, on average 96.3%.

Keywords: CNN, Python, Leaf, Disease, Implementatoin

1. INTRODUCTION:

When plants and crops are affected by pests it affects the agricultural production of the country. Usually farmers or experts observe the plants with naked eye for detection and identification of disease. But this method can be time processing, expensive and inaccurate. Automatic detection using image processing techniques provide fast and accurate results. This paper is concerned with a new approach to the development of plant disease recognition model, based on leaf image classification, by the use of deep convolutional networks. Advances in computer vision present an opportunity to expand and enhance the practice of precise plant protection and extend the market of computer vision applications in the field of precision agriculture. Novel way of training and the methodology used facilitate a quick and easy system implementation in practice. All essential steps required for implementing this disease recognition model are fully described throughout the paper, starting from gathering images in order to create a database, assessed by agricultural

experts, a deep learning framework to perform the deep CNN training. This method paper is a new approach in detecting plant diseases using the deep convolutional neural network trained and fine-tuned to fit accurately to the database of a plant's leaves that was gathered independently for diverse plant diseases. The advance and novelty of the developed model lie in its simplicity; healthy leaves and background images are in line with other classes, enabling the mode l to distinguish between diseased leaves and healthy ones or from the environment by using deep CNN.

2. EXISTING SYSTEM:

When plants and crops are affected by pests it affects the agricultural production of the country. Usually farmers or experts observe the plants with naked eye for detection and identification of disease. But this method can be time processing, expensive and inaccurate. Existing systems use expert system that contains many rules (business) which leads much time and much coding. May not give more effective results. Most of machine

learning algorithms are on statistical approach. These statistical approaches are used for textual and numerical data. They may not work heavy or large no of image inputs. Disadvantages of existing system

1. Inaccurate
2. Expensive
3. It takes more time
4. Much coding
5. Mostly statistical approach
5. Inaccurate training

3. PROPOSED SYSTEM:

Novel way of training and the methodology used facilitate a quick and easy system implementation in practice. All essential steps required for implementing this disease recognition model are fully described throughout the paper, starting from gathering images in order to create a database, assessed by agricultural experts, a deep learning framework to perform the deep CNN training. This method paper is a new approach in detecting plant diseases using the deep convolutional neural network trained and fine-tuned to fit accurately to the database of a plant's leaves that was gathered independently for diverse plant diseases. The advance and novelty of the developed model lie in its simplicity; healthy leaves and background images are in line with other classes, enabling the model to distinguish between diseased leaves and healthy ones or from the environment by using deep CNN. Advantages of proposed system

- More accurate
- Less time
- It gives more efficiency results.
- Meant for Image data
- Heavy no Images / Large data sets
- More training
- Usage of hidden layers

4. MODEL OF THE PROPOSED WORK:

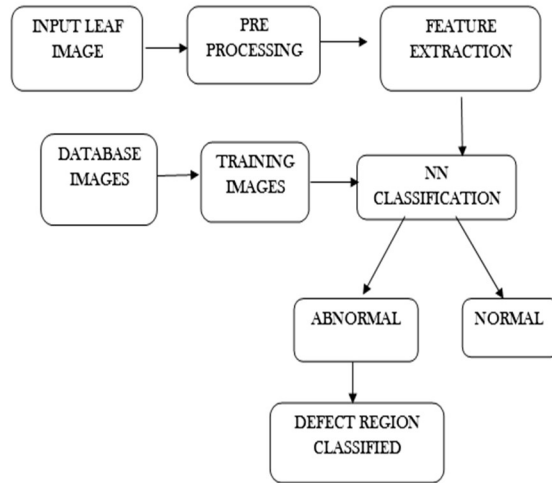


Fig: .1 Architecture of proposed system

5. SOFTWARE REQUIREMENTS:

Anaconda (Jupyter notebook)

- Tensorflow Frame work
- Keras Frame work
- Libraries:
 - Matplotlib
 - Numpy
 - Pandas
 - Regex
 - Requests
 - Scikit-learn
 - Scipy
 - Sklearn.
- Language: Python

6. METHODOLOGY OF PROPOSED WORK AND MODULES DESCRIPTION:

Appropriate datasets are required at all stages of object recognition research, starting from training phase to evaluating the performance of recognition algorithms. All the images collected for the dataset were downloaded from the Internet, searched by disease and plant name on various sources. Images in the dataset were grouped into different classes which represented plant diseases which could be visually determined from leaves. In order to distinguish healthy leaves from diseased ones, one more class was added in the dataset. It contains only images of healthy leaves. An extra class in the dataset with background images was beneficial to get more accurate classification. Thus, deep neural

network could be trained to differentiate the leaves from the surrounding. All duplicated images taken from different sources were removed by developed python script applying the comparing procedure.

The script removed the duplicates by comparing the images' metadata: name, size, and the date. After the automated removal, images were assessed by human experts in much iteration. Next step was to enrich the dataset with augmented images. The main goal of the presented study is to train the network to learn the features that distinguish one class from the others.

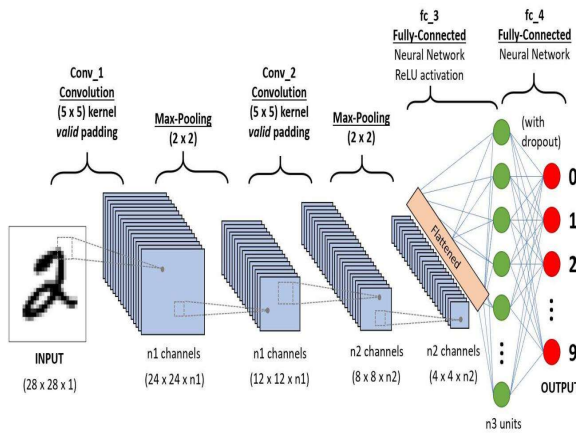


Fig: 2 Block diagram

The Modules in the proposed work can be

1 Load dataset: data set can be loaded

2 Data Set Split: data set can be split

3 Train Images:

Train images to the image generator which flips the images, shears the images and zoom the images so that all the features of the leaf can be feed for training so that it will be able to increase the robustness of the model.

4 Build CNN Layers:

Building the CNN layers, so in our CNN network, we have added 12 layers which include CNN layers, max pool layers, dropout layers.

4.1 Steps for Building a CNN Model

- 1) Import libraries
- 2) Initialize neural network model
- 3) Add input layer, weight, activation function, hidden layer
- 4) Add hidden layer
- 5) Add output layer
- 6) Compile neural network model

5 Activation Function:

It's just a thing function that you use to get the output of node. It is also known as **Transfer Function**.

Why we use Activation functions with Neural Networks?

It is used to determine the output of neural network like yes or no. It maps the resulting values in between 0 to 1 or -1 to 1 etc. (depending upon the function).

The Activation Functions can be basically divided into 2 types-

1. Linear Activation Function
2. Non-linear Activation Functions

6. Implementation Steps:

1. We are first loading all the images in their respective categories from their directories.
2. Then we are splitting the images into train and test splits in the ratio of 80:20 from this we will be getting train data and test data separated.
3. After separation, we will be giving train images to the image generator which flips the images, shears the images and zoom the images so that all the features of the leaf can be feed for training so that we will be able to increase the robustness of the model.
4. Once the train set is ready we will be building the CNN layers, so in our CNN network, we have added 12 layers which include CNN layers, max pool layers, dropout layers.
5. We have used different activation functions such as Relu(which allows all the positive weights), Softmax(which gives the probability of occurrence of a particular category).
6. In our model, we have implemented 25 epochs.
7. After that, we have saved our model and loaded the model for prediction using the Tkinter UI. In the UI we have used OpenCV to load the images.

7. RESULTS:

We will get directed to the following terminals after clicking the anaconda prompt icon on the desktop.



Fig: 3 Anaconda Prompt

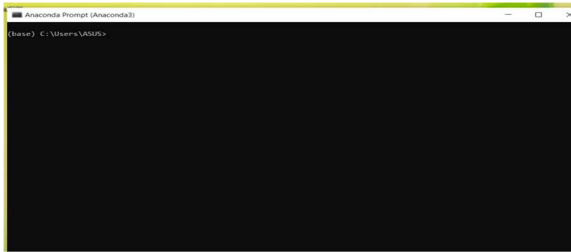


Fig: 4 Anaconda Prompt Path Setting

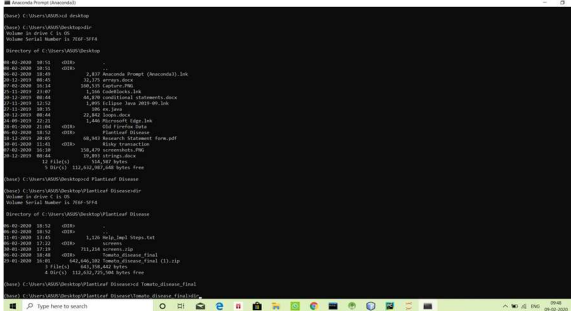


Fig: 5 Execution Step -1

After processes for certain amount of time it will automatically get directed to the tinkter GUI, which will get pop-up on the terminal

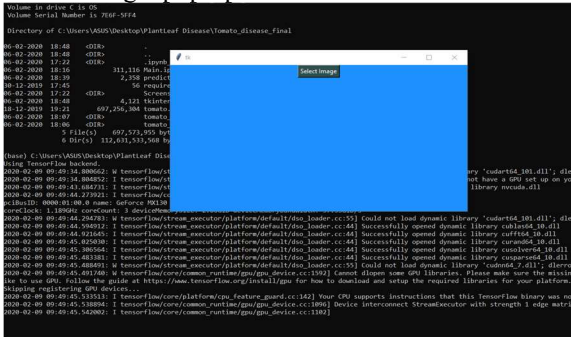


Fig: 6 Execution Step -2

After clicking the Select image on the Tinkter GUI which is popped up, then we will automatically get directed to the file explorer, where our 10 sets of Diseased files (Each file saved with its diseased features, with overall gathering of 2000 leaves).

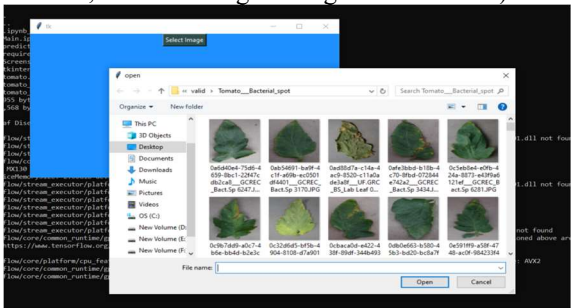


Fig: 7 Execution Step -3

Now we need to select the particular diseased feature file, in that file any one image is choosed. It takes few seconds to get processed and gives desired output that whether the leaf. Diseased or Not (By showing its diseased feature on the GUI)

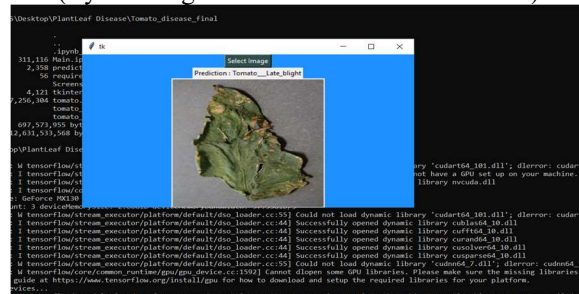


Fig: 8 Execution Step -4

8. CONCLUSION AND FUTURE WORK:

This paper has proposed a real-time detection approach that is based on improved convolutional neural networks for tomato leaf diseases. The deep-learning-based approach can automatically extract the discriminative features of the diseased tomato images and detect the ten common types of tomato leaf diseases with high accuracy in real time. In this project, to ensure satisfactory generalization performance of the proposed model and a sufficient tomato disease image dataset, a total of 2,000 images with uniform and complex backgrounds were collected in the laboratory and in a real tomato field. Hence, the proposed model is fully capable of real-time detection of apple leaf diseases. The results demonstrate that the proposed model can detect the ten common types of tomato leaf diseases with high accuracy in real time and provides a feasible solution for the real-time detection of apple leaf diseases.

The proposed system was developed taking in mind the benefits of the farmers and agricultural sector. The developed system can detect disease in plant and also provide the remedy that can be taken against the disease. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant. The proposed system is based on python and gives an accuracy of around 78%. The accuracy and the speed can be increased by use of Googles GPU for processing. The system can be installed on Drones so that aerial surveillances of crop fields can be done.

REFERENCES

- [1] Mrunalini R. et al., An application of K-means clustering and artificial intelligence in pattern recognition for crop diseases, 2011.
- [2] S.Raj Kumar , S.Sowrirajan, " Automatic Leaf Disease Detection and Classification

- using Hybrid Features and Supervised Classifier”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 5, Issue 6,2016..
- [3] Tatem, D. J. Rogers, and S. I. Hay, “Global transport networks and infectious disease spread,” *Advances in Parasitology*, vol. 62, pp. 293–343, 2006. View at Publisher · View at Google Scholar · View at Scopus.
- [4] J. R. Rohr, T. R. Raffel, J. M. Romansic, H. McCallum, and P. J. Hudson, “Evaluating the links between climate, disease spread, and amphibian declines,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 105, no. 45, pp. 17436–17441, 2008. View at Publisher · View at Google Scholar · View at Scopus.
- [5] T. Van der Zwet, “Present worldwide distribution of fire blight,” in *Proceedings of the 9th International Workshop on Fire Blight*, vol. 590, Napier, New Zealand, October 2001.
- [6] H. Cartwright, Ed., *Artificial Neural Networks*, Humana Press, 2015.
- [7] Steinwart and A. Christmann, *Support Vector Machines*, Springer Science & Business Media, New York, NY, USA, 2008. View at MathSciNet.
- [8] Steinwart and A. Christmann, *Support Vector Machines*, Springer Science & Business Media, New York, NY, USA, 2008. View at MathSciNet.
- [9] S. Sankaran, A. Mishra, R. Ehsani, and C. Davis, “A review of advanced techniques for detecting plant diseases,” *Computers and Electronics in Agriculture*, vol. 72, no. 1, pp. 1–13, 2010. View at Publisher · View at Google Scholar · View at Scopus.
- [10] P. R. Reddy, S. N. Divya, and R. Vijayalakshmi, “Plant disease detection technique tool—a theoretical approach,” *International Journal of Innovative Technology and Research*, pp. 91–93, 2015. View at Google Scholar.
- [11] A.-K. Mahlein, T. Rumpf, P. Welke et al., “Development of spectral indices for detecting and identifying plant diseases,” *Remote Sensing of Environment*, vol. 128, pp. 21–30, 2013. View at Publisher · View at Google Scholar · View at Scopus.
- [12] Tata Balaji, Kurra Upendra Chowdary, Dr. P Venu Madhav, Dr.A Geetha Devi, Mrs.T. Mahalakshmi, Dr.Surya Prasada Rao Borra, N.Jaya, “Pragmatic Investigations To Smart Dusts Location Appraisal Precisely Using Machine Learning”, *Journal Of Theoretical And Applied Information Technology*, 2023,101(16),Pp-6301-6309
- [13] T Balaji, P.Ravi Kumar, M.V.Ganeswara Rao, Geetha Devi Appari, “Creating The Best Directed Random Testing Method To Minimize Interactive Faults- Empirical Perspective”, *Journal Of Theoretical And Applied Information Technology*, 2023,101(7),Pp-2540-2546