IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 6, June 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

Automatic Plant Disease Detection using Advanced Machine Learning Model

[1]N MANEESHA, [2]N M V NIRMALA

[1]PG Scholar, Department of CSE, ST. Marys Group of Institutions Guntur, AP, India.

[2]Associate professor, Department of CSE, ST. Marys Group of Institutions Guntur, AP, India.

ABSTRACT: Automatic plant disease prediction is an important research area. It is a technology driven approach that improves prospects for precision farming. Deep learning models are widely used for processing leaf images and predict the diseases early. From the literature, it is ascertained that CNN models are widely used in deep learning approaches. CNN model is found to be suitable for processing leaf images. Therefore, it is important to make a prediction model based on CNN with more enhancements. In this paper we have proposed an advanced CNN model that is based on baseline CNN model. It is empirically studied and configured to perform better for plant disease prediction. A framework is proposed towards advanced CNN based solution. An algorithm is proposed to realize the framework. The proposed model is evaluated and compared with several pre-trained models. The proposed model showed highest performance with 97.62%.

KEYWORDS – Machine Learning, Deep Learning, Automatic Plant Disease Prediction, Agriculture

I. INTRODUCTION

With innovations in machine learning and deep learning, there are many real world problems solved. In Agriculture, it is important to exploit such AI enabled models in order to improve applications. For instance, deep learning is found suitable for image processing. It can be used to process plant leaves to predict diseases automatically. Provided a plant leaf image, CNN can be trained to gain knowledge from training data to help in prediction process. Deep learning models are found useful for solving problems with their capability in learning process and depth in knowledge. This is the reason why CNN is exploited in this paper.

There are many existing methods found in literature. Ferentinos and Konstantinos [5] studied diagnosis models with deep learning for plant diseases in agriculture. Loey et al. [6] studied technology based solutions for agricultural crop disease prediction covering many deep learning models. Daniya et al. [7] considered rice crop for experiments using machine learning for crop disease prediction. Mohanty et al. [8] used image based approach towards deep learning for plant disease prediction. Majji et al. [9] focused on detection and classification of plant diseases. Raina et al. [14] studied various techniques that use leaf image as input and perform disease prediction. Saleem et al. [15] used deep learning models for prediction and classification of diseases. Abed et al. [16] used deep learning for robot vision applications towards precision farming. Marzougui et al. [17] proposed CNN based deep learning model for plant disease prediction. Sujatha et al. [18] made a comparative study of deep learning and ML models for understanding their contributions.From the literature, it is ascertained that CNN models are widely used in deep learning approaches. CNN model is found to be suitable for processing leaf images. Therefore, it is important to make a prediction model based on CNN with more enhancements. Our contributions in this paper are as follows.

1. We proposed a framework based on advanced CNN model for improving leaf disease prediction performance.
2. We proposed an algorithm to realize the proposed framework.
3. A prototype application is built in order to evaluate the framework with the underlying algorithm.

The remainder of the paper is structured as follows. Section 2 reviews literature on the existing methods used for plant disease prediction. Section 3 presents the proposed deep learningbased framework. Section 4 presents results of empirical study. Section 5 concludes the paper and gives directions for future work.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

II. RELATED WORK

Automatic plant disease detection models existing in the literature are reviewed here. Akhtar et al. [1] discussed different ML models used for plant disease prediction. Nagaraju et al. [2] explored different deep learning techniques to detect plant diseases in agricultural applications. Too et al. [3] also investigated on deep learning models for plant disease prediction. Lili et al. [4] used different deep learning models to compare their performance in prediction. Ferentinos and Konstantinos [5] studied diagnosis models with deep learning for plant diseases in agriculture. Loey et al. [6] studied technology based solutions for agricultural crop disease prediction covering many deep learning models. Daniya et al. [7] considered rice crop for experiments using machine learning for crop disease prediction. Mohanty et al. [8] used image based approach towards deep learning for plant disease prediction. Majji et al. [9] focused on detection and classification of plant diseases. Zhou et al. [10] used saliency maps visualization for prediction of plant diseases with deep learning. Shruthi et al. [11] investigated the performance different ML models for performance prediction.

Guo et al. [12] proposed smart forming methods based on deep learning models. HernÃ¡ndez et al. [13] used Baysian deep learning along with uncertainty quantification with regard to plant disease prediction. Raina et al. [14] studied various techniques that use leaf image as input and perform disease prediction. Saleem et al. [15] used deep learning models for prediction and classification of diseases. Abed et al. [16] used deep learning for robot vision applications towards precision farming. Marzougui et al. [17] proposed CNN based deep learning model for plant disease prediction. Sujatha et al. [18] made a comparative study of deep learning and ML models for understanding their contributions. Arsenovic et al. [19] focused on identification of current limitations in deep learning and solving such problems. Jiang et al. [20] used an improved CNN for real time detection of diseases in Apple leaves. From the literature, it is ascertained that CNN models are widely used in deep learning approaches. CNN model is found to be suitable for processing leaf images. Therefore, it is important to make a prediction model based on CNN with more enhancements.

III. PROPOSED FRAMEWORK

Agriculture in India plays crucial role in the economy and growth of the country. However, technology driven innovation in this field known as Precision Agriculture (PA) is still in its infancy. Nevertheless, there are significant improvements with technology innovations. With the emergence of deep learning as part of Artificial Intelligence (AI), it is made possible to bring about technology into agriculture activities. Different scholars view the images in terms of Artificial Intelligence, Machine learning and demonstrate their achievements and problems that still exist. To draw some assumptions, our study of the various approaches suggested is also given. Image Acquisition, Image Pre-processing, Image segmentation, Feature Extraction and Statistical Analysis, Classification based on classifier are the key steps for the identification of diseases. We proposed an advanced CNN model based on baseline CNN model for better performance in prediction.

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

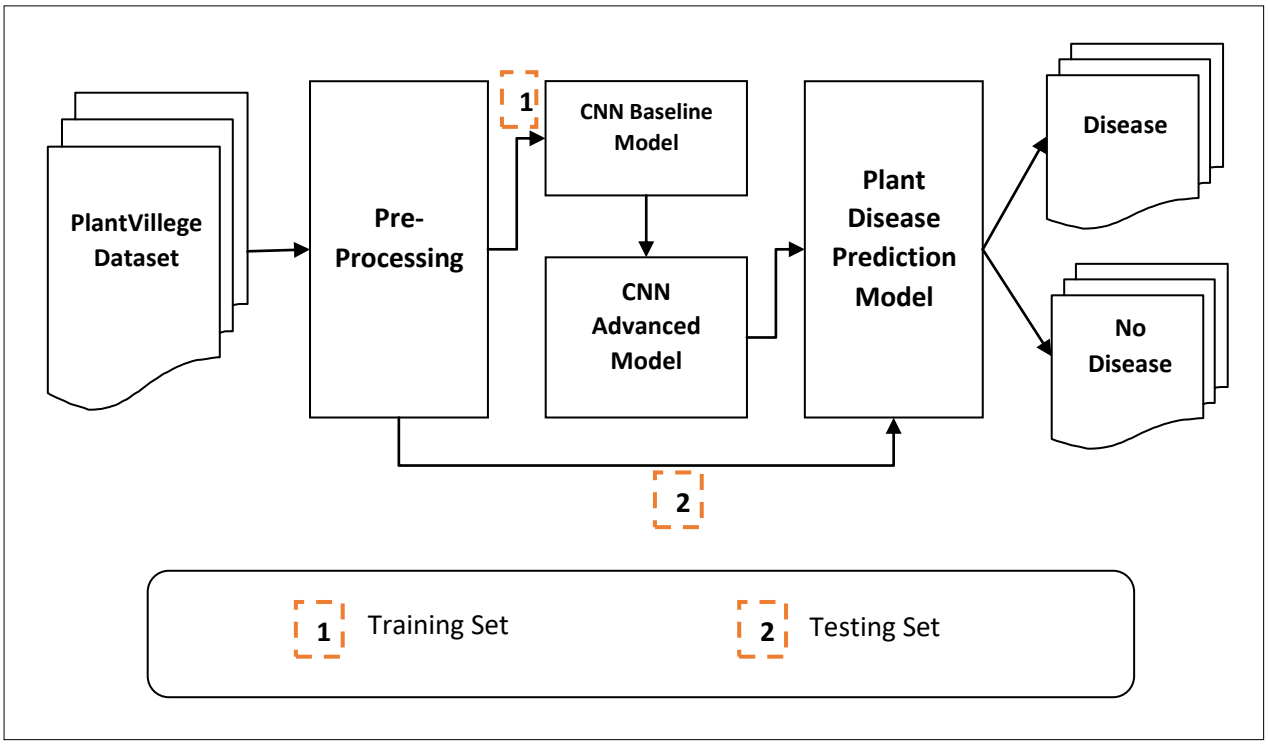


Figure 1: The proposed advanced CNN framework

As presented in Figure 1, the proposed system makes use of PlantVillege dataset as input. This dataset has all possible agricultural crops and their leaf images. The framework supports pre-processing to improve quality of images. Then it has supervised learning process with advanced CNN model. Once training is completed, it results in plant disease prediction model. This model is meant for prediction of disease automatically.

Algorithm: Advanced CNN (A-CNN) algorithm

Inputs:
Training data T1
Test data T2
batch size *m*
number of epochs *n*
Output:
Results of Prediction *P*

1. *A* = FeatureExtraction(T1)
2. *F* = FeatureSelection(*A*)
3. Add convolutional layers
4. Add max pooling layers
5. Add cascade inception
6. *M* = TrainModel(*F*)
7. For each Epoch *e* in *n*
8. For each batch *b* in *m*
9. Update M
10. End For

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

11. End For
12. *M'* = FitModel(*M*)
13. *P* = PredictionOfDiseases(*M'*, *T2*)
14. Return *P*

Algorithm 1: Shows the proposed algorithm

As presented in Algorithm 1, it takes training and testing datasets from plant villege dataset. It has feature selection process and configuration of different layers in the advanced CNN network. Then it learns from the training dataset and the knowledge is then used for detection and classification of plant diseases.

IV. EXPERIMENTAL RESULTS

Experiments are made with the proposed deep learning model based on CNN. The results are compared with other pre-trained models.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

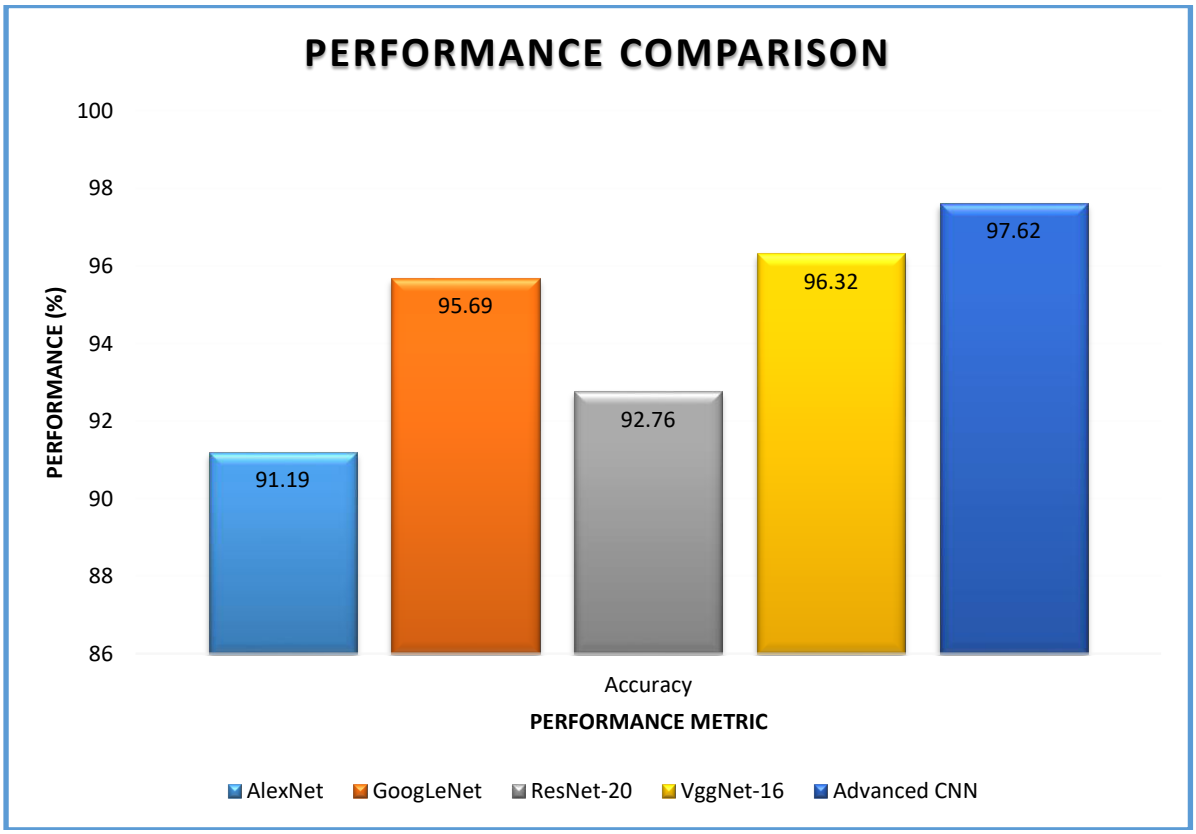
Figure 2: Shows the detection results based on leaf image input

As presented in Figure 2, the given leaf image is analysed by the proposed deep CNN model and the result of prediction is provided accurately.

Method	Accuracy
Alex Net	91.19
GoogLeNet	95.69
ResNet-20	92.76
VggNet-16	96.32
Advanced CNN	97.62

Table 1: Results of experiments

As presented in Table 1, the accuracy of different models including the proposed advanced CNN model is compared.



| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

Figure 3: Shows the performance comparison among the deep learning models

As presented in Figure 3, it is evident that the performance of different models is observed. The models showed varied performance in terms of accuracy. The least accuracy is shown by the pre-trained model known as Alex Net with 91.19%. The highest performance is shown by the proposed deep CNN model with 97.62%.

V. CONCLUSION AND FUTURE WORK

In this paper we have proposed an advanced CNN model that is based on baseline CNN model. It is empirically studied and configured to perform better for plant disease prediction. A framework is proposed towards advanced CNN based solution. An algorithm is proposed to realize the framework. The proposed model is evaluated and compared with several pre-trained models. The proposed model showed highest performance with 97.62%. There are many directions for future work. First, it is interesting to incorporate transfer learning for improving the performance of the proposed model. Second, there is possibility of using Region of Interest (ROI) for further improvement in prediction performance.

REFERENCES

[1]Akhtar, Asma; Khanum, Aasia; Khan, Shoab A.; Shaukat, Arslan (2013). [IEEE 2013 11th International Conference on Frontiers of Information Technology (FIT) - Islamabad, Pakistan (2013.12.16-2013.12.18)] 2013 11th International Conference on Frontiers of Information Technology - Automated Plant Disease Analysis (APDA): Performance Comparison of Machine Learning Techniques. , p60–65.

[2]Nagaraju, M.; Chawla, Priyanka (2020). Systematic review of deep learning techniques in plant disease detection.International Journal of System Assurance Engineering and Management, p1-14.

[3] Too, Edna Chebet; Yujian, Li; Njuki, Sam; Yingchun, Liu (2018). A comparative study of fine-tuning deep learning models for plant disease identification. Computers and Electronics in Agriculture, p1-8.

[4]LiliLi;ShujuanZhang;Bin Wang; (2021). Plant Disease Detection and Classification by Deep Learning—A Review .IEEE Access, p1-16.

[5]Ferentinos, Konstantinos P. (2018). Deep learning models for plant disease detection and diagnosis. Computers and Electronics in Agriculture, 145, p311–318.

[6]Loey, Mohamed; ElSawy, Ahmed; Afify, Mohamed (2020). Deep Learning in Plant Diseases Detection for Agricultural Crops.International Journal of Service Science, Management, Engineering, and Technology, 11(2), p41–58.

[7]T.Daniya, 2Dr.S.Vigneshwari. (2019). A Review on Machine Learning Techniques for Rice Plant Disease Detection in Agricultural Research. International Journal of Advanced Science and Technology. 28 (13), p 49-62.

[8]Mohanty, Sharada P.; Hughes, David P.; Salathé, Marcel (2016). Using Deep Learning for Image-Based Plant Disease Detection.Frontiers in Plant Science, 7, p1-10.

[9]Majji V Applalanaidu;G. Kumaravelan; (2021). A Review of Machine Learning Approaches in Plant Leaf Disease Detection and Classification . 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), p1-9.

[10] Zhou, Jianlong; Chen, Fang (2018). [Human–Computer Interaction Series] Human and Machine Learning || Deep Learning for Plant Diseases: Detection and Saliency Map Visualisation. , 10.1007/978-3-319-90403-0(Chapter 6), p93–117.

[11] U, Shruthi; Nagaveni, V; Raghavendra, B K (2019). [IEEE 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) - Coimbatore, India (2019.3.15-2019.3.16)] 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) - A Review on Machine Learning Classification Techniques for Plant Disease Detection., p281–284.

[12]Guo, Yan; Zhang, Jin; Yin, Chengxin; Hu, Xiaonan; Zou, Yu; Xue, Zhipeng; Wang, Wei (2020). Plant Disease Identification Based on Deep Learning Algorithm in Smart Farming. Discrete Dynamics in Nature and Society, 2020, p1–11.

[13]HernÃ¡ndez, S.; LÃ³pez, J.L. (2020). Uncertainty quantification for plant disease detection using Bayesian deep learning. Applied Soft Computing, p1-23.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006057 |

[14]SakshiRaina;Abhishek Gupta; (2021). A Study on Various Techniques for Plant Leaf Disease Detection Using Leaf Image .2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS), p1-6.

[15]Saleem, ;Potgieter, ; MahmoodArif, (2019). Plant Disease Detection and Classification by Deep Learning.Plants, 8(11), p1-22.

[16] Abed, S. H., Al-Waisy, A. S., Mohammed, H. J., & Al-Fahdawi, S. (2021). A modern deep learning framework in robot vision for automated bean leaves diseases detection. International Journal of Intelligent Robotics and Applications, 5(2), p235–251.

[17]Marzougui, F., Elleuch, M., &Kherallah, M. (2020). A Deep CNN Approach for Plant Disease Detection.2020 21st International Arab Conference on Information Technology (ACIT), p1-6.

[18]Sujatha, R., Chatterjee, J. M., Jhanjhi, N., &Brohi, S. N. (2021). Performance of deep learning vs machine learning in plant leaf disease detection.Microprocessors and Microsystems, 80, 103615.P1-11.

[19]Arsenovic, M., Karanovic, M., Sladojevic, S., Anderla, A., &Stefanovic, D. (2019). Solving Current Limitations of Deep Learning Based Approaches for Plant Disease Detection. Symmetry, 11(7), 939.P1-21.

[20] Jiang, P., Chen, Y., Liu, B., He, D., & Liang, C. (2019). Real-Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks. IEEE Access, 7, p59069–59080.

INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details