International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.040 ISSN: 2581-4621

Advanced Plant Disease Detection UsingNeural Network

Hasika S[1], Kaviya Priya R[2] , Dr.B.Shridar[3]
[1] *UG – Agriculture Engineering, SNS College Of Technology, Coimbatore, Tamil Nadu*
[2]*UG – Agriculture Engineering, SNS College Of Technology, Coimbatore, Tamil Nadu*
[3]*Dean-Agriculture Engineering, SNS College Of Technology, Coimbatore, Tamil Nadu*
Corresponding Author Orcid ID : 0009-0006-8354-8400

ABSTRACT
The latest generation of convolutional neural networks (CNNs) has achieved impressive results in the field of image classification. This paper is concerned with a new approach to the development of tomato plant disease recognition model, based on leaf image classification, by the use of deep convolutionalnetworks. Novel way of training and the methodology used facilitate a quick and easy system implementation in practice. The developed model is able to recognize different types of tomato plant diseases out of healthy leaves, with the ability to distinguish plant leaves from their surroundings. According to our knowledge, this method for plant disease recognition has been proposed for the first time. 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. Neural network, was used to perform the disease detection. The experimental results on the developed model achieved detection between 85% and 95%.
Keywords—Impressive, Leaf Image, Implementation, Gathering Images, Recognition, Neural Network.

1. Introduction

Despite having seen many improvements in the mass production and accessibility of food, food security remains threatened by a variety of factors such as the decline of pollinators and plant diseases. In the developing world, more than 80 percent of the agricultural production is generated by smallholder farmers, and reports of yield loss of more than 50% due to pests and diseases are common. Furthermore, the majority of individuals suffering from hunger live in smallholder farminghouseholds. Fortunately, diseases can be managed by identifying the diseases as soon as it appears on the plant. In addition, with the rise of the internet and mobile technology worldwide, it easy to access diagnosis information on a particular type of disease.

As a result, the prevalence of smartphones with powerful cameras can help to scale up any type of solution that involves crop detection feasible and practical. Smartphones in particular offer very novel approaches to help identify diseases because of their computing power, high-resolution displays, and extensive built-in sets of accessories, such as advanced HD cameras. In fact, it is estimated that around 6 billion phones would be available around 2050. The input to the algorithm in this paper areof 2D images of diseased and healthy tomato plant leaves. A deep convolutional network is used, a generative adversarial network is used, and a semi supervised learning approach that utilizes a ladder network. These different approaches will be used to output a predicted disease type or a typeof healthy tomato plant species.

2. Problem Statement

The existing method for tomato plants disease detection is simple naked eye observation which requires more man labour, properly equipped laboratories, expensive devices, etc. And improper diseasedetection may led to inexperienced pesticide usage that can cause development of long-term resistance of the pathogens, reducing the ability of the crop to fight back. Existing methods takes a long time to process and the accuracy of the system is low.

DOI:10.46647/ijetms.2023.v07i03.040 ISSN: 2581-4621

3. Processes in CNN Data Set Collection

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 name on various sources in different languages.

Image Processing and Labelling

Images downloaded from the Internet were in various formats along with different resolutionsand quality. In order to get better feature extraction, final images intended to be used as datasetfor deep neural network classifier were pre-processed in order to gain consistency. Furthermore, procedure of image pre-processing involved cropping of all the images manually, in order to highlight the region of interest.

Augmentation Process

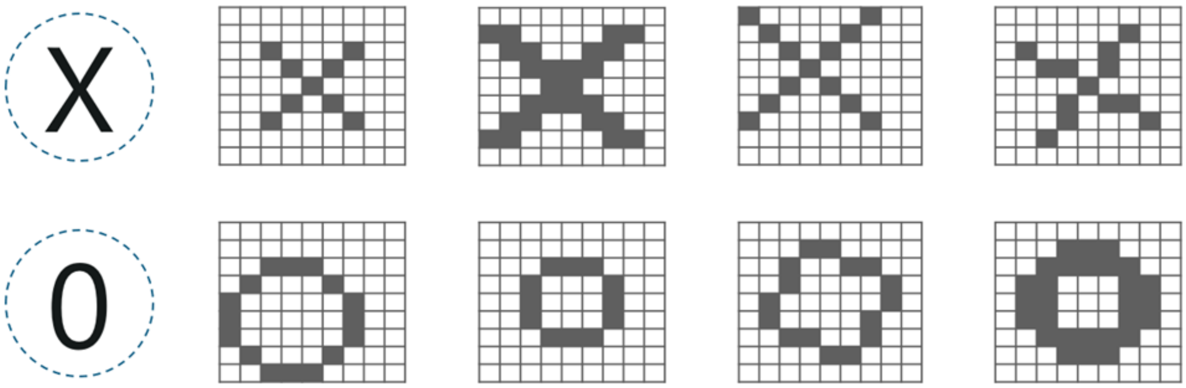
The main purpose of applying augmentation is to increase the dataset and introduce slight distortion to the images which helps in reducing overfitting during the training stage. Image data augmentation is a technique that can be used to artificially expand the size of a training datasetby creating modified versions of images in the dataset. Training deep learning neural network models on more data can result in more skillful models, and the augmentation techniques can create variations of the images that can improve the ability of the fit models to generalize what they have learned to new images.

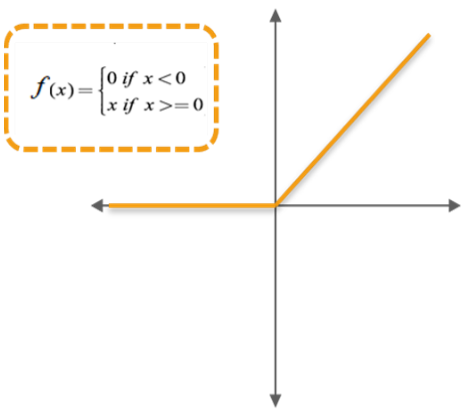
Neural Network Training

The main goal of training the network is for neural network to learn the features that distinguish one class from the others. Therefore, when using more augmented images, the chance for the network to learn the appropriate features has been increased.

Testing Trained Model with Valuation Data

Finally, the trained network is used to detect the disease by processing the input images in valuation dataset and results are processed.





DOI:10.46647/ijetms.2023.v07i03.040 ISSN: 2581-4621

4. Advantages of Open CV over MATLAB

Speed

MATLAB is built on Java, and Java is built upon C. So when you run a MATLAB program, your computer is busy trying to interpret all that MATLAB code. Then it turns it into Java, and then finally executes the code. OpenCV, on the other hand, is basically a library of functions written in C/C++. You are closer to directly provide machine language code to the computer to get executed. So ultimately you get more image processing done for your computers processing cycles, and not more interpreting. As a result of this, programs writtenin OpenCV run much faster than similar programs written in MATLAB. So, conclusion? OpenCV is damn fast when it comes to speed of execution. For example, we might write a small program to detect peoples smiles in a sequence of video frames. In MATLAB, we would typically get 3-4 frames analysed per second. In OpenCV, we would get at least 30 frames per second, resulting in real-time detection.

Resources Needed

Due to the high-level nature of MATLAB, it uses a lot of your systems resources. And I mean A LOT! MATLAB code requires over a gig of RAM to run through video. In comparison, typical OpenCV programs only require ~70mb of RAM to run in real-time. The difference as you can easily see is HUGE!

Portability

MATLAB and OpenCV run equally well on Windows, Linux and MacOS. However, when it comes to OpenCV, any device that can run C, can, in all probability, run OpenCV. Despiteall theseamazing features, OpenCV does lose out over MATLAB on some points

Ease OD use

MATLAB is a relatively easy language to get to grips with. MATLAB is a high-level scripting language, meaning that you don't have to worry about libraries, declaring variables, memory management or other lower-level programming issues. As such, it can be very easy to throw together some code to prototype your image processing idea. Say for example I want to read in an image from file and display it.

5. Collection of diseased leaf images

The diseased leaf of tomato plant is collected as image from the agriculture field. The image is captured using normal mobile phone camera. For the proper detection of diseased tomato plant leaf in this developed software, the pixel of the image can be from 250 – 350 pixels. And the resolution of the image can be from 80 dpi – 96 dpi. Once the collected image is selected in the application, the disease of the tomato plant can be detected along with what type of fertilizer or pesticide to be used for the particular disease will be known.

Collecting images of the leaf from the field → Inserting the collected images into the application → Type of disease and solution is detected

DOI:10.46647/ijetms.2023.v07i03.040 ISSN: 2581-4621

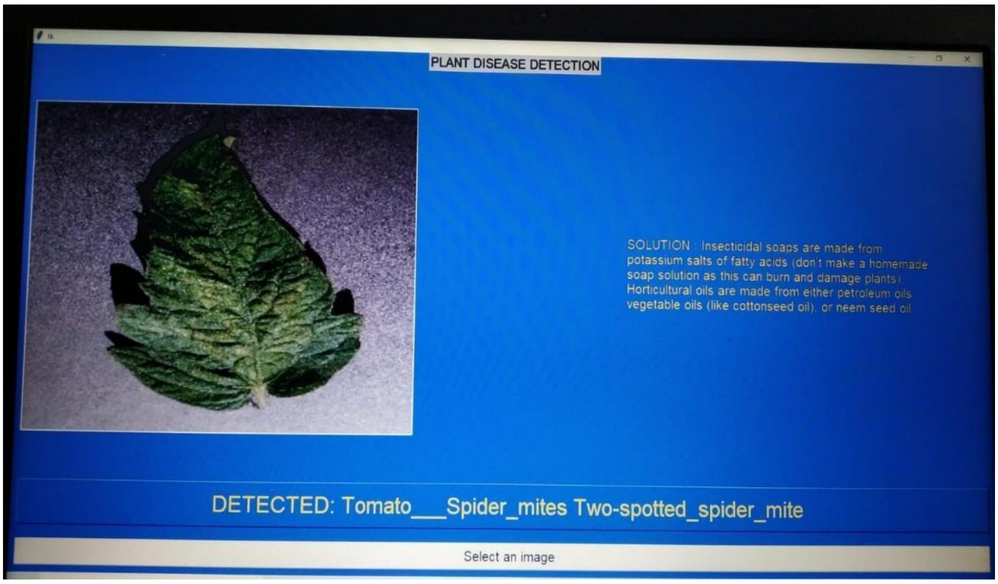
6. Advantages

- This tomato leaf disease detection software application is an eco-friendly tool
- The disease of the tomato plant leaf can be detected accurately
- Low cost
- Reliable

7. Application

- Detecting diseases on leaf of tomato plant at early stages gives strength overcome it.
- Treating it appropriately by providing the details to the farmer that which prevention actionshould be taken.
- Agriculture field crop disease detection for treatment to be done.

8. Results and Discussion



The performance matrices for each model developed for the plant tomato. We can observe that the accuracy scores are nearly equal to fi scores. This is because of balanced number of false negative and false positive predictions. This is considered as best case for any machine learning algorithm. The average accuracy was 91%.

9. Conclusion

This paper has utilized deep learning capabilities to achieve automatic tomato plant disease detection system. This system is based on a simple classification mechanism which exploits the feature extraction functionalities of CNN. For detection finally, the model utilizes the fully connected layers. The research was carried out using the publically accessible collection of images, from experimental conditions and actual environment. The system has achieved a high overall testing accuracy on publically accessible dataset, and performed well on images of field of tomato plants. It is concluded from accuracy that CNN is highly suitable for automatic detection and diagnosis of tomato plants.
This system can be integrated into mini-drones to live detection of diseases from tomato plants in cultivated areas. Though this system is trained on Plant Village dataset with only few classes it couldtell if the plant has a disease or not as somehow symptoms are same in all kinds of plants. In addition, more actual environment images can be added to the dataset to improve the accuracy on real-condition images of leaves and classify more plant types as well as disease types. In the future, this system can also adopt 3-layer approach where the first layer detects if there's any plant in an image or not, second layer tells the plant type and the third layer tells if there is any disease or not

and what type of disease is there if any.

10. References

1. Dhiman Mondal; Aruna Chakraborty; Dipak Kumar Kole; D. Dutta Majumder, "Detection and Classification technique Of Yellow Vein Mosaic Virus Disease in Okra Leaf Images Using Naive Bayesian Classifier", International Conference on Soft Computing Techniques and Implementations (ICSCTI) 13 June 2016

2. Pranjali B.Padol; Anjali A. Yadav, "Svm Classifier Based Grape Leaf Disease Detection", Conference on Advances in Signal Processing (CASP) 17 November2016

3. Zarreen Naowal Reza; Faiza Nuzhat; Nuzhat Ashraf Mahsa; Md. Haider Ali, "Detecting Jute Plant Disease Using Image Processing and Machine", International Conference on Electrical Engineering and Information Communication Technology (ICEEICT), 24 September 2016

4. M S Arya; K Anjali; Divya Unni, "Detection Of Unhealthy Plant Leaves Using Image Processing and Genetic Algorithm with Arduino", International Conference on Power, Signals, Control and Computation (EPSCICON), 14 June 2018

5. Tanvi Mehra; Vinay Kumar; Pragya Gupta, "Maturity and disease detection in toma-to using computer vision" Fourth International Conference on Parallel, Distributed and Grid Computing (PDGC), 27 April 2017

6. Pooja Pawar; Varsha Turkar; Pravin Patil ,"Cucumber disease detection using artifi-cial neural network." International Conference on Inventive Computation Technologies (ICICT),26 January 2017

7. R. P. Narmadha; G. Arulvadivu, "Detection and measurement of paddy leaf disease symptoms using image processing International Conference on Computer Communication and Informatics (ICCCI), 23 November 2017

8. Mukesh Kumar Tripathi; Dhananjay D. Maktedar. "Recent Machine Learning Based Ap- proaches for Disease Detection and Classification of Agricultural products.", International Conference on Computing Communication Control and automation (ICCUBEA), 23 February 2017

9. R. Meena Prakash; G.P. Saraswathy; G. Ramalakshmi; K.H. Mangaleswari; T. Kaviya,"Detection of leaf disease and classification using digital image processing", International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS),01 February 2018

10. Rajashekhar V S, Pravin T, Thirupathi K, Raghuraman S.Modeling and Simulation of Gravity based Zig-zag Material Handling System for Transferring Materials in Multi Floor Industries. Indian Journal of Science and Technology.2015 Sep, 8(22), pp.1-6.

11. Minh Ly Duc; Que Nguyen Kieu Viet. "Analysis Affect Factors of Smart Meter A PLS-SEM Neural Network". International Research Journal on Advanced Science Hub, 4, 12, 2022, 288-301. doi: 10.47392/irjash.2022.071

12. Maurya, Arti, Kartick Chandra Majhi, and Mahendra Yadav. "One Pot Synthesis of Lanthanum Doped Cobalt Selenate Electrocatalyst for Oxygen Evolution Reaction (OER)." International Research Journal on Advanced Science Hub 04.04 April (2022): 81–87. http://dx.doi.org/10.47392/irjash.2022.022

13. M. S. N. K. Nijamudeen, G. Muthuarasu, G. Gokulkumar, A. Nagarjunan, and T. Pravin, "Investigation on mechanical properties of aluminium with copper and silicon carbide using powder metallurgy technique," Advances in Natural and Applied Sciences, vol. 11, no. 4, pp. 277–280, 2017

14. T. Pravin, C. Somu, R. Rajavel, M. Subramanian, P. Prince Reynold, Integrated Taguchi cum grey relational experimental analysis technique (GREAT) for optimization and material characterization of FSP surface composites on AA6061 aluminium alloys, Materials Today: Proceedings,Volume 33, Part 8, 2020, Pages 5156-5161, ISSN 2214-7853. doi.org/10.1016/j.matpr.2020.02.863

15. V.S. Rajashekhar; T. Pravin; K. Thiruppathi , "Control of a snake robot with 3R joint mechanism", International Journal of Mechanisms and Robotic Systems (IJMRS), Vol. 4, No. 3, 2018. Doi: 10.1504/IJMRS.2018.10017186

16. T. Pravin, M. Sadhasivam, and S. Raghuraman, "Optimization of process parameters of Al10% Cu compacts through powder metallurgy," Applied Mechanics and Materials, vol. 813-814, pp. 603–607, 2010.
17. Rajashekhar, V., Pravin, T., Thiruppathi, K.: A review on droplet deposition manufacturinga rapid prototyping technique. Int. J. Manuf. Technol. Manage. 33(5), 362–383 (2019) https://doi.org/10.1504/IJMTM.2019.103277
18. Mondal, Palash, Hrittik Dey, Sreetama Paul, Shamik Sarkar, Apurba Das, and Amit Karmakar. "Additively manufactured porous titanium alloy scaffolds for orthopaedics: An effect of process parameters on porosity." International Research Journal on Advanced Science Hub 04.04 April (2022): 88–93. http://dx.doi. org/10.47392/irjash.2022.023
19. Krishna, Ch Yashwanth, Y Shanmukha Venkata Sri Sai, and Muniyandy Elangovan. "Development of Telemetry system for Student Formula Cars and All-terrain vehicles." International Research Journal on Advanced Science Hub 04.05 May (2022): 154–160. http://dx. doi.org/10.47392/irjash.2022.035
20. Anwer, Mohsin, Ashray Saxena, and Saif Ullah Khan. "Construction and Demolition Waste-based Geopolymer Concrete: A Brief Review." International Research Journal on Advanced Science Hub 04.05 May (2022): 108– 119. http://dx.doi.org/10.47392/irjash.2022.031
21. Bhattacharya, Kousik, Dr. Avijit Kumar Chaudhuri, Anirban Das, and Dilip K Banerjee. "Comparison of Recent Data Mining Algorithms to Identify of the factors and effects of Dengue Fever and Ensemble Random Forest, A new Algorithm." International Research Journal on Advanced Science Hub 04.05 May (2022): 143– 153. http://dx.doi.org/10.47392/irjash.2022.034
22. Baral, Manoj Kumar, Radhakrishna Das, and Abhipsa Sahu. "DFIG based WT harmonics Analysis subjected to Diverse Transmission Fault." International Research Journal on Advanced Science Hub 04.01 January (2022): 16–23. http://dx.doi.org/10.47392/irjash.2022.003
23. Pradeep Kumar Krishnan; Mallak Al Maqbali. "Investigating the Viscosity Reduction of Heavy Crude Oil Using Organic Materials to Improve Oil Production and Transportation". International Research Journal on Advanced Science Hub, 4, 01, 2022, 1-6. doi: 10.47392/irjash.2022.001
24. Rajdeep Routh; Dhruma Bhavsar; Rajiv Patel. "Socio-Economic and Policy Impacts of Heritage Conservation: A Case of Deewanji ni Haveli, Ahmedabad". International Research Journal on Advanced Science Hub, 4, 01, 2022, 7-15. doi: 10.47392/irjash.2022.002
25. Manoj Kumar Baral; Radhakrishna Das; Abhipsa Sahu. "DFIG based WT harmonics Analysis subjected to Diverse Transmission Fault". International Research Journal on Advanced Science Hub, 4, 01, 2022, 16-23. doi: 10.47392/irjash.2022.003
26. Khaled Salem Ahmad Amayreh; Ahmad Taufik Hidayah Bin Abdullah. "Conjunction in Expository Essay Writing by Jordanian Undergraduate Students Studying English as a Foreign Language (EFL)". International Research Journal on Advanced Science Hub, 4, 02, 2022, 24-30. doi: 10.47392/irjash.2022.006
27. Mohammadibrahim Korti; Basavaraj S. Malapur; Smita Gour; Rajesh M. Biradar. "Shuchi 1.0: Robotic System For Automatic Segregation of Waste & Floor Cleaning". International Research Journal on Advanced Science Hub, 4, 02, 2022, 31-37. doi: 10.47392/irjash.2022.007
28. Bhuneshwari Nayak; Rachana Choudhary; Roymon M. G.. "Isolation, Screening and Morphological characterization of Laccase producing fungi". International Research Journal on Advanced Science Hub, 4, 02, 2022, 38-43. doi: 10.47392/irjash.2022.008
29. Kotte Sowjanya; Munazzar Ajreen; Paka Sidharth; Kakara Sriharsha; Lade Aishwarya Rao. "Fuzzy thresholding technique for multiregion picture division". International Research Journal on Advanced Science Hub, 4, 03, 2022, 44-50. doi: 10.47392/irjash.2022.011
30. Mohammadibrahim Korti; Girish B. Shettar; Ganga A Hadagali; Shashidhar Shettar; Shailesh Shettar. "Voice-based direction control of a robotic vehicle through User commands". International Research Journal on Advanced Science Hub, 4, 03, 2022, 51-56. doi: 10.47392/irjash.2022.012
31. Nagendra Singh; Manoj Kumar Agrawal; Sanjeev Kumar Verma; Ashish Kumar Tiwari. "A Review on Effect of Stress and Strain Distribution on the AA5083 With Respect to Different Channel

Angle of ECAP". International Research Journal on Advanced Science Hub, 4, 03, 2022, 57-66. doi: 10.47392/irjash.2022.013

32. Nusrath Unnisa A; Manjula Yerva; Kurian M Z. "Review on Intrusion Detection System (IDS) for Network Security using Machine Learning Algorithms". International Research Journal on Advanced Science Hub, 4, 03, 2022, 67-74. doi: 10.47392/irjash.2022.014