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Plant Disease Detection using Deep Learning

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***Abstract*—Finding plant diseases is a difficult task in the agricultural industry. An early detection method might be developed with a faster and more accurate forecast of plant diseases in crops, greatly lowering economic losses. As a result, farmers may readily spot unhealthy plants using the suggested approach, increasing their profit margin and producing higher-quality harvests. Food security is seriously threatened by plant diseases. Convolutional Neural Networks (CNN), one of the most recent developments in Deep Learning techniques, have greatly aided researchers in improving the performance and accuracy of object detection and recognition systems, which are used in the proposed method to aid in the automatic detection of Plant diseases.**

Keywords—Object Detection, Disease Detection, CNN Algorithm, Deep Learning

I. INTRODUCTION

Agriculture is one of the main occupations in India. Over 60% of the country's land is dedicated to agriculture in order to supply food for its 1.3 billion inhabitants. In light of this, it is essential to use current agricultural methods. Our country's farmers will benefit financially from this. Since most farmers have always been able to identify plant diseases on their own from the past to the present, there is a chance that they will occasionally predict something incorrectly because most plants appear to be the same and are in many ways identical. The entire plant was messed up or sufficiently damaged since they utilized the wrong fertilizers or applied more fertilizer than was advised. The machine learning and deep learning model will therefore be used in this instance to help. Therefore, by using machine learning and deep learning models, we can assist framers in determining the correct plant disease. Using the image dataset, one can categorize the various plant diseases.

The manual examination of Plants by professionals is required by traditional procedures for disease detection. For many rural small-scale farmers, this continual process may be prohibitively expensive or perhaps impossible. This is the reason why there have been numerous attempts over the past few decades to automate disease identification. The system will indicate whether a plant is healthy or sick.

II. LITERATURE SURVEY

S. Kagiwada, H. Iyatomi, H. Uga, and E.E.Fujita [1] - Using a deep learning algorithm like CNN is advised. They arrive at the conclusion that they have proposed an accurate and practical cucumber diagnosis approach by utilizing a highly reliable dataset and CNNs with transfer learning. Occasionally, misclassifications occur as a result of the similarity of disease symptoms.The used algorithm is CNN. Veerendra Chaudhary, Supriya Khaitan Chandra, and Sumit Kumar[2] - Using a deep learning algorithm like CNN is advised. According to their findings, managing plant diseases can help increase yields by about 50%.

It is also possible to upgrade the system to include a real-time video entrance system that allows for unattended plant maintenance.The algorithms employed are faster , SSD, and RFCN. SVM, K-NN, and CNN are recommended machine learning algorithms, according to Ayesha Siddiqua, M. Rudagi, Sunil S. Harakannanavara Jayashri, Veena I. Puranikmath, and R. Pramodini [3]. In that procedure, they reach the conclusion that the suggested model can be strengthened by employing fusion techniques for the extraction of significant features and evaluated on various leaf samples of datasets. The proposed model has the

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requisite accuracy and works well with CNN machine learning. The used algorithms are SVM, K-NN, and CNN.

Drasko Radovanovic and Slobodan Dukanovic [4] - Using one Deep Learning algorithm and three Machine Learning algorithms (SVM, k-NN, and CNN) is advised. (CNN). In that algorithm, they come to the conclusion that even though machine learning algorithms had attained a comparatively high accuracy, their error rates were still orders of magnitude higher than those of the deep learning model and that it would be futile to attempt to enhance their performance on the same dataset. It is possible to increase the accuracy of the traditional approach by experimenting with different algorithms and by enhancing the characteristics. The algorithms used include one Deep Learning algorithm and three Machine Learning algorithms (SVM, k-NN, and CNN). (CNN).

III. PROPOSED SYSTEM

This proposed system would determine whether the plant is healthy or diseased utilizing CNN (Convolutional Neural Network) algorithm. Furthermore, any type of plant disease is input via an image. Our suggested approach provides 90% accuracy for diagnosing common plant diseases as Black Spot, leaf spots, blights, scabs, etc

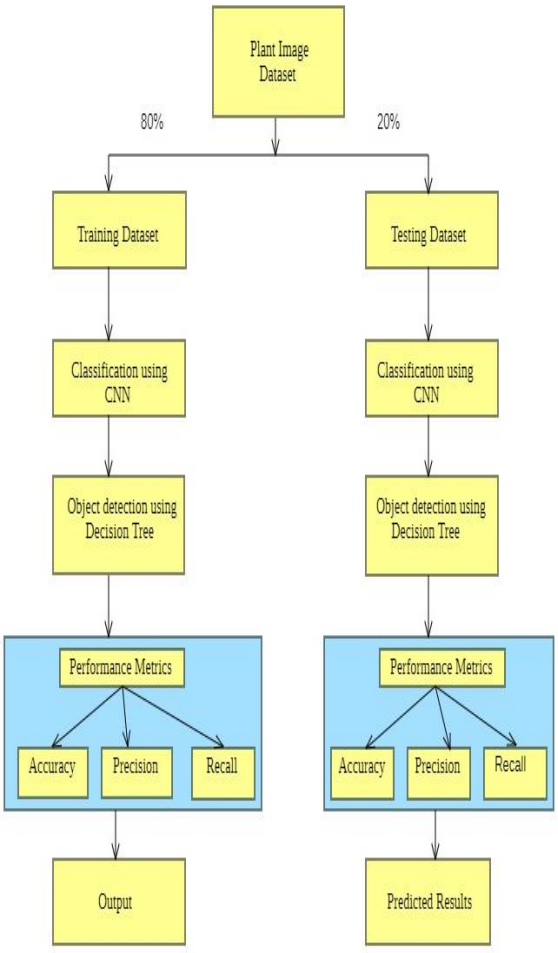

Fig.1 System Architecture of Plant Disease Detection

IV. ALGORITHMS

Convolutional neural networks (CNNs) have shown outstanding results in the classification and regression of several Plant diseases. Numerous neuron-wise and layer-wise visualization techniques were applied using a CNN trained on a publicly available dataset of images related to Plant disease. demonstrated that by capturing the colors and textures of lesions that are specific to a given disease, neural networks can mimic human decision-making when diagnosing the condition. A few visualization methods were applied as-is, while others required improvement to concentrate on a specific layer that fully captures the information and yields useful results. In addition, additional layers that weren't assisting with inference were discovered through analysis of the attention maps and eliminated from the network, leading to a 75% reduction in parameters without impacting performance.

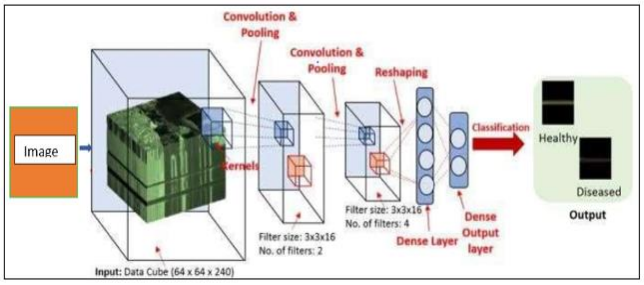

Fig.2 Convolutional Neural Networks Algorithm

Convolutional Neural Networks have the following layers:

- Convolutional Layer
  Equation for Convolutional Layer:

$$n_{out} = \left[\frac{n_{in} + 2p - k}{s}\right] + 1$$

  Where
  n_{out} =Number of output features
  n_{in} =Number of input features
  k=Convolutional Kernel Size
  p=Convolutional Padding Size
  s=Convolutional Stride Size
- ReLU Layer
  Equation for ReLU Layer
  f(x)=max(0,x)
- Pooling Layer
- Fully Connected Layer

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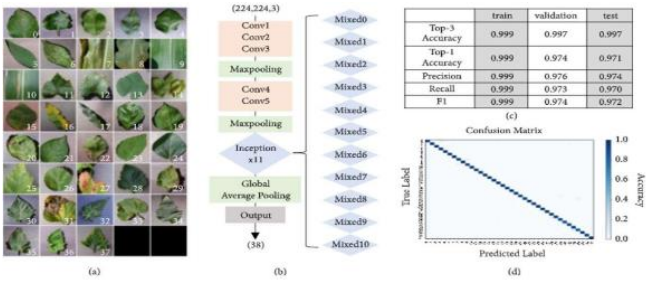

Fig .3 Image Based Diagnosis Using Convolutional Neural Network

V. EXPERIMENTAL RESULTS

Fig .4 Entry Point for Login or Register

Fig .5 Register an Account

Fig.6 Upload Plant Dataset

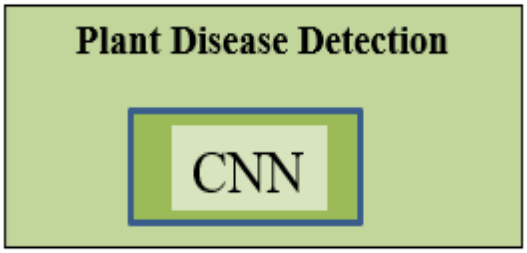

Fig .7 Detection Using the Algorithm

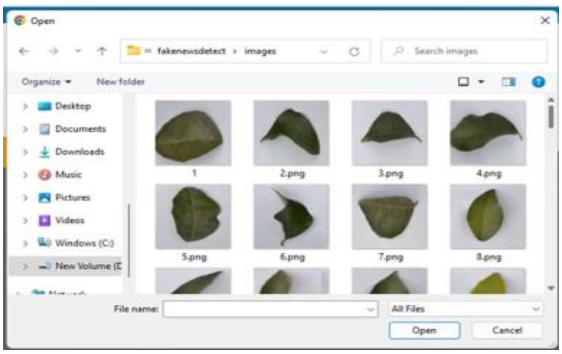

Fig .8 Selecting a Plant for prediction

Fig.9 Healthy Plant

Fig .10 Diseased Plant

VI. CONCLUSION AND FUTURESCOPE

Plant disease protection in organic agriculture is not an easy task at the moment because our farmers are not using technology and analysis efficiently. Farmer-friendly systems with GUIs have been created to forecast which plant diseases would cause these kinds of losses in order to minimize them. According to experimental findings, numerous plant illnesses can be classified into distinct groups, and specific diseases can also be treated. The following features can be added to the system to make it even better: Image processing is used to detect plant illnesses, and users can upload photos of sick plants to receive pesticide advice. Farms should use smart irrigation systems to increase productivity.

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REFERENCES

[1] E. E. Fujita, H. Uga, S. Kagiwada, H. Iyatomi , Vol 7 (4.11) ,Published 2018, Pg No 49- 54 "A Practical Plant Diagnosis System for Field Leaf Images and Feature Visualization".

[2] Sumit Kumar, Veerendra Chaudhary, Ms. SupriyaKhaitan Chandra, Vol.12, No.12, Year: 2021, Pg no: 2106-2112"Plant Disease Detection Using CNN".

[3] Sunil S. HarakannanavaraJayashri, M. Rudagib, Veena I. Puranikmathb, Ayesha Siddiquaa,R. Pramodini, Volume 3, Issue 1, June 2022, Pages 305-310 "Plant leaf disease detection using computer vision and machine learning algorithms".

[4] slobodan Dukanovic, Drasko Radovanovic, Vol 11, Issue 4, Publish 2020, Pg no: 251 – 264 "Image-Based Plant Disease Detection: A Comparison of Deep Learning and Classical Machine Learning Algorithms".

[5] Majumdar D, Kole D K, Chakraborty A, Majumder D D. Review: Detection and diagnosis of plant leaf disease using integrated image processing approach. International Journal of Computer Engineering and Applications, 2014, 6(3), 10-16.

[6] Themen D. 2014. Reduction of food losses and waste in Europe and Central Asia for improved food security and agrifood chain efficiency.http://www.fao.org/publications/card/en/c/3cc68649-a7c4-401d-ad3b14bb238f14a6.

[7] Little E L. 2014. Georgia plant disease loss estimates. http://extension.uga.edu/publications/detail.cfm?number=AP102-7.

[8] Yao Q, Guan Z, Zhou Y, Tang J, Hu Y, Yang B. Application of support vector machine for detecting rice diseases using shape and color texture features. Proceedings of the Engineering and Computation, 2009, pp. 79-83.

[9] Bashish D A, Braik M, Bani-Ahmad S. A framework for detection and classification of plant leaf and stem diseases. Proceedings of the International Conference on Signal and Image Processing, 2010, pp. 113-118.

[10] Sannakkiet S S, Rajpurohit V S, Nargund V B, Kulkarni P. Diagnosis and classification of grape leaf diseases using neural networks. Proceedings of the International Conference on Computing, Communications and Networking Technologies, 2013, pp. 1-5.

[11] Pujari J D, Yakkundi Math R, Byadgi A S. Recognition and classification of produce affected by identically, looking powdery Mildew disease. Acta Technologica Agriculturae, 2014, 17(2), 29-34.

[12] Barbedo G A. An automatic method to detect and measure leaf disease symptoms using digital image processing. Plant Disease. 2014, 98, (12) 1709-1716.

[13] Patil S P, Zambre R S. Classification of cotton leaf spot disease using a support vector machine. Engineering Research and Applications, 2014, 4(5), 92-97.

[14] Li B, Hulin M T, Brain P, Mansfield J W, Jackson R W, Harrison R J. Rapid, Automated detection of stem canker symptoms in woody perennials using artificial neural network analysis. Plant Methods, 2015, 111(), 1-9.

[15] Kawasaki Y, Uga H, Kagiwada S, Iyatomi H. Basic study of automated diagnosis of viral plant diseases using convolutional neural networks. Lecture Notes in Computer Science, 2015, 9475, 638-645.

[16] Mwebaze E, Owomugisha O G. Machine learning for plant disease incidence and severity measurements from leaf images. Proceedings of the International Conference on Machine Learning and Application, 2016, pp. 158-163.

[17] Paware P, Tukar V, Patil P. Cucumber disease detection using artificial neural network. Proceedings of the International Conference on Inventive Computation Technologies, 2016, pp. 1-5.

[18] Abdullah S N H S, Abdullah S, Petrou M, Razalan S A. A portable rice disease diagnosis tool based on bi-level color image thresholding. Applied Engineering in Agriculture, 2016, 32(4), 295-310.

[19] Mohanty S P, Hughes D P, Salathe M. Using deep learning for image based plant disease detection. Frontiers in Plant Science, 2016, 7(1419), 1-10.

[20] Qin F, Liu D, Sun B, Ruan L, Ma Z, Wang H. Identification of alfalfa leaf diseases using image recognition technology. Plos One, 2016, 11(12), 1-26.

[21] Fujita E, Uga H, Kagiwada S, Iyatomi H. Basic investigation on a robust and practical plant diagnostic system. Proceedings of the. International Conference on Machine Learning and Application, 2016, pp. 989-992.

[22] Sunil S. Harakannanavar, Jayashri M. Rudagi, Veena I Puranikmath, Ayesha Siddiqua, R Pramodini. "Plant Leaf Disease Detection using Computer Vision and Machine Learning Algorithms",Global TransitionsProceedings,2022
DOI:https://doi.org/10.1016/j.gltp.2022.03.016

[23] E. E. Fujita, H. Uga, S. Kagiwada, H. Iyatomi. "A Practical Plant Diagnosis System for Field Leaf Images and Feature Visualization" , International Journal of Engineering & Technology, 2018 DOI: https://doi.org/10.14419/ijet.v7i4.11.20687

[24] C Jackulin, S. Murugavalli. "A comprehensive review on detection of plant disease using machine learning and deep learning approaches" , Measurement: Sensors, 2022 DOI: https://doi.org/10.1016/j.measen.2022.100441