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Plant Disease Detection Using InceptionV3

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Abstract - *Plants have evolved into a major source of energy and hence play a vital role in solving the global warming challenges. There are many types of diseases that are present in plants. To detect these diseases patterns are required to recognize. To achieve their goals, many of the methods that use this approach use digital image processing tools. There are many types of pattern recognition algorithms that give detection of disease with accuracy. In the existing work backpropagation and principal component analysis are used to detect plant diseases. These algorithms are learned from training supervision in neural networks. There is an issue with the accuracy of these algorithms. These algorithms are able to detect diseases in plants but not in an accurate way. So, to increase the accuracy of plant detection a new method will be proposed. This research work is a survey based on the data and information in these research papers mentioned below.*

Key Words: *Digital image processing, Neural Networks, Pattern Recognition algorithms, Inceptionv3, CNN, Disease Detection, Cotton Disease Detection*.

1. INTRODUCTION

Plant diseases can badly affect a wide range of crops, posing a major threat to agricultural production. Manual disease identification can be time-consuming and labor-intensive. One of the most significant factors hindering plant growth is disease attack. According to a detailed agricultural study, diseases could be identified more easily using machine learning techniques instead of a manual method. As a result, pictures of the affected leaves can be identified using a machine learning method. To process the pictures captured by a camera, various image processing methods will be used. These methods would then assist in plant disease detection, resulting in increased plant yield. This research paper examines various disease identification and classification techniques as well as plant disease recognition using a Machine Learning approach.

Agriculture is vital to the economies of developing countries such as India. Plant disease has concentrated the quantity and the quality of agricultural merchandise. Cotton is a major source of revenue in India. Cotton crops suffer once leaves fall off prematurely or become infected with diseases. For millennia, farmers and planting experts have had many concerns and ongoing agricultural obstacles, including cotton disease. Even though the severe cotton disease can outcome in no grain harvest, a quick, efficient, low-cost, and dependable method for identifying cotton diseases is highly desired in the agriculture field.

Microorganisms' lifecycles cannot be predicted. Some diseases are not visible in the early stages and only appear at the end. Plant disease prediction by the naked eye is used in practice, but the results are subject to interpretation, and disease extent isn't really strategically placed. Nowadays, automatic identification of plant disease is a hot research topic, and thus detects diseases based on symptoms that appear on plant leaves. Many image processing methods have been introduced to resolve issues by pattern recognition and also some automatic segmentation tools, depending on the applications. In the next section, these papers present a survey of those proposed systems in a meaningful way. A comparison table of various algorithms, methodology, and their accuracy has been made as follows:

2. LITERATURE SURVEY

Title	Author	Method Used	Result	Journal / Conference	Year of Publication	SCI/Scopus/IEEE
Deep learning models for plant disease detection and diagnosis	Konstantinos Ferentinos	CNN	The final model achieved 99.53% accuracy on 17,548 previously unseen images.	Journal	2018	IEEE
Plant Disease Detection using CNN	Emma Harte	CNN, RestNet34	The proposed model can obtain an accuracy of 97.2 % and an F1 score of more than 96.5 %, according to validation data.	Journal	2020	IEEE
Rice plant disease classification using color features: a machine learning paradigm	Vimal K. Shrivastava & Monoj K. Pradhan	Support Vector Machine	Using a support vector machine (SVM) classifier, a performance of 94.65% was obtained.	Journal	2020	SpringerLink
An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques.	Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande	CNN	The model 3D-CNN had an accuracy rate of 95.73 %.	Journal	2014	IOSR Journal of Computer Engineering (IOSR-JCE)
Plant Disease Detection and Classification by Deep Learning	Lili Li, Shujuan Zhang, Bin Wang	CNN, ResNet, VGG16	The overall disease accuracy rate was 98% at the leaf level and 94 percent at the pixel level, according to the study.	Journal	2021	IEEE
Plant Disease Detection and Classification using CNN	Rinu R, Manjula S H	The technologies used are deep learning, CNN and VGG 16 Model.	The accuracy achieved is around 94.8%.	Journal	2021	IRJET
A Survey on Plant Leaf Disease Detection	Sneha Patel ,Dr. U.K. Jaliya , Pranay Patel	CNN	An accuracy of 93.82% was achieved on PlantVillage	Journal	2020	IJMTST

Detection of Diseases on Cotton Leaves Using K-Mean Clustering Method	Pawan P. Warne , Dr. S. R. Ganorkar	K-mean clustering algorithm	K-Mean Clustering algorithm has highest accuracy of 80.56%	Journal	2015	IRJET
Plant disease detection using CNN	Sumit Kumar, Veerendra Chaudhary,Ms. Supriya Khaitan Chandra	CNN	K-Mean Clustering algorithm has highest accuracy of 80.56%	Journal	2021	Turkish Journal of Computer and Mathematics Education
Plant Disease Detection and Classification Using Deep Neural Networks	Aravindhan Venkataraman an, Deepak Kumar P Honakeri, Pooja Agarwal	CNN, Keras deep learning framework, ResNet	A plant disease identification system with an accuracy of 96% was developed.	Journal	2019	ISSN
Real-Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks	Peng Jiang, Yuehan Chen , Bin Liu Dongjian He And Chunquan Liang	Deep-CNNs	The experimental results show that the INAR-SSD model realizes a detection performance of 78.80%	Journal	2019	IEEE
A Deep Learning-based Approach for Banana Leaf Diseases Classification	Jihen Amara, Basse m Bouaziz,and Alsayed Algergawy	Deep learning	The trained model achieves an accuracy of almost 98%	Conference Paper	2017	IEEE
Using Deep Learning for Image-Based Plant Disease Detection	Sharada Prasanna Mohanty, David Hughes and Marcel Salathé	Deep learning	The trained model achieves an accuracy of 99.35% on a held-out test set, demonstrating the feasibility of this approach	Journal	2016	Frontiers in Plant Science
Detection and classification of rice plant diseases	Harshad kumar B. Prajapati,Jites h P. Shah,Vipul K. Dabhi	K-means clustering	On the training dataset, they were 93.33 percent accurate, and on the test dataset, they were 73.33 percent accurate. They also conducted 5- and 10-fold cross-validations, achieving an accuracy of 83.80% and 88.57 %, respectively.	Journal	2017	Intelligent Decision Technologies , IOS Press

3. PROPOSED METHOD

The proposed method uses the CNN image classification technique to classify the leaf picture. Based on retrieved information at each convolution layer, it can detect and recognize diseases automatically. The architectural system of the proposed system is depicted in the diagram below. For disease identification, the system used image processing techniques. The user should first upload an image of a cotton plant leaf. The algorithm can preprocess the image before applying the CNN algorithm. The network was built using a combination of the benefit of pre-trained on ImageNet and the Inception component, and this technique outperforms other state-of-the-art techniques. Every convolution layer within dense block is tiny, so each convolution kernel is still in charge of learning the tiniest details. The below images show the block diagram and flowchart of our project :

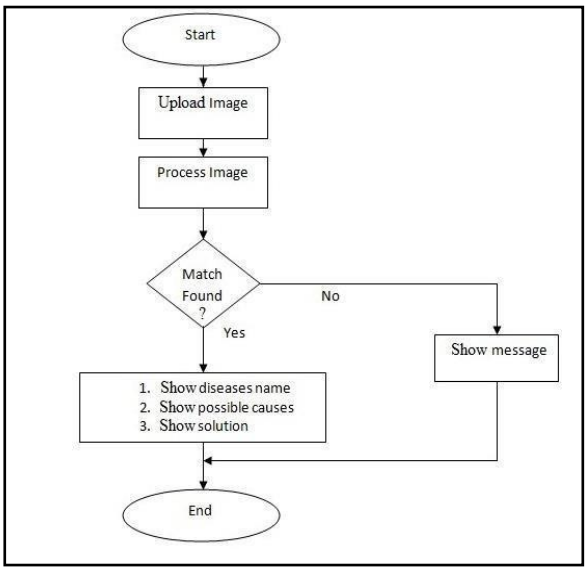


Fig -2: Flowchart

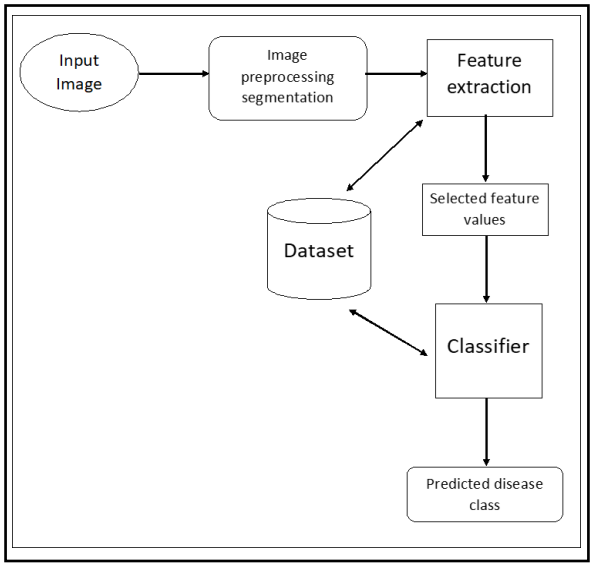


Fig -3: Block Diagram

4. IMPLEMENTATION

I. Dataset Collection: The Dataset was taken from the Kaggle of Cotton Disease Dataset existing online as such the code was also inscribed on the online kernel of Kaggle for well computation and study of training loss and validation.

II. Data Pre-Processing: Pre-processing of the input image to improve the quality of the image and to remove the undesired distortion from the image. Clipping of the leaf image is performed to get the interesting image region and then image smoothing is done using the smoothing filter. To increase the contrast, Image enhancement is also done.

II. Transfer learning is a method in which information obtained while attempting to solve one problem is saved and applied to another related problem. The most complex part of a CNN is typically the feature extraction part, which is a very issue that emerges with limited computational resources. By reusing this extraction of features section, transfer learning makes it simple. Users consider removing the final layers of the pre-trained model and replacing them with new layers to create the new CNN. The training is only done on the newly added layers.

III. Recognition Based on Inception V3 Network Transfer Learning: The Inception series of convolutional neural networks is a series of neural networks that cannot be ignored in the history of convolutional neural networks. Most neural networks only deepen the depth of the network by increasing the convolutional layer to get better performance before the emergence of the Inception neural network. Inception neural networks have changed this strategy. The Inception module proposed by Inception Neural Network uses different sizes of filters and maximum pooling to reduce the dimension of the data. This has the advantage of obtaining richer features with significantly reduced computation and fewer parameters.

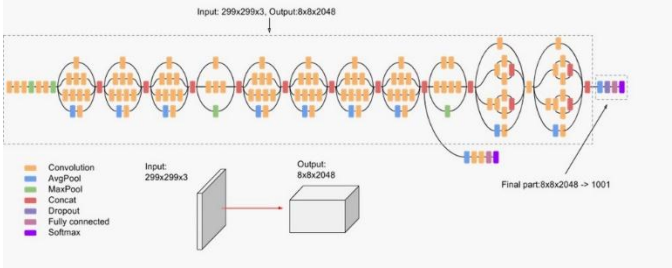
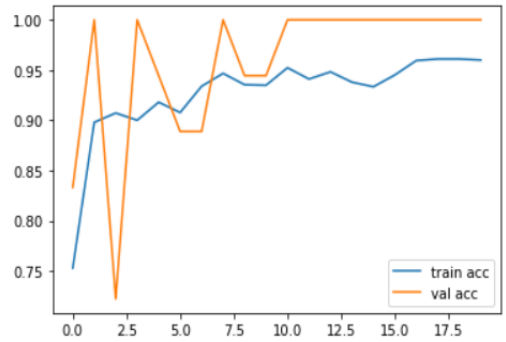
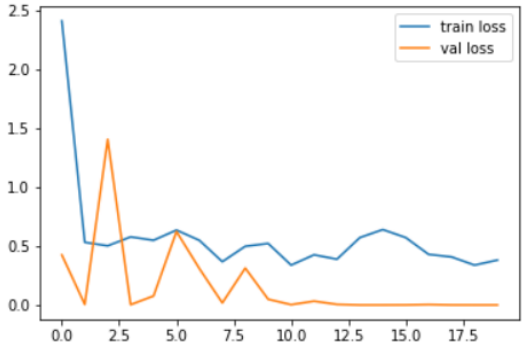


Fig -3: Inception Model

5. RESULT AND ANALYSIS



The above figure shows Train-Val Accuracy.



The above figure shows Train-Val Loss.

6. CONCLUSIONS

This research paper describes a study on various methods for detecting plant leaf disease using image processing techniques. A single method cannot be used to identify all diseases. Many methods have been developed for identifying and classifying plant diseases using the diseased plant leaves dataset. However, there is currently no reliable and cost-effective commercial technology for disease detection. In our research, we used CNN and Inception Model to detect only cotton disease. We have used the Kaggle dataset with nearly 500 photos taken in laboratory conditions to train and test the model. Further in the future, we intend to expand this project by creating a database of different plants and predicting their diseases.

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