Image Based Plant Disease Detection A Comparison of Deep Learning.

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Abstract : Agriculture is an important source of livelihood and agricultural production depends on the Indian economy. In order to increase crop yield and benefit, the identification of plant leaf diseases at an early stage is critical. This paper offers an overview of different types of plant diseases and various machine learning algorithms used for disease detection in agricultural fields. India ranks second in total farm yields. As indicated by 2018, more than 50 c/o Indian manpower was used by the agribusiness section and contributed 18 percent to total national production. For farmers, continuous monitoring of the plant according to human standards can be expensive. By using distinctive AI algorithms for plant disease detection, automatic image recognition is performed.

KEYWORDS **–** plant leaf disease, pre-processing, classifier algorithm, feature extraction, Convolutional neural network (CNN) etc.

INTRODUCTION

Plant infections cause incredible harms to farming harvests by significantly diminishing creation. Shielding plants from infections is crucial to ensure the quality and the amount of yields. A fruitful security system begins with an early discovery of the sickness and the correct therapy to forestall its spreading. Numerous examinations proposed the utilization of Convolutional Neural System (CNN) to recognize and characterize ailments. This new pattern delivered more exact classifiers contrasted with shallow AI approaches dependent close by made highlights. Notwithstanding every one of these triumphs, CNN still experiences the absence of straightforwardness that restricts its spreading in numerous spaces. These CNNs are intricate profound models that yield great outcomes to the detriment of reasonableness and interpretability. High precision isn't sufficient for plant maladies classification. Agriculture is India's backbone and about 70% of people are interested in it. Due to climate conditions, farmers have recently faced various agricultural problems due to plant diseases. Bacteria, fungi and viruses are responsible for various diseases affecting crops. This decreases crop yield. Manually, the recognition of plant diseases leads to false belief and time consuming. Image processing has been a excellent tool for diagnosis of diseases in various medical field. CNN is used specifically for the process of image and pattern recognition. In comparison with another image algorithm, CNN is a pre-processing tool. CNN achieves a stronger outcome on the vision issue of generalisation.

Literature survey

[1] “Survey on Plant diseases detection and Classification Techniques”

Author: Dr.B.Gomathy, V.Nirmala

Image processing has been a excellent tool for diagnosis of diseases in various medical field. In literature several works are carried out for leaf diagnosis also. In the disease detection process, the image is acquired, preprocessed and free from noise.

[2] “Image-Based Plant Disease Detection: A Comparison of Deep Learning and Classical Machine Learning Algorithms”

Author: Draško Radovanović 1 , Slobodan Đukanović 1, 2

Rapid human population growth necessitates a rise in food production to keep up. Diseases that are easily distributed can have a significant negative effect on plant yields, including destroying whole crops. As a result, early disease detection and prevention are extremely important.
[3] "A Review on Machine Learning Classification Techniques for Plant Disease Detection"

Author: Mrs. Shruthi U, Dr. Nagaveni V, Dr. Raghavendra B K

Agriculture is extremely important in India due to the rapid growth of the population and increased demand for food. As a result, crop yield must be increased. Disease caused by bacteria, virus, and fungus is one of the major causes of low crop yield.
[4] A Survey on Plant Disease Detection using Support Vector Machine

Author: Harshitha Poojary, Shabari Shedthi B

Agriculture is the most important source of human sustenance on the planet. It has a significant impact on the economy of countries such as India, which is heavily reliant on the quality and output of crops. Crops are susceptible to a variety of diseases, with symptoms appearing on the leaf, fruit, and stem in the majority of cases.
[5] Survey of Plant Disease Detection Using Image Classification Techniques

Author: Ankit Chhillar, sanjeev takur,ajay rana

The agricultural lands and yields have been taking care of supplying feeding currently. Thus in field of cultivating, anticipation of infection in plants expect a critical activity. Farmers widely use pesticides to prevent the crops from disease, however sometimes it happens that the infection is not evenly spread across the field but occurs at some specific spots
[6] Survey on Diseased Leaf Using Segmentation

Author: Jothiaruna.N, Joseph Abraham Sundar. K

Agriculture is important to all living things, but cultivating anything like plants and vegetables free of diseases is difficult. Disease affecting the plant or leaf is a normal occurrence; whether sufficient care is taken or not, the plant will undoubtedly be affected by disease due to nature, climate, soil conditions, and water. The identification of a diseased leaf is the main priority here. [7] Detection And Prevention Of Banana Leaf Diseases From Banana Plant Using Embedded Linux Board

[7] Detection And Prevention Of Banana Leaf Diseases From Banana Plant Using Embedded Linux Board

Author: Karthik .G, Praburam.N

Agriculture is India's economic backbone. Banana is considered to be one of the most valuable plants among different plants. Musa Paradisiacal is the scientific term for banana. It has a 10- to 12-month life cycle.

[8] Survey Paper on Plant Disease Identification Using Machine Learning Approach

Author: Jyoti Shirahatti, Rutuja Patil, Pooja Akulwar

Agriculture is vital to a farmer's livelihood. Manual disease identification can take a long time and require more labor. One of the most famous Disease is an essential factor that inhibits plant development.
Assault

[9] Recognition of Jute Diseases by Leaf Image Classification using Convolutional Neural Network
Author: Md. Sazzadur Ahamed, Aniruddha Rakshit, K. M. Zubair Hasan

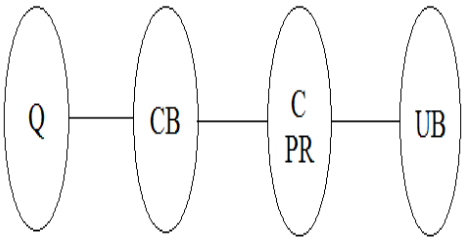
Since Convolutional Neural Networks (CNN) are achieving state-of-the-art in the field of image classification, this study focuses on using deep learning to find prominent accuracy of jute leaf image diseases. The primary goal of this paper is to improve disease identification accuracy.

[10] Design of Plant Disease Detection System: A Transfer Learning Approach
Work in Progress

Author: Boikobo Tlhobogang1 and Muhammad Wannous2

ICT has become critical in assisting farmers in gathering useful and up-to-date information and expertise, which are valuable tools in farming. The study looks into the issues surrounding the lack of timely, appropriate, and reliable farming information and knowledge for small-scale farmers.

MATHEMATICAL MODELING



Where,
Q = User entered input
CB = preprocess
C = feature selection
PR = apply cnn Algorithem
UB = predict outcome

Set Theory

1) Let S be as system which input image

S = {In, P, Op, Φ}

2) Identify Input In as

In = {Q}

Where,
Q = User entered input image(dataset)

3) Identify Process P as

P = {CB, C, PR}

Where,
CB = Preprocess
C = feature selection
PR = apply cnn Algorithem

4) Identify Output Op as

Op = {UB}

Where,
UB = Predict outcome
Φ=Failures and Success conditions.

Failures:

1. Huge database can lead to more time consumption to get the information.
2. Hardware failure.
3. Software failure.

Success:

1. Search the required information from available in Datasets.
2. User gets result very fast according to their needs.
3. **Space Complexity:**
4. The space complexity depends on Presentation and visualization of discovered patterns. More the storage of data more is the space complexity.

5. **Time Complexity:**
6. Check No. of patterns available in the datasets= n

7. If (n>1) then retrieving of information can be time consuming. So the time complexity of this algorithm is O(n^n).

8. **Proposed system:**
9. Since images shape essential data and knowledge in biological sciences, the proposed project uses image processing to detect and diagnose leaf infection. Digital image processing and image analysis technology, which is focused on developments in microelectronics and computers, has a wide range of applications in biology and avoids the issues that come with traditional photography.

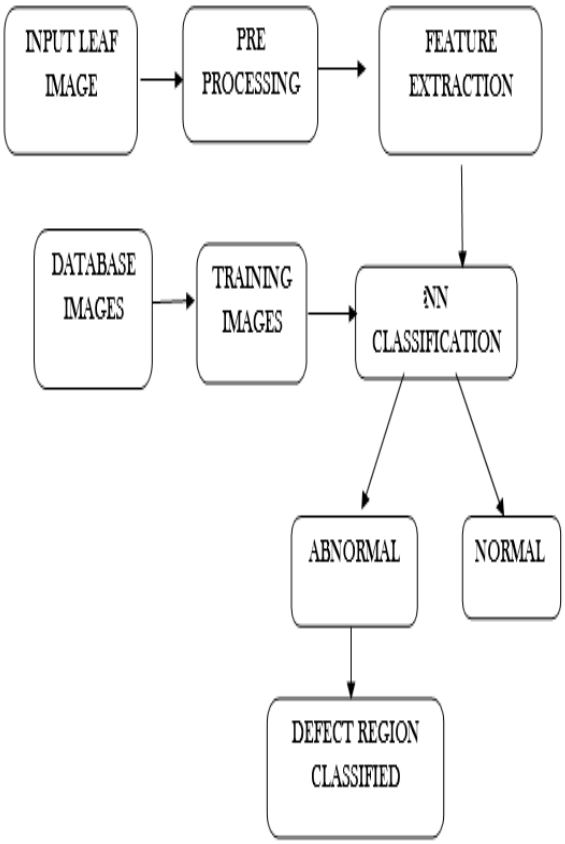


Figure: Advance System Architecture

CNN:

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm that can take an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and distinguish between them. As compared to other classification algorithms, the amount of pre-processing needed by a ConvNet is significantly less.

How CNN works

- Convolution
- Relu layer
- Pooling
- Fully connected

The integral of the product of the two functions after one is reversed and shifted is known as the convolution

$$s(t) = \int x(a)w(t-a)da \qquad s(t) = (x * w)(t)$$

of f and g, written fg:

Convolution is a commutative operation. At any time, it can be interpreted as a weighted average procedure (for this w need to be a valid probability density function).
Discrete Convolution (one-axis):

$$s[t] = (x * w)(t) = \sum_{a=-\infty}^{\infty} x[a]w[t-a]$$

Convolution and Cross-Correlation in Images
Convolution operator : G=H*F

$$G[i,j] = \sum_{u=-k}^{k} \sum_{v=-k}^{k} H[u,v]F[i-u,j-v]$$

Advantages:

[1] Confirming those infected is essential to manage and contain the virus successfully. Without reliable testing, it would be hard to determine the actual rates of cases. Thus, it is vital to identify what these available tests can and can't do to use them appropriately.
[2] Secure and efficient system.
[3] The leading objective of our paper is to enhance the value of plant leaf detection.

CONCLUSION AND FUTURE WORK

This paper presents the dominance of the DL (deep learning) method over the classical ML (machine learning) algorithms. Both the simplicity of the approach and the achieved accuracy confirm that the DL is the way to follow for image classification problems with relatively large datasets. As the achieved accuracy of the DL method is already very high, trying to improve its results on the same dataset would be of little benefit. Further work with the DL model could be done by expanding the dataset with more diverse images, collected from multiple sources, in order to allow it to generalize better. This paper presents the dominance of the DL (deep learning) method over the classical ML (machine learning) algorithms. Both the simplicity of the approach and the achieved accuracy confirm that the DL is the way to follow for image classification problems with relatively large datasets. As the achieved accuracy of the DL method is already very high, trying to improve its results on the same dataset would be of little benefit. Further work with the DL model could be done by expanding the dataset with more diverse images, collected from multiple sources, in order to allow it to generalize better.

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