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Identification of Disease and Nutrition Deficiency in Crop: A Review

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Abstract:- Farming is one of the most important areas that influences a country's economic growth. In country like India, majority of the people are dependent on agriculture for their livelihood. Several new technologies, such as Machine Learning and Deep Learning, are being executed into agriculture so that it is easier for farmers to produce and take full advantage of their yield. Improving Agriculture, Enlightening Lives, Cultivating Crops to make Farmer's Rise revenue. The objective of this paper is Identification of Disease, Nutrition Deficiency in Crop, Recommendation of Crop, Fertilizer. We have used state-of-the-art machine learning and deep learning technologies to help Farmer's guide through the entire farming processes. Make well-informed decisions to recognize the demographics of your area to know the factors that affect your crop and keep them healthy for a super awesome successful yield.

I. INTRODUCTION

In today's environment, technology plays a vital part in every field. Agriculture is essential for human survival. In agricultural techniques, we continue to use conventional ways. Farmers still have a hard time detecting nutritional deficiencies in their crops. It will require more time, work, and money to discover nutrient deficiency in crops if we use traditional methods. If the product yield, money, and time are misidentified, the product yield, money, and time will all suffer.

Overall, Nutrient deficiency of this nature In general, agricultural laboratories and experienced personnel can detect this type of nutritional deficiency (farmers). Due to a variety of environmental factors, manual nutrient deficiency predictions may be incorrect. We use the leaf to identify nutrient deficit in crops since it can occur in their leaves, stems, flowers, and fruits, among other places. A plant's growth should necessitate almost twelve nutrients. [2]

Plant diseases can reduce the quality of agricultural products. Diseases undermine the plant's normal state, causing it to adapt or halt its vital operations. Fungi, bacteria, and viruses cause these disorders, which are exacerbated by adverse environmental circumstances. [3]

Thus, Plant disease diagnosis at an early stage is critical. Farmers require continual specialised care from professionals, which can be costly and time-consuming. Subsequently, It is critical to find a quick, low-cost, and effective approach for detecting diseases from symptoms that occur on the plant leaf on a regular basis.[3]

There are agricultural crop suggestion systems on the market that take into account a variety of factors such as the weather at the time the crop is to be planted, soil type, terrain of the location, temperature and rainfall in the area, and crop market charges. [1]

II. BODY

The five elementary the following CNN architectures were tried in the problem examined in this paper, which was the diagnosis of plant illnesses from photographs of their leaves: (i) Alex Net, (ii) AlexNet, (iii) Google Net, (iv) Overfit, and (v) VGG.

The Torch71 machine learning computational framework, which leverages the LuaJIT2 programming language, was used to implement these models and their training and testing processes. In a Linux environment, training methods were implemented on the GPU of an NVIDIA® GTX1080 card using the CUDA® parallel programming framework. (Ubuntu operating system).[4]

This paper reviews and summarizes 5 models used for plant disease detection (i) Alex Net, (ii) AlexNetOWTBn, (iii) Google Net, (iv) Overfit, and (v) VGG. Performance was measured based on the Success rate in percentage, Average error, training epoch, average time per epoch. The results were like this AlexNetOWTBn given success rate of 99.44%, Avg error of 0.0192, Epoch is 46 and time is 7520s.(ii)Google Net given success rate of 97.27%, Avg error of 0.0957, Epoch is 45 and time is 7845s.

(IV) Overfit given success rate of 97.78%, Avg error of 0.0412, Epoch is 45 and time is 6204s.(iv)VGG given achievement of 99.53%, Average fault of 0.0223, Epoch is 48 and time is 7294s.The maximum success rate was By VGG so that model was finalized. [4]

III. METHODOLOGY

➢ *Pre-processing:*

Pre-processing is used to remove any noise or inconsistencies from the collected image before it is processed further.

➢ *Edge detection:*

The Sobel edge detector is employed in the proposed system to detect the edges of the paddy crop leaf and the edges of the sick section.

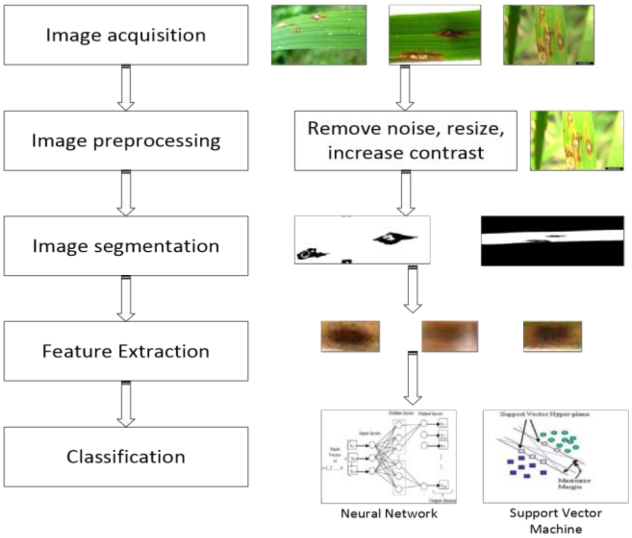

Fig. 1. Identification of Plant Diseases from Images: A General Approach [21]

➢ *Background Subtraction:*

The background of a captured image fluctuates a lot depending on the time and weather. [5]

➢ *Segmentation:*

For segmentation, the Simple Linear Interactive Clustering (SLIC) technique is used.

➢ *Feature Extraction:*

For feature extraction, we use the Gray-Level Co-occurrence Matrix (GLCM).

➢ *Classification:*

SVM, ANN (Artificial Neural Network) is utilized in the system to classify afflicted and healthy picture regions.

➢ *Pesticides Recommendation GSM*

(Global System for Mobile Communication) is used to communicate with agronomists about the bug. (6)

Image processing is utilized to find manufacturing defects, according to the author. Image accession, image pre-processing, image segmentation, characteristic bloodline, and division are all steps in the disease discovery process.

➢ *Image Acquisition:*

The photographs of the plant leaf captured by the photographic camera are enthralling. Image Pre-processing: Various pre-processing approaches are investigated to eliminate noise from images or other objects. [7]

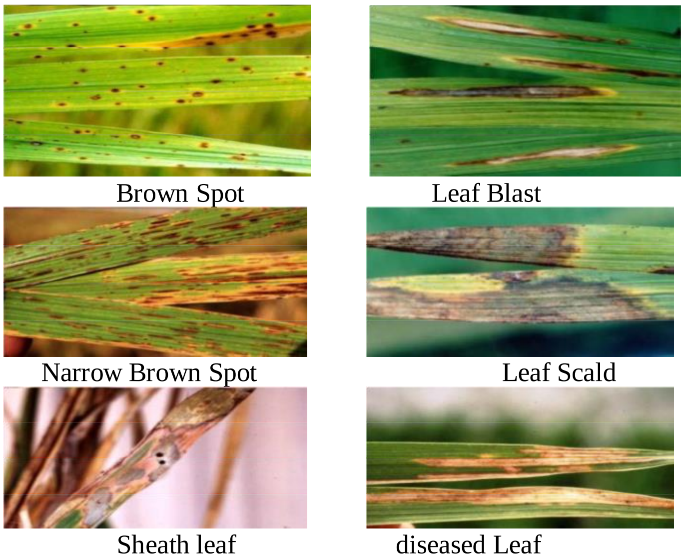

Fig. 2. Different Kinds of Diseases. Source of Images [21].

Image Segmentation: partitioning of image into various part of same features or having some similarity.

Algorithms used:

➢ Division by means of Boundary and spot finding algorithm.
➢ Clustering via K-means When it comes to identifying an object, Feature Extraction is crucial. Feature extraction is employed in many image processing applications. Color, texture, morphology, and edges, among other things, can be utilised to diagnose plant illnesses..
➢ Classification: Algorithm used are Classification ANN, BPNN algorithm.[7]

Author focused on two popular architecture, AlexNet and GoogleNet which were designed in the context of the “Large Scale Visual Recognition Challenge” (ILSVRC) for the ImageNet dataset. They then verified the performance of both architectures on the Plant Village dataset, training model from starting in first case and adapting an existing model in the other. trained models (trained on the ImageNet dataset) using transfer learning.[8]

All of the above tests were carried out with their own branch of Caffe, a fast, open-source deep learning framework. [8]

➢ *Key findings:*

This paper reviews and summarizes various techniques of deep learning. The major architecture used were AlexNet and GoogleNet architecture. In those choices of training mechanisms Were Transfer learning, Training from scratch. The total accuracy we found on the Plant Village dataset diverse from 85.53% (in case of AlexNet: Training from Scratch: Grey Scale::80–20) to 99.35% (in case of GoogleNet::Transfer Learning::Color::80–20)[5].

Image acquisition stands the primary stage of the plant disease finding system. Digital cameras, can be used to capture high-resolution plant photos. Annotated Dataset: A knowledge-based dataset for acquired photos of various classifications will be generated.

- *Image processing:*

Acquired images will be used in pre-processing stages in order to improve some image attributes that are necessary for subsequent processing.

The plant image is divided into segments using a segmentation procedure. This will be used to extract sick areas from a plant's leaf, stem, or root from the backdrop. Extraction of features: Grey level Co-occurrence Matrix (GLCM), Blend vision, and machine intelligence are commonly used to extract colour, shape, and texture features of diseased plant parts. Finally, any of the machine learning techniques are frequently used to classify the various illnesses that affect plants. The Department of Agriculture has taken steps to protect plants from many forms of illnesses throughout the seasons. By using image processing 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) methods, automation can replace manual disease surveillance in plants.

Image acquisition is the first stage of a disease detection system. Digital cameras are frequently used to capture high-quality plant photos. Annotated Dataset: a dataset based on information that will be developed for collected images of various types.

- *Image processing:*

Acquired images will be used in pre-processing phases to improve certain image attributes that are necessary for subsequent processing. The plant image is divided into segments using a segmentation procedure. This will be used to extract sick areas from a plant's leaf, stem, or root from the backdrop.

- *Feature extraction:*

Grey level Co-occurrence Matrix (GLCM), Blend vision, and machine intelligence are commonly used to extract color, shape, and texture features of diseased plant parts.

Finally, any of the machine learning techniques are frequently used to classify the various illnesses that affect plants.

- *Key findings:*

This work examines and summarises numerous disease detection strategies based on image processing that have been used by a range of academics in recent years. BPNN, SVM, K-means clustering, Otsu's method, CCM, and SGDM were the key approaches used. These methods are commonly used to determine whether the leaves are healthy or sick. The automation of the detecting system employing complicated photos acquired in outdoor lightning and extreme climatic circumstances is one of the problems encountered during this process. [9]

- *Identification:*

The information acquired by using image processing techniques often allows not only for the detection of illness, but also for the detection of other diseases. estimating its severity, there aren't many methods focused only within the detection problem. There are two main situations during which simple detection applies. Quantification The methods presented during this section aim to quantify the severity of a given disease.

- *Classification*

Classification methods are typically thought of as expansions of detection methods, however instead of attempting to discover a single illness among a variety of diseases and symptoms, these methods attempt to identify and label whatever pathology is afflicting the plant.

- *Key findings:*

This study presents a review of methods for detecting, measuring, and classifying plant diseases from digital images within the visible range using digital image processing techniques. Despite the fact that disease symptoms might appear in any part of the plant, only methods that detect visible signs in leaves and stems were tested. [10]

For picture segmentation, the k-mean segmentation technique is used. The GLCM algorithm is the useful for the feature removal. The technique of classification is applied for the disease name prediction. In the research work, two classification techniques are compared which are SVM algorithm and Naïve Bayes algorithm used for the disease prediction.

The texture analysis and texture feature extraction techniques used for the image segmentation. The threshold value algorithm is the applied for the feature extraction. The technique of classification is applied for the disease name prediction. In the research work, two classification techniques are compared which are ANN and SVM for the disease prediction.

- *Key findings:*

This paper analyses and summarises numerous image processing-based approaches for plant disease diagnosis that have been used by a number of researchers in recent years. ANN, SVM, and SGDM were the main approaches used. These methods are used to determine if the leaves are sick or healthy. Various difficulties develop as a result of this. Process that includes the automation of a detection system that makes use of complex photographs recorded in the midst of outdoor lightning and extreme weather.[13]

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Topic Name	Reference and Year	Objective	Data Set	Technique Used	Output	Advantage	Disadvantage
For enhanced plant disease identification, unsupervised picture translation utilising adversarial networks was used.	Alvaro Fuentes	Detection of leaf disease in crop.	2789 tomato plant images	GAN And CNN	Accuracy= 86.17%	Demonstration of information appropriate. GANs were used to prepare generator organization.	training process was not very stable there for it got very tough. Require several strategies to gain sufficient results. More Downfall issue.
Sunflower leaf diseases detection using Image Segmentation based on Particle swarm optimization.	Vijai Singh (2019) [16]	Detection of Sunflower leaf disease (6 diseases in leaf.)	Capture Sunflowers leaves.	Particle Swarm Optimization Algorithm.	Accuracy = 98%	PSO has the advantages of being simple to adopt and having few constraints in terms of modification. In terms of computing productivity, PSO achieves a higher level than GA.	PSO is a well-known approach, yet its application for the problem is not complicated due to its basic qualities.
Multilayered Convolution neural network for the Classification of mango leaves infected by Anthracnose Disease.	SINGH CHOUHAN et al. (2019) [15]	Classification of the Mango leaves contaminated by the Anthracnose contagious sickness.	Captured images at SMVDU, Katra	Multilayer convolutional neural network (MCNN)	Accuracy = 97.13%	The main advantage of separating MCNN from its models is that it can detect life-threatening characteristics without the need for human intervention.	Because MCNN has a restricted number of layers, the training process takes a long time if the computer does not have a powerful CPU.
Deep CNN based detection system for real time corn plant disease recognition.	Sumita Mishra [17]	Detection of disease using leaf	Plant Village dataset.	Deep Convolution Neural Network	Accuracy = 88.46%	This approach necessitates minimal human work due to the low necessity for pre-processing. It functions as a self-learner, making the pre-processing step less stressful.	To process and train the neural network, a large dataset is required.
Cucumber leaf disease identification with global pooling dilated CNN	Shanwen Zhang, [14]	Detection of disease using leaf	Acquisition of 600 cucumber sick leaves of 6 regular cucumber leaf infected	GPDCNN	Accuracy = 94.65%	GP Deep Convolution Neural Network is additional dynamic than diverse approaches.	The total accompanying layer features a huge amount of constraints, which slows down the concocting process and effectively causes over-fitting.

Performance analysis of deep learning CNN models for disease detection in plants using image segmentation	Yash Paul Singh (2019) [18]	Detection of leaf disease	Tomato healthy and infected leaves images	Convolution Neural Network	Accuracy = 98.6%	The automatic abstraction of highlights by directly handling the crude photographs is perhaps CNN's most promising condition.	CNNs lack established summaries, which are an important component of human vision.
Tomato Leaf Disease Detection using Convolution Neural Network.	Mohit Agarwal, Abhishek Singh, Siddhartha Arjaria, Amit Sinha, Suneet Gupta (2019) [19]	Detection of Tomato leaf disease.	Images taken from Plant Village dataset.	Convolution Neural Network	Classification Accuracy= 76% to 100% Average Accuracy for disease=91.2 %	The packing space required by the predicted model was on the order of 1.5MB, whereas pre-organized models required roughly 100MB.	A CNN is just an additional measure of an action, such as pooling.

Table 1: Comparison And Summary Of Related Work:

IV. CONCLUSIONS

Based on the findings of this paper's research, we believe that more research is needed in the agricultural industry to improve precision. Using ensemble approaches to ensure the system's correctness might be a wonderful way to go. Also, because CNN has minimal computing needs, we will employ it if we just consider one algorithm for the advising system.

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