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Detection of Disease Affecting on a Specific Plant Organs (Okra) and Remedies for Sustainable Crop Management

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ABSTRACT: The health of crop plants is essential for ensuring food security and sustainable agriculture. In this study, we focus on the detection of diseases affecting a specific plant organ and explore effective remedies for their management. Specifically, we investigate diseases that target a particular plant organ, such as leaves, stems, roots, or fruits, and aim to develop targeted strategies to mitigate their impact on crop yield and quality.

The research involves the use of advanced diagnostic tools, including imaging techniques, to identify and differentiate specific diseases based on the affected plant organ. Subsequently, we evaluate various remedies for disease control and management with a focus on sustainability and minimal environmental impact.

By identifying diseases affecting specific plant organs and providing targeted remedies, this research contributes to the sustainable management of crop diseases, reducing yield losses, and enhancing the quality of agricultural produce. The findings will be valuable for farmers for their productions.

KEYWORDS: Convolutional Neural Network, Image Processing, Okra Crop, Agriculture, Plant Disease.

I. INTRODUCTION

The primary occupation in India is agriculture. India ranks second in the agricultural output worldwide. Here in India, farmers cultivate a great diversity of crops. Various factors such as climatic conditions, soil conditions, various disease, etc affect the production of the crops. The existing method for plants disease detection is simply naked eye observation which requires more man labor, properly equipped laboratories, expensive devices, etc. And improper disease detection may lead to inexperienced pesticide usage that can cause development of long term resistance of the pathogens, reducing the ability of the crop to fight back. The plant disease detection can be done by observing the spot on the leaves of the affected plant. The method we are adopting to detect plant diseases is image processing using Convolution neural network (CNN).

India is an agricultural land. Agriculture provides employment to 50% of the countries workforce. India has the 61.9% production share in cultivating okra in the world. The plant is known to be cultivated in tropical, subtropical and warm temperate regions around the world. The plant often grows around 2 meters tall. Important states involved in processing okra in the volume are Tennessee, Georgia, Texas, Florida and Louisiana. There are many types of okras, but the

preference is only given to okra with rich green color. The most used is Clemson Spineless, which is rich green with fuzzy surface and ranges from about 5/8 to 1 inch in diameter. The emerald is a long variety and dark green podded.

Early recognition of plant diseases and pests is crucial for sustainable development in the agricultural sector, as well as for reducing severe financial loss and preventing waste of essential resources. Okra (scientific name: *Abelmoschus esculentus*) is an important vegetable grain that has high demand in markets for its significant health benefits and is widely cultivated in the Southern Asian regions.

To solve intricate problems compared to traditional techniques in computer vision. Convolution neural network (CNN) has shown significant success in several imaging domains and provided continuous improvement in respect of accuracy and efficiency.

II. OBJECTIVES

We focus on the detection of diseases affecting a specific plant organ and explore effective remedies for their management to detect a plant disease at very initial stage. To successfully implement automatic disease detection technique. Reducing yield losses, and enhancing the quality of agricultural produce. We evaluate various remedies for disease control. Develop a comprehensive understanding of common diseases affecting okra plants, particularly those targeting specific organs.

III. LITERATURE REVIEW

Summarize key studies and methodologies that have demonstrated the effectiveness of CNNs in detecting diseases in various crops. Discuss different CNN architectures commonly used in plant disease detection, such as AlexNet, VGG, Inception, ResNet, and DenseNet. The analysis in this research shows that plant diseases are usually detected when they start showing an impact on the physical appearance of the plants.[10]

Discuss potential solutions and future research directions to address these challenges. Provide details on experimental setups, methodologies, and outcomes, including detection accuracy and computational efficiency. Propose future research directions and areas for improvement in the application of CNNs for okra disease detection. Conclude with insights on the potential impact of CNN-based disease detection on sustainable crop management practices for okra cultivation.[08]



Figure 1: Okra Plant Disease Images

Plants are highly prone to diseases that affect the growth of the plant which in turn affects the ecology of the farmer. In order to detect a plant disease at very initial stage, use of automatic disease detection technique is advantageous. The symptoms of plant diseases are conspicuous in different parts of a plant such as leaves, fruits, flower. In this research we see, only the disease detection can be done only a separate part of the plant like leaves but the disease may occur on other plant as well like fruit, flower. [03]

Table 1: Literature Survey

Author(s)	Technology Used	Findings	Analysis	Year
Sandesh Raut, Kartik Ingole [3]	Image Processing Techniques	Reviewed various image processing techniques for leaf disease detection	Evaluated effectiveness of different methods	2021
Aditya Sinha, Rajveer Singh [4]	Image Processing	Summarized image processing approaches for disease detection in plants	Identified common methods and their performance	2020
Rashidul Hasan Hridoy et al. [5]	Deep Convolutional Neural Networks	Proposed an early recognition approach for okra plant diseases and pests classification using CNNs	Demonstrated the efficacy of CNNs for early disease detection	2021
Divyanshu Varshney et al. [9]	Machine Learning	Explored various machine learning techniques for plant disease detection	Compared performance of different ML algorithms	2022
Vijaypal Singh Dhaka et al. [10]	Deep Convolutional Neural Networks	Surveyed the use of CNNs for prediction of plant leaf diseases	Evaluated CNN architectures and their suitability	2021
Hasika S et al. [15]	Neural Network	Explored advanced plant disease detection using neural networks	Discussed the advantages and limitations of NNs in this context	2023

IV. METHODOLOGY

In this project we use okra (*Abelmoschus Esculentus*) as the data input. Okra is one of medicinal plants which are useful for diabetes and high cholesterol patient. These image data become inputs in convolutional neural network algorithm. Deep learning based to detect macronutrient deficiency of plant based on image input data. Gather a diverse dataset of okra plant images, including healthy plants and plants affected by various diseases. A large number of training images help CNNs to enhance the ability of anti-interference under complex conditions and avoid the overfitting issue during the training stage. Convolutional Neural Network (CNN) is one of deep learning methods which is used to obtain spatial information in an image. CNN has several architectures which were introduced by previous researchers to reach better performance in image recognition. To predict the disease, trained model is compared with the test image. We focus on the detection of diseases affecting a specific plant organ and explore effective remedies for their management to detect a plant disease at very initial stage. we evaluate various remedies for disease control.

The common viruses which infect okra are Yellow vein mosaic virus (YVMV), Okra mosaic virus (OkMV) and Okra leaf curl virus (OkLCV). The most serious viral disease of okra is caused by yellow vein mosaic virus (YVMV) universally faced by all okra growers Yield losses due to this virus were reported up to 63% in okra growing area of India.[14]

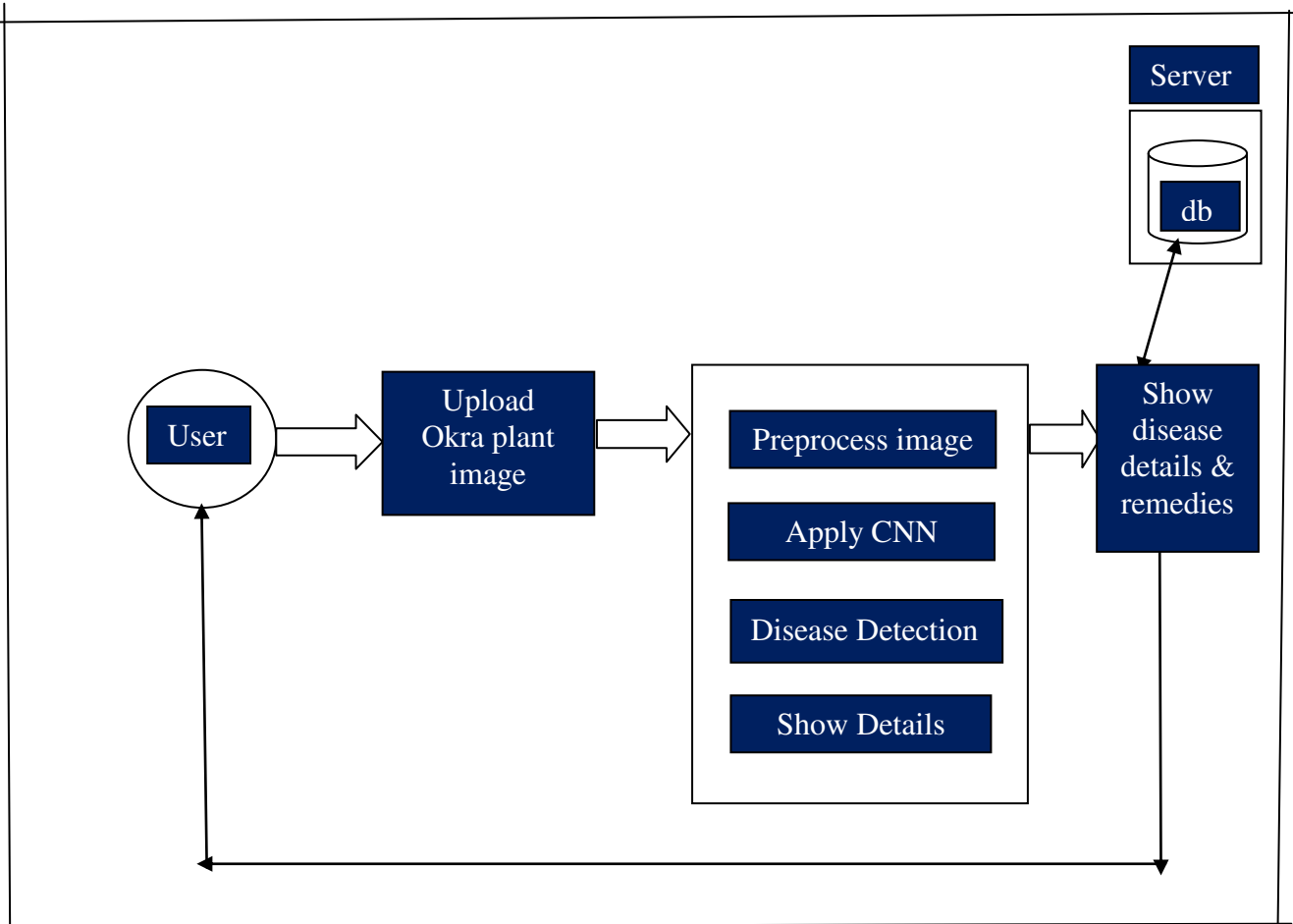


Figure 2: Working

Convolutional Neural Networks are a class of feed forward neural networks that have the ability to process multidimensional data. The first layer takes inputs and the last layer produces outputs. CNN is fine-tuned to fit accurately to the dataset of plant organ which is gathered, properly segregated and assessed by agricultural experts and verified independently for different plant diseases. To predict the disease, trained model is compared with the test image.

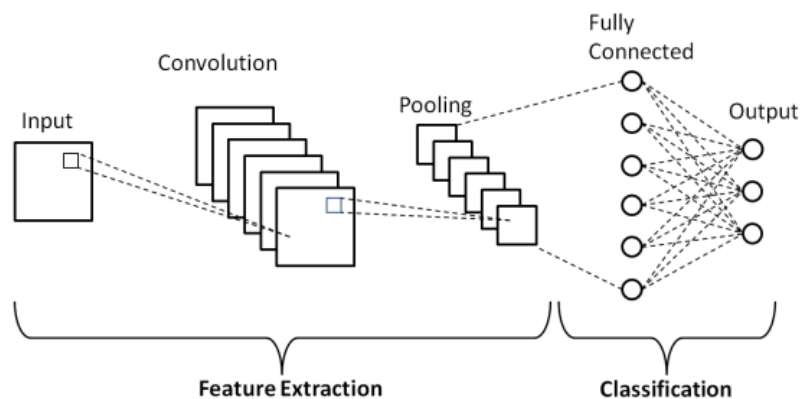


Figure 3: Convolutional Neural Network

CNN layers are arranged in three dimensions, including width, height, and depth. The four main types of layers used to build CNN architectures include the convolutional layer, the ReLU layer, the pooling layer, and the fully connected. The figure illustrates the general architecture of a CNN. It consists of multiple layers, each with a specific function in transforming the input image to a set of class probabilities. The input image is first processed by a set of convolutional layers, followed by ReLU layers for nonlinearity and pooling layers to down sample the feature maps. Finally, the fully-connected layers are used to obtain the class probabilities. [09]

Manual detection of plant disease using images is a tedious job. Hence, it is required to develop computational methods which will make the process of disease detection and classification is automatic. so that the diseased can be early detected and it is helpful for the farmers for good production.

V. ANALYSIS

Compare and contrast the performance of these architectures in terms of accuracy, speed, and computational efficiency. Review publicly available datasets specific to okra diseases, including datasets annotated for diseases affecting specific organs. Evaluate the quality and diversity of these datasets for training CNN models. There are some drawbacks of existing systems. [05]

Table 2: Available Algorithms

Method	Drawback
K-Means	Less Accurate
Naïve Bayes	Slow Learning Rate
SVM	Poor Performance Levels
KNN	Dimensionality Issues
ANN	Error Rate was high

The above figure 4, Shows Comparative Analysis of existing models and proposed CNN model. We see the CNN gives highest 96 % accuracy.

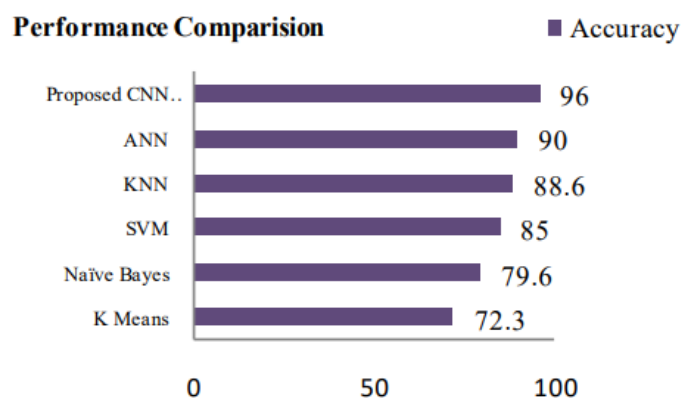


Figure 4: Performance Comparison

EXPECTED OUTCOMES

Manual detection of plant disease using leaf images is a tedious job. Hence, it is required to develop computational methods which will make the process of disease detection and classification is automatic. The goal is to develop integrated pest management strategies that are tailored to target specific plant organ diseases while minimizing the development of resistance and maintaining the overall health of the agroecosystem. In this plant diseased detection we can detect the diseased on the different organs of plant like fruit, flower, leaves. so that the diseased can be early detected and it is helpful for the farmers for good production.

VI. CONCLUSION

The proposed system was developed taking in mind the benefits of the farmers and agricultural sector. The developed system can detect disease in plant and also provide the remedy that can be taken against the disease. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant. The main goal is to identify and detect the plant diseases on a specific plant organs accurately keeping in mind the benefits of farmers. The method we are adopting to detect plant diseases is image processing using Convolution neural network (CNN).

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