A Project report on

CROP DISEASE IDENTIFICATION BY DEEP LEARNING

A Dissertation submitted to JNTU Hyderabad in partial fulfillment of the academic requirements for the award of the degree.

Bachelor of Technology

in

Computer Science and Engineering

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CERTIFICATE

This is to certify that the Major Project Phase I report entitled **"CROP DISEASE IDENTIFICATION BY DEEP LEARNING"** being submitted by S.ABHINAYA REDDY(20H51A0549),M.PRITHVIRAJ(20H51A05H8),G.BHAGATH(20H51A05K5) in partial fulfillment for the award of **Bachelor of Technology in Computer Science and Engineering** is a record of bonafide work carried out his/her under my guidance and supervision.

The results embodies in this project report have not been submitted to any other University or Institute for the award of any Degree.

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ABSTRACT

Rapid human population growth requires corresponding increase in food production. Easily spreadable diseases can have a strong negative impact on plant yields and even destroy whole crops. That is why early disease diagnosis and prevention are of very high importance. Traditional methods rely on lab analysis and human expertise which are usually expensive and unavailable in a large part of the undeveloped world. Since smartphones are becoming increasingly present even in the most rural areas, in recent years scientists have turned to automated image analysis as a way of identifying crop diseases. This paper presents the most recent results in this field, and a comparison of deep learning approach with the classical machine learning algorithms. For the problem that the network based on natural image classification is not suitable for crop pest and disease identification tasks, this paper has improved the network structure that can take care of both recognition speed and recognition accuracy.

CHAPTER 1
INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1.Problem Statement

As a result, early disease detection and prevention are extremely important.Traditional approaches depend on laboratory research and human experience, all of which are typically costly and scarce in most of the developing world. Since smartphones are becoming more common even in rural areas, scientists have switched to automatic image processing to identify crop diseases in recent years. This discusses the most recent findings in this area, as well as a comparison of deep learning and traditional machine learning algorithms.

1.2.Research Objective

There are many diseases and insect pests of crops. There are external factors, including their own factors, their own plant attributes, external weather factors, and the influence of other plants such as weeds in the growing environment and pests in the natural environment, which will affect the crops. The output and quality have a huge impact.

The research of the artificial neural network is largely inspired by the bionics. It consists of a series of simple artificial neurons connected to each other. Each neuron has three parts: input, artificial nerve cells, and output.The input signal of one neuron can come from an externally given initial value or it can be the output of another neuron. Artificial nerve cells integrate these input signals and perform threshold operations. If the integrated stimulus value exceeds a certain threshold, the neuron enters an active state; otherwise, the neuron is in a suppressed state.

1.3.Project Scope

Clearly define the main goal of the project, which is to identify and diagnose diseases in crops.

Specify the types of crops the system will focus on (e.g., wheat, rice, tomatoes) as the approach may vary depending on the crop.

Specify the machine learning or deep learning models that will be used for disease identification. Common choices include convolutional neural networks (CNNs) for image-based analysis.

Discuss whether the system will run on edge devices or mobile platforms, as this can be important for real-time diagnosis in the field.

CHAPTER 2
BACKGROUND WORK

CHAPTER 2

BACKGROUND WORK

2.1.Imaga Based Plant Disease Detection

2.1.1. Introduction

Traditional disease detection methods necessitate professional manual inspection of plants. This method must be ongoing, and it can be prohibitively costly in big farms or even inaccessible in recent decades, several efforts to automate disease detection have been made. Hyperspectral imaging is one of the most notable methods. The working model will be as follows:

For image recognition activities, researchers have moved almost entirely to DL approaches in recent years. The explanation for this is that, given a sufficiently large dataset, they almost often outperform classical algorithms and can be applied without the need for hand-engineered functionality. For the research case of plant disease classification, we equate the DL solution to traditional ML algorithms.

2.1.2. Merits, Demerits and Challenges

❖ Machine learning algorithm optimizes both variables efficiently, continuous or discrete

❖ Gives a number of optimum solutions, not a single solution. So different image segmentation results can be obtained at the same time

❖ Large number of variables can be processed at the same time.

❖ It can optimize variables with highly complex cost surfaces.

Demerits

❖ Data Collection Problem

❖ It searches from a large sampling of the cost surface.

2.1.3 Implementation

Traditional methods for detecting diseases require manual inspection of plants by experts.This process needs to be continuous, and can be very expensive in large farms, or even completely unavailable to many small farm holders living in rural areas.the PlantVillage Dataset . It consists of images of plant leaves taken in a controlled environment. In total, there are 54 306 images of 14 different plant species, distributed in 38 distinct classes given as species/disease pair.Classical methods rely on image pre-processing and the extraction of features which are then fed into one of the ML algorithms. Popular algorithm choices are Support Vector Machines (SVM), k-Nearest Neighbours (k-NN), Fully Connected Neural Networks (FCNN), Decision Trees, Random Forests etc.

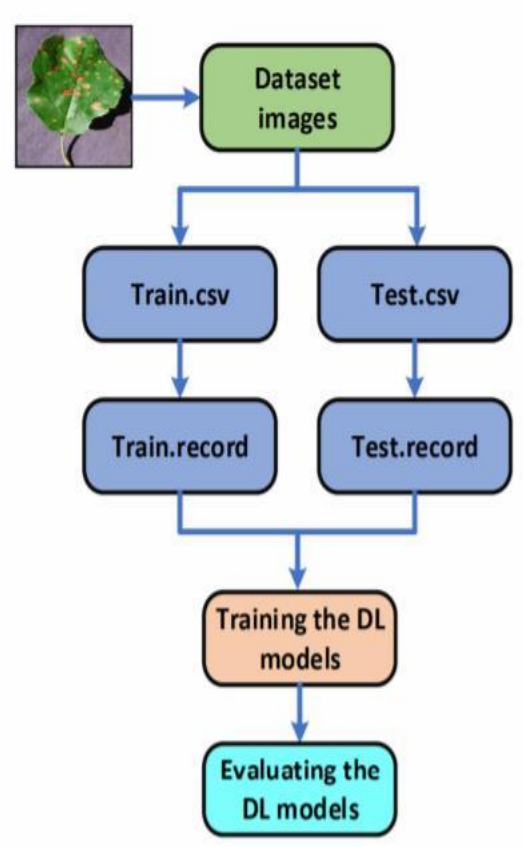

Figure 2.1.3. Deep Learning Architecture

2.2 Agri-Pal

2.2.1. Introduction

Agri-Pal is the simplest solution to aid a farmer in Agriculture - Crop and Poultry Farming. Agri-Pal is a simple Plug n Play device ensuring Disease Detection and Animal Breach Detection.

2.2.2 Merits, Demerits and Challenges

Merits

Agri-Pal is designed to increase productivity and Decrease the losses as much as possible.

Demerits

No machine learning.

Challenges

Identifying the diseases of crops as much as possible

2.2.3 Implementation

- Monitor and evaluate the plant's physical environment.
- Detects Plant and Poultry Diseases and intimate the user via Mobile App.
- App and Chatbot is introduced to guide the user which will attract Youth more into Agriculture. As a result more involvement of Youth in Agriculture. The Chat Bot is programmed in a diversity of languages to ensure that the user is able to easily clarify all their doubts and to know what they have to do in particular situations easily.
- Agri-Pal is designed to increase productivity and Decrease the losses as much as possible.
- Children in towns and cities do not get the chance to understand Agriculture in a practical way and there is nobody to guide them in it and as a result, they lose their interest. Agri-Pal will serve as a personnel companion and help them nurture their passion for agriculture
- Gardners and Kitchen Gardners can make the best use of the Device to monitor and detect diseases in their gardens, helping them in nurturing their interest it.

2.3. Crop Yield Prediction using machine learning

2.3.1 Introduction

Machine learning is an important decision support tool for crop yield prediction, including supporting decisions on what crops to grow and what to do during the growing season of the crops. Several machine learning algorithms have been applied to support crop yield prediction research. In this study, we performed a Systematic Literature Review (SLR) to extract and synthesize the algorithms and features that have been used in crop yield prediction studies. Based on our search criteria, we retrieved 567 relevant studies from six electronic databases, of which we have selected 50 studies for further analysis using inclusion and exclusion criteria. We investigated these selected studies carefully, analyzed the methods and features used, and provided suggestions for further research. According to our analysis, the most used features are temperature, rainfall, and soil type, and the most applied algorithm is Artificial Neural Networks in these models. After this observation based on the analysis of machine learning-based 50 papers, we performed an additional search in electronic databases to identify deep learning-based studies, reached 30 deep learning-based papers, and extracted the applied deep learning algorithms. According to this additional analysis, Convolutional Neural Networks (CNN) is the most widely used deep learning algorithm in these studies, and the other widely used deep learning algorithms are Long-Short Term Memory (LSTM) and Deep Neural Networks (DNN).

2.3.2 Merits, Demerits and Challenges

Merits

Accuracy was 70.06%

Demerits

No blockchain

2.3.3 Implementation

The first stage is planning the review. In this stage, research questions are identified, a protocol is developed, and eventually, the protocol is validated to see if the approach is feasible. In addition to the research questions, publication venues, initial search strings, and publication selection criteria are also defined. When all of this information is defined, the protocol is revised one more time to see if it represents a proper review protocol.

In the final stage, a.k.a., Reporting the Review, the review was concluded by documenting the results and addressing the research questions. The searching is done by narrowing down to the basic concepts that are relevant for the scope of this review. Machine learning has many application fields, which means that there are a lot of published studies that are probably not in the scope of this review article. The basic searching is done by an automated search. The starting input for the search was “machine learning” AND “yield prediction”. Articles were retrieved, and abstracts were read to find the synonyms of the keywords. The search was performed in six databases. The search input “machine learning” AND “yield prediction” was used to get a broad view of the studies. After the exclusion criteria were applied, and all the results were processed, and a more complex search string was built in order to avoid missing relevant studies. This final search string is as follows: “machine learning” OR “artificial intelligence” AND “data mining” AND “yield prediction” OR “yield forecasting” OR “yield estimation”.

CHAPTER 3
RESULTS AND DISCUSSION

CHAPTER 3

RESULTS AND DISCUSSION

3.1 Performance metrics

Author	Project	Algorithms	Limitations	Accuracy	ML	DL	BC
Baral et al.	Yield Prediction Using Artificial Neural Networks	Neural Networks	Can be improved if large dataset is provided	97%	✓	✗	✗
Gonzalez-Sanchez et al.	Predictive ability of machine learning methods for massive crop yield prediction	M5-prime regression tree, k-nearest neighbor, support vector machine	Errors in seasonal weather forecasting were not taken into account.	96%	✓	✓	✗
Ruß et al.	Data Mining with Neural Networks for Wheat Yield Prediction	Neural Networks	It takes only a fixed sized input and output for any task.	93%	✗	✓	✗

Table 3.1 Performance Comparison

CHAPTER 4
CONCLUSION

CHAPTER 4

CONCLUSION

Crop disease prediction using deep learning has the potential to revolutionize agriculture by enabling early and accurate disease detection, reducing environmental impacts, and supporting sustainable and efficient farming practices. Trying to boost the DL method's results on the dataset as the method's accuracy is still very high. Expanding the dataset of more varied images obtained from different sources.

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