A Project report on

Agrolife: ML Enabled Plant Disease Classification System

Submitted in partial fulfillment of the requirements
of the degree of

Bachelor of Engineering

in

Information Technology

by

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CERTIFICATE

This is to certify that the project Synopsis entitled ***"Agrolife: ML Enabled Plant Disease Classification System"*** Submitted by ***"Ishika Sharma(19104061), Anagha Rai(19104030), Ruta Mhaskar(19104013)"*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Information Technology*** to the University of Mumbai,is a bonafide workcarried out during academic year 2022-2023

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Declaration

I declare that this written submission represents my ideas in my own words. I have adequately cited and referenced the original sources wherever other's ideas or words have been included. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

In growing nations like India, agriculture plays a huge role, but there are still major concerns about food security. Plant diseases are the primary cause of squandered crops. In India, diseases, weeds, and pests cause the loss of 15–25 percent of the annual potential agricultural production. An autonomous system that can minimize plant loss is necessary to protect the safety of the food supply. The approach of spotting plant leaf illnesses with the unaided eye has been used by farmers for many years, although not all farmers are capable of doing so. Early detection of plant diseases is crucial since they have an impact on how much food is produced. To recognize and categorize plant leaf diseases, a variety of machine learning models are employed. However, deep learning has a significant deal of potential for improved accuracy. This article provides a thorough explanation of how Deep Learning models are used to visualize different plant illnesses and offer appropriate advice for curing these problems. Our goal is to determine whether the plant is sick or not and if it is, to identify the type of illness that caused it. Along with this, the system will give a general overview of the illness, suggest a few straightforward home cures (if necessary), and direct the user toward getting the appropriate consultation. Convolutional Neural Network (CNN), a Deep Learning technology, is applied to display the type of ailment as well as potential treatments after receiving input from the user in the form of picture data. Other programs utilized include React Native (for mobile apps), Google Cloud/ AWS Cloud Server, and TensorFlow (for data preprocessing) Thus, this would aid in increasing productivity and reducing crop loss.

Introduction

Farming produces the majority of the world's food and textiles. It is the science and art of cultivating soil, growing crops, and raising livestock. Agriculture progressed slowly for thousands of years. Farmers have traditionally used a variety of methods to protect their crops from pests and diseases. To control insects, they have used herb-based poisons on crops, hand-picked insects from plants, bred strong crop varieties, and rotated crops. Pest control chemicals are now used by almost all farmers, particularly in developed countries. Crop losses and prices have decreased dramatically as a result of the use of chemicals. Most crops are lost due to a lack of storage space, transportation, and plant diseases. More than 15 percent of crops in India are lost due to disease, making it one of the most pressing issues to address.

The ability to produce enough food to meet the needs of more than 7 billion people is still preserved by modern technology. However, a number of factors, such as temperature change, the decline in pollinators, plant diseases, and others continue to threaten food security[1]. In addition to posing a threat to global food security, plant diseases can have negative effects on smallholder farmers whose livelihoods depend on robust yields. To increase the growth and productivity of agricultural plants, diseases must be identified and treated. For traditional machine vision-based plant diseases and pests detection methods, conventional image processing algorithms or manual design of features plus classifiers are often used[2].

Disease identification is one of the key components of a successful farming system. A crucial component of agriculture is the early diagnosis of plant leaf disease. In general, a farmer can spot disease symptoms in plants that require ongoing inspection by using eye observations. A plant's leaves might die from a variety of illnesses. To get over these difficulties, many groups used image processing using ML/DL for the quality evaluation of leaves. According to studies, image processing methods are useful tools for identifying and classifying plant leaf diseases. Plant diseases have an impact on the development of their particular species, hence early detection is crucial.

For autonomous plant disease diagnosis utilizing artificial intelligence approaches with less human labor, a number of strategies are now offered[3]. Many Machine Learning (ML) models have been employed for the detection and classification of plant diseases but, after the advancements in a subset of ML, that is, Deep Learning (DL), this area of research appears to have great potential in terms of increased accuracy[4]. The method for classifying images that has the highest success is a deep convolutional neural network (DCNN). Convolutional, pooling, and fully connected layers are among the layers that make up the DCNN, which can learn features from training data. Deep learning techniques are very successful in image classification problems[5]. The performance of deep neural network models is now notably better than that of traditional models, and deep learning is currently sweeping both industry and academia. The deep convolutional neural network has been the most widely used deep learning framework in recent years.

Objectives

- To detect the crop disease using a Convolutional Neural Network algorithm.
- To give the right knowledge to the users about which disease the crop has based on the image classification.
- To help predict disease and display the actions to be taken at the right time.
- To provide information about the disease predicted to the user and help them make an informed decision before taking appropriate measures.
- To provide multilingual facility to the website.

Literature Review

The goal of the literature review is to understand the knowledge that is already available on the Plant Disease Classification System. The study of the research helped in choosing the best algorithm and feature extraction technique for effective results.

1. In paper [1], pre-trained weights are used as a starting point to avoid a very long treatment. Following this, the proposed approach is compared to several artisanal shallow structure approaches based on machine learning. The proposed system achieves promising precision results on the plant leaves dataset, demonstrating the effectiveness of its approach for the detection of diseases.

2. In paper [2], the review provides a definition of plant diseases and pest detection problems and puts forward a comparison with traditional plant diseases and pest detection methods. According to the difference in network structure, this study outlines the research on plant diseases and pests detection based on deep learning in recent years from three aspects of classification network, detection network, and segmentation network, and the advantages and disadvantages of each method are summarized. Common datasets are introduced, and the performance of existing studies is compared. On this basis, possible challenges in practical applications of plant diseases and pest detection based on deep learning are discussed. In addition, many possible solutions and research ideas are proposed for the challenges, and several suggestions are given.

3. In paper [3], a novel 14-layered deep convolutional neural network (14-DCNN) was proposed to detect plant leaf diseases using leaf images. A new dataset was created using multiple open datasets. Data augmentation techniques were used to balance the individual class sizes of the dataset. Three image augmentation techniques were used namely basic image manipulation (BIM), deep convolutional generative adversarial network (DCGAN) and neural style transfer (NST). The dataset consists of 147,500 images of 58 different healthy and diseased plant leaf classes along with one no-leaf class. The proposed DCNN model was trained in multi-graphics processing units (MGPUs) environment for 1000 epochs. The random search with the coarse-to-fine searching technique was used to select the most suitable hyperparameter values in order to improve the training performance of the proposed DCNN model.

4. In paper [4], the review provides a comprehensive explanation of Deep Learning models used to visualize various plant diseases. In addition to this, some research gaps are identified from which to obtain greater transparency for detecting diseases in plants, even before their symptoms appear clearly. The paper also states that plant diseases affect the growth of their respective species, thus making its early identification very important. Many Machine Learning (ML) models have been employed for the detection and classification of plant diseases but, after the advancements in a subset of ML i.e Deep Learning (DL), this area of research appears to have great potential in terms of increased accuracy. Many developed/modified DL architectures are implemented along with several visualization techniques to detect and classify the symptoms of plant diseases. Moreover, several performance metrics are used for the evaluation of these architectures/techniques.

5. In Paper [5] deals with a replacement approach to the development of a disease recognition model, supported leaf image classification, by the utilization of deep convolutional networks. All the essential steps required for implementing this disease recognition model are completely described throughout the paper, starting from gathering images to make a database, assessed by agricultural experts, and a deep learning framework to perform the deep Convolutional Neural Network training. This method paper may be a new approach to detecting plant diseases using the deep convolutional neural network trained and fine-tuned to suit accurately to the database of a plant's leaves that were gathered independently for diverse plant diseases. The advance and novelty of the developed model illustrate its simplicity: healthy leaves and background images are in line with other classes, enabling the model to distinguish between diseased leaves and healthy ones, or from the environment by using CNN.

6. In Paper [6] provides the research progress of deep learning technology in the field of crop leaf disease identification in recent years. The application of deep learning in plant disease recognition can avoid the disadvantages caused by the artificial selection of disease spot features, make plant disease feature extraction more objective as well as improve the research efficiency and technology transformation speed. In this paper, the authors present the current trends and challenges for the detection of plant leaf disease using deep learning and advanced imaging techniques hoping that this work will be a valuable resource for researchers who study the detection of plant diseases and insect pests. At the same time, they also discussed some of the current challenges and problems that need to be resolved.

Problem Definition

Problem Identified:
India is renowned as a nation of farmers, and there are acres dedicated to agriculture. The plants become sick because of a variety of circumstances, including temperature, pollution, pests, and many more. Sometimes these infected plants are not visible enough to determine the type of illness that it has produced. This results in mass deduction of food production.

Solution Proposed:
As a solution to this problem, this project focuses on studying and identifying whether the plant is diseased. If so, we give a brief overview of the illness, suggest various natural treatments, and advise the user to seek appropriate medical advice. The Convolutional Neural Network deep learning approach utilized here receives input from the user and shows the type of disease, along with a description of it and possible treatments. The goal of this project is to pinpoint the disease's type and offer a cure. Consequently, it contributes to increased output and the prevention of crop loss.

Proposed System Architecture/Design Prototype

A database containing all the various plant leaf diseases that we have considered is seen in figure 1.1. To achieve the highest level of accuracy, the module is repeatedly trained. When the module receives a new image, its features are compared to those that have already been trained and stored in the database. It then delivers the necessary outcome.

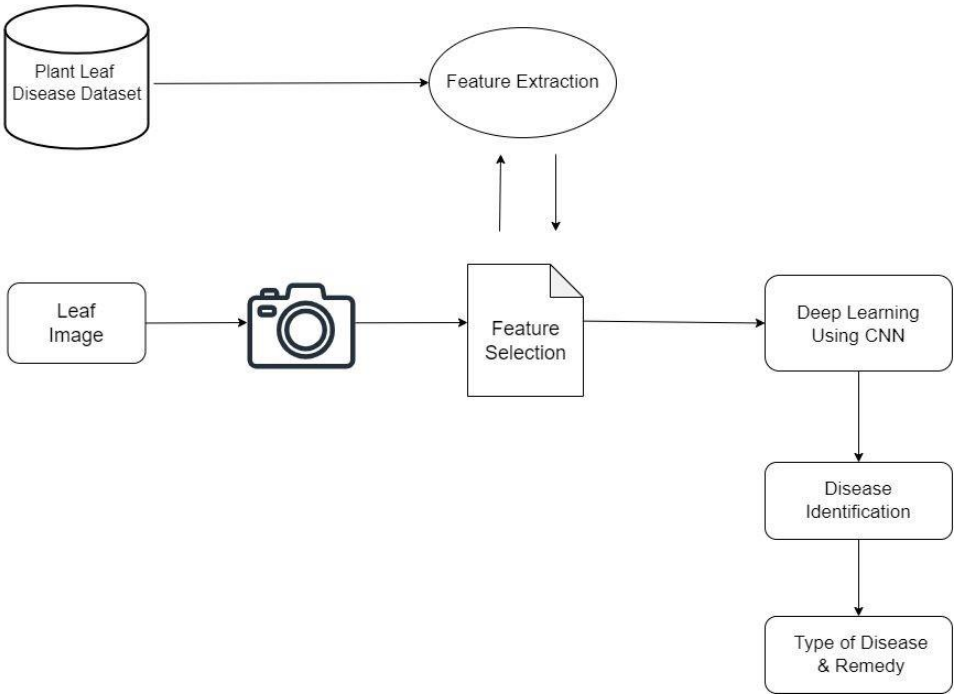

Figure 1: Architecture Diagram

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1 Publication

Paper entitled **“Paper Title”** is presented at **“International Conference/Journal Name”** by **“Author Name”.**