**Plant Disease Detection using Deep Learning**

**DISSERTATION**

Submitted in partial fulfillment of the

*Requirements for the award of the degree*

*of*

Bachelor of Technology

in

**Computer Science & Engineering**

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**Dwarka, New Delhi**

**Year 2022-2023**

**Introduction**

The health and productivity of agricultural crops play a crucial role in ensuring food security and sustainable development. However, plant diseases pose significant threats to crop yields and can lead to substantial economic losses for farmers worldwide. Timely and accurate detection of plant diseases is essential for effective disease management and minimizing crop damage. This project aims to contribute to the field of plant pathology by developing a “Plant Disease Detection” system that can efficiently identify diseases affecting various crops. By different machine learning algorithms and image processing techniques, the system will analyze images of plant leaves or other affected parts, and accurately identify the presence of diseases or abnormalities. The project will focus on the detection of common and economically significant plant diseases, such as powdery mildew, leaf spot, blight, and rust. By harnessing the power of machine learning techniques, this project seeks to provide an efficient and accurate solution to detect and diagnose plant diseases, leading to improved crop management, increased agricultural productivity, and ultimately, a more sustainable future for the farming community.

**A Convolutional Neural Network** (CNN) is a type of artificial neural network commonly used for analyzing visual data such as images and videos. CNNs are particularly effective in tasks like image recognition, object detection, and image classification.

The key feature of CNNs is the convolutional layer, which performs the convolution operation on the input data. The convolution operation involves sliding a small filter (also known as a kernel) over the input data and computing the dot product between the filter and the local receptive field of the input at each position. This operation allows the network to detect local patterns and features, such as edges, corners, and textures.

CNNs typically consist of multiple convolutional layers followed by pooling layers and fully connected layers. The pooling layers reduce the spatial dimensionality of the feature maps produced by the convolutional layers, allowing the network to focus on the most important features while reducing the computational cost. The fully connected layers at the end of the network combine the high-level features learned by the previous layers and produce the final classification or regression output.

The training process of a CNN involves feeding the network with labeled training data and adjusting the weights and biases of the neurons through a process called backpropagation. Backpropagation computes the gradients of the network's parameters with respect to a loss function, and then updates the parameters using optimization algorithms like stochastic gradient descent (SGD) or its variants.

**Objective**

The main implication of this project to benefit farmers and the agricultural community as a whole, leading to improved crop management and sustainable agriculture.

1. Enable the system to provide real-time detection of plant diseases, allowing for immediate intervention and preventive measures.
2. Improve the efficiency of disease detection by reducing reliance on manual inspection, thus saving time and resources for farmers and agricultural experts.
3. Enable farmers to proactively manage crop health by providing early detection and identification of diseases, facilitating timely treatment and prevention strategies.
4. Minimize the impact of plant diseases on crop yield and quality by enabling early intervention, leading to increased productivity and reduced economic losses.

**Scope**

The scope of this project is as follows:

1. This can benefit farmers by providing early and accurate detection of diseases, enabling timely intervention and effective crop management practices.
2. It will provide valuable insights into disease patterns, epidemiology, and factors influencing disease spread, leading to a deeper understanding of plant diseases and their management.
3. We can integrate this technology with Remote sensing technologies to enable the monitoring of large agricultural areas, providing a broader perspective on disease occurrence, spread, and severity.

**Software & Tech Stack**

1. Python 3.0+
2. Pytorch
3. Jupyter Notebook
4. ReactJS
5. Fast API
6. Visual Studio Code
7. Dataset : Identification of Plant Leaf Diseases Using a 9-layer Deep Convolutional Neural Network

**References**

[1] Liu, J., Wang, X. Plant diseases and pests detection based on deep learning: a review. *Plant Methods* 17, 22 (2021). https://doi.org/10.1186/s13007-021-00722-9.

[2] Barbedo, J. G. A. 2013. Digital image processing techniques for detecting, quantifying and classifying plant diseases. SpringerPlus 2:660. https://doi.org/10.1186/2193-1801-2-660 Crossref, ISI, Google Scholar

[3] Singh, D., Gupta, P., & Sahoo, S. K. (2020). Plant disease detection using deep learning models: A comprehensive review. Computers and electronics in agriculture, 172, 105345. doi: 10.1016/j.compag.2020.105345

[4] Sladojevic, S., Arsenovic, M., Anderla, A., Culibrk, D., & Stefanovic, D. (2016). Deep neural networks based recognition of plant diseases by leaf image classification. Computational intelligence and neuroscience, 2016, 3289801. doi: 10.1155/2016/3289801