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CROP RECOMMENDATION AND LEAF DISEASE DETECTION USING DEEP LEARNING

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ABSTRACT

A significant portion of India's population relies on agriculture as a primary source of income. The success of farming is heavily influenced by the quality of the soil and the ability to match crops to their ideal growing conditions. Despite its importance, farmers, particularly those new to the industry, often encounter challenges. One of the most prevalent issues is crop disease, which can be detrimental to crop yield and quality. To address this challenge, a deep learning-based system has been developed to identify crop diseases and provide recommendations for suitable plants. The system utilizes RGB images to accurately identify diseases and suggest optimal crops. The identification and classification of crop diseases are accomplished using various machine learning algorithms such as KNN, K-Means, Random Forest, Naive Bayes, and CNN.

Keywords: Agriculture, Crop disease, deep learning, KNN, K-Means, Random Forest, Naive Bayes, CNN, crop recommendations.

I. INTRODUCTION

India is a country where most of the economy comes from farming. There is a variety of weather and soil see in India. In India, different regions grow different types of crops. Also one of the major problems of farming is crop diseases. It affects the growth of crops and production. We build a system that recommends the crop and identifies the diseases at the same time. The system based of deep learning. A subset of machine learning is known as deep learning. Deep learning uses neural networks for classification and identification. Neural networks give the ability to think like a human brain. From that, we get more accurate results. The system uses a dataset for training. After training identifies diseases and recommends the crops.

II. LITERATURE SURVEY

In recent years, the use of image processing and machine learning techniques has gained popularity in the field of agriculture for crop management and disease detection. The objective of this literature survey is to provide an overview of recent research studies that utilize image processing and machine learning techniques to address various agricultural issues such as crop yield, disease detection, and soil quality.Merchant proposed a system in 2018 in that uses image processing and machine learning techniques to detect nutrient deficiencies in mango leaves. They created a convolutional neural network that uses the K-means clustering algorithm to identify numerous foliar plant illnesses and reduce the possibility of unhealthful plant growth. The other research paper written by Abirami in 2019 developed a software system capable of detecting diseases such as Alternaria, Alternata, Anthracnose, Bacterial Blight, and Cercospora Leaf Spot by utilizing image processing techniques in MATLAB. Sannakki (2013) proposed a method for diagnosing and classifying grape leaf diseases through the use of neural networks.In 2017 Kaur introduced a novel technique for plant disease detection using image processing that identifies and classifies diseases that affect plant leaves, stems, and fruits. Rothe developed a system in 2015 that utilizes pattern recognition techniques for the identification of cotton leaf diseases.Apart from disease detection, there are studies focused on crop recommendation and soil quality assessment. Parikh proposed a system in 2021 that gives crop recommendations based on Machine Learning to help farmers take proper crops based on weather, soil, and humidity conditions. In 2019 Jujur developed a model based on the KNN Supervised Learning algorithm to reduce soil degradation and the use of fertilizers. The Pande write a paper in 2021 in that he proposed a mobile application model based on the ANN, SVM, MLR, KNN, and Random forest ML algorithms that give about 91% accuracy in crop prediction. Finally, In 2021 Gosai

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proposed a system that combines IoT and machine learning methods to test soil quality and improve agricultural productivity.

III. METHODOLOGY

In the proposed system we will build crop recommendation and disease identification. The user is given the input of an RGB image to predict crops and identify diseases. The model is working on deep learning techniques.

A. Image Acquisition- In image acquisition, the images are collected for training purposes. The images are in the same format. So it is easy to train the system.

B. Pre-processing- After the collection of the data from the different sources, the next is image pre-processing. In that, the data is purified. For data pre-processing model uses different approaches.

C. Feature Extraction- Feature extraction is focused on unique attributes. It takes the specific attribute from the data. From that the data is easy and faster to classify.

D. Classification- For classification use the neural networks. CNN is the most efficient way to classify the data and give quick output.

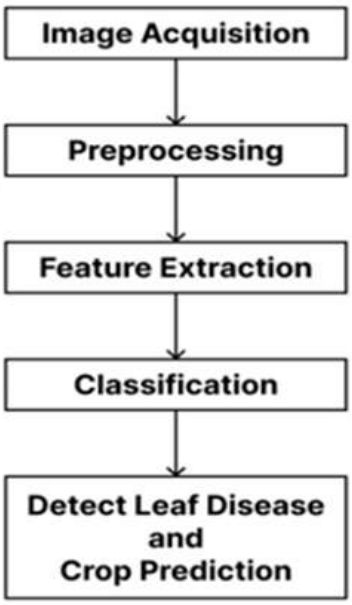

Figure 1: Architecture Diagram.

At end the system recommends the plats and leaf disease based on the input image. It helps the growth of farming and tackles difficulties.

IV. ALGORITHM

The Convolutional Neural Network (CNN) algorithm is a type of deep learning algorithm commonly used in image and video recognition tasks. It works by applying a series of convolutional filters to the input image, which extract relevant features at different levels of abstraction. These features are then passed through a series of fully connected layers, which map them to the appropriate output class.

To explain the CNN algorithm more formally, here are the main steps:

1. Convolutional Layer: In the first layer of the CNN, the input image is convolved with a set of learnable filters. Each filter performs a convolution operation over the input image, producing a feature map that highlights certain patterns or features. The filters are typically small in size (e.g. 3x3 or 5x5) and are applied with a stride value that determines the amount of overlap between adjacent filters.

2. ReLU Activation: After each convolution operation, a rectified linear unit (ReLU) activation function is applied element-wise to the feature map. This introduces non-linearity into the model, allowing it to learn complex patterns and relationships in the input data.

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3. Pooling Layer: The output of the ReLU activation is then passed through a pooling layer, which downsamples the feature map by a factor of 2 (or other value). This reduces the spatial dimensionality of the data and helps to prevent overfitting by introducing a form of regularization.

4. Fully Connected Layer: After several convolutional and pooling layers, the output is passed through one or more fully connected layers, which map the features to the appropriate output class. Each neuron in the fully connected layer is connected to all neurons in the previous layer, and their weights are learned during training using backpropagation.

5. Output Layer: The final layer of the CNN is typically a softmax activation function, which outputs a probability distribution over the different classes. The class with the highest probability is then selected as the predicted output.Overall, the CNN algorithm is a powerful tool for image and video recognition tasks, and has been used to achieve state-of-the-art results on a wide range of benchmark datasets.

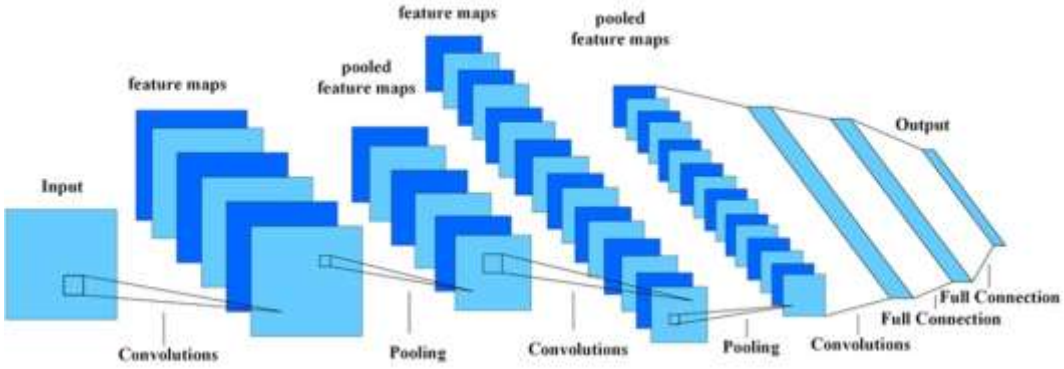

Figure 1: CNN Algorithm.

V. CONCLUSION

The system is beneficial for farmers and new once who interested in farming. The system predicts crops and identifies the disease on the crop. Based on identify disease recommended effective pesticides. Help to reduce the difficulties and production in agriculture.

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