A Wheat Crop Disease Prediction Using Convolution Neural Network

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ABSTRACT –

A programme that can take pictures of common medicinal plants and calculate the percentage of damage done to the plants developed with the aid of the deep learning CNN algorithm for the analysis portion that displays the results on the programme. They also developed the client side of the programme in Python. The user of this application will have access to the data set's photos, the plant's historical information, and frequently occurring pests and diseases. In this study, we utilized photos taken on-site by camera devices at different resolutions to diagnose wheat illnesses using a deeplearning system. Our dataset includes the four types of wheat diseases: stem rust, yellow rust, Powderly, and normal. There were many photos in each category. To train our classifier we have used the Convolutional Neural Network (CNN). One of CNN's most significant advantages is its ability to analyze the raw pictures and automatically extract features immediately. The proposed research has developed a framework to identify and classify different wheat crop diseases using CNN-based classification. They might negatively impact Wheat crop production regarding quality, quantity, or productivity if due care is not given in recognizing the illnesses. This article suggests a strategy for automating the disease identification process in Wheat crop leaves, where image processing is first employed for the necessary color transformation. Then the CNN algorithm is used to identify the sick area of the leaves. Convolutional neural networks (CNNs) have been used for deep learning to classify a variety of plant leaf diseases effectively. In this study, we suggested a deep-learning approach identify plant diseases. CNN has been used for feature extraction and classification. They used some real-time plant images for experimental analysis with leaf objects. The proposed model comprises of four processes, viz., i) acquisition, ii) preprocessing, iii) segmentation, iv) feature extraction and classification. Initially, acquisition of images takes place using Internet of Things (IoT) devices

Keywords: Deep learning, Prediction, preprocess. .

INTRODUCTION

All nations' economies depend heavily on agriculture because, on average, a state's GDP is based on farming to the tune of 70%. Plant ailments, however, have a negative impact on the economy, production, and ultimately food quality. We can observe plants everywhere. Thus there are a wide diversity of plants on earth. For instance, more than 240,500 plant species have been identified and cataloged. According to statistics, plants are crucial in improving the climate, serving the soil, and purifying the water. In particular, plants provide us with food and oxygen. Every plant, in reality, has unique traits, such as economic worth, dietary preferences, and shape. Because of this, farmers have a wide variety of options for choosing different acceptable crops and discovering the best insecticides for plants. A kind of plant called wheat is produced all over the globe for its high nutrient and valuable grain. It is among the top three crops grown worldwide, along with rice and maize. Wheat cultivation has been practiced for almost 6,000 years and probably began there, along with other dependable crops. The wheat disease causes a significant decrease in both the quality and output of agricultural production. Stem rust, yellow rust, and

Powderly are wheat's three most prevalent diseases; for a good understanding, experiments on plant disease are preferable to the visually discernible patterns of wheat plant disease. Monitoring leaf disease is crucial to the productive development of crops on a farm. Initially, a knowledgeable individual manually keeps track of the wheat illness. To do this, the specialists must possess training in agriculture, in-depth knowledge of many different fields, experience with the signs of conditions, and an understanding of the causes of diseases. Farmers in certain developed nations would need to travel great distances to consult specialists since doing so is costly and time-consuming. A helpful study topic is the automated detection of wheat illnesses, which has been shown to aid in crop monitoring and automatically identify disease signs as soon as they develop on wheat leaves. Enhancing crop yield and quality is essential for the disease protection of plants. To choose the best course of action and prevent the spread of the illness, providing initial detection and identifying the target disease is more beneficial.

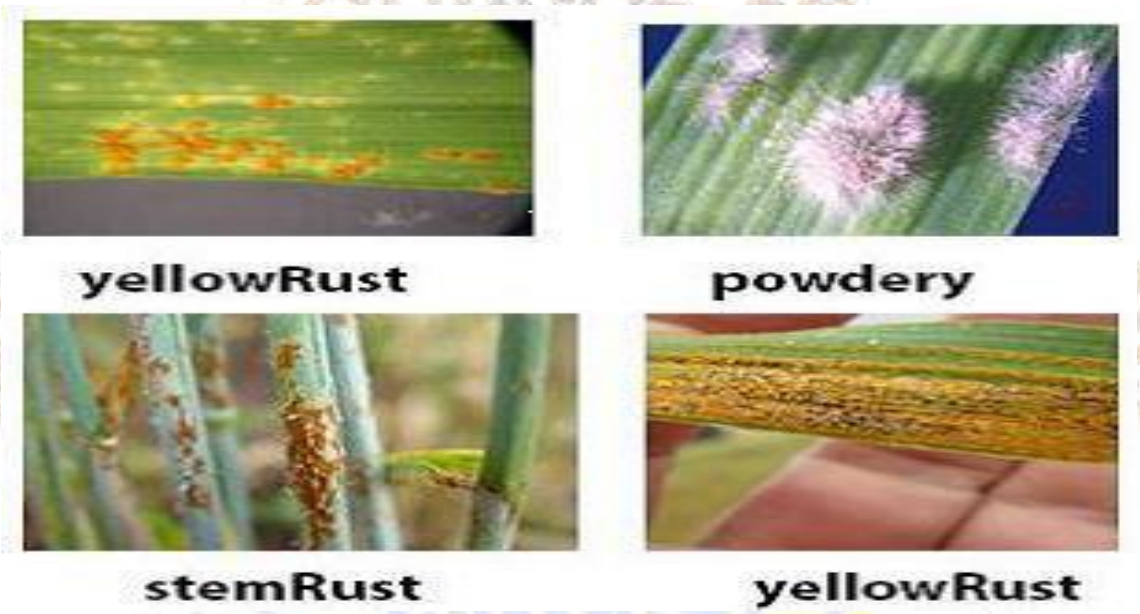


Figure 1.1: Samples of wheat crop

The symptoms of plant diseases are evident in different parts of a plant; however leaves are found to be the most commonly observed part for detecting an infection. Researchers have thus attempted to automate the process of plant disease detection and classification using leaf images. Advances in artificial intelligence, machine learning, deep learning, image processing and graphical processing units (GPUs) can expand and improve the practice of precise plant protection and growth. Deep learning refers to the use of artificial neural network architectures that contain a quite large number of processing layers. The basic deep learning tool used in this work is Convolutional Neural Networks (CNNs). CNNs constitute one of the most powerful techniques for modeling complex processes and performing pattern recognition in applications with large amount of data, like the one of pattern recognition in images.

LITERATURE SURVEY

Identification of Pathological Disease in Plants using Deep Neural Networks - Powered by Intel® Distribution of OpenVINO™ Toolkit [1].Blister Blight in Tea, Citrus Canker, Early Blight, Late Blight, Powdery Mildew in Cucurbitaceae. This paper illustrates how the solution is built using deep learning and computer vision algorithms powered by the Intel® Distribution of OpenVINO™ toolkit Model Optimizer.

Plant Leaf Disease Classification Using Grid Search Based SVM [2]. A computationally effective method to classify plant leaves as healthy or unhealthy and detection of plant leaf diseases if found unhealthy. Our method for classification is based on Support Vector Machine and its optimization through Grid Search technique.

Multiclass Support Vector Machine based Plant Leaf Diseases Identification from Color, Texture and Shape Features [3]. I'm the one that does the RGB to HSI colour conversion. Image segmentation using K-means clustering is done in step two. In

phase III, colour, texture, and form characteristics are retrieved. Finally, multiclass SVM is utilised to classify the retrieved features in step-IV.

Image Processing System based Identification and Classification of Leaf Disease: A Case Study on Paddy Leaf [4]. Various rice leaf diseases impacting paddy agriculture, such as bacterial leaf blight, brown spot, and leaf smut, were automatically identified and classified using an image processing method. Pre-processing of pictures, segmentation, feature extraction, and classification are the main stages of the suggested approach. The suggested study uses the Otsu threshold approach for segmentation, grey level co-occurrence metrics for feature extraction, and the k-nearest neighbours algorithm for classification to detect paddy leaf disease. A Generic Approach for Wheat Disease Classification and Verification Using Expert Opinion for KnowledgeBased Decisions [5].

PROBLEM STATEMENT

In this research, we acquired various features for detecting the actual counting from the images dataset to develop an approach using a multi-level deep convolutional neural network for wheat crop disease detection from synthetic dataset images.

OBJECTIVE

- To study and analysis of wheat crop disease prediction using deep learning and machine learning.
- To design and develop various feature extraction and selection techniques for module design.
- To design and develop a hybrid deep-learning classification algorithm for detecting and predicting wheat crop plants.
- To explore and validate the proposed system results with various existing systems and show the system's effectiveness.

ALGORITHM USED

Convolutional Neural Networks (CNN)

Convolution: The purpose of convolution is to extract features from the input image. It preserves the spatial relationship between pixels by learning image features using small squares of input data. It is usually followed by Relu.

Relu: It is an element-wise operation that replaces all negative pixel values in the feature map by zero. Its purpose is to introduce non-linearity in a convolution network.

Pooling: Pooling (also called down sampling) reduces the dimensionality of each feature map but retains important data.

Fully-connected layer: It is a multi-layer perceptron that uses SoftMax function in the output layer. Its purpose is to use features from previous layers for classifying the input image into various classes based on training data.

The combination of these layers is used to create a CNN model. The last layer is a fully connected layer. A convolutional neural network (CNN) consists of many neural network layers. Two different types of layers, convolutional and pooling, are typically alternated. The depth of each filter increases from left to right in the network. The last stage is typically made of one or more fully connected layers.

A type of artificial neural network called a Convolutional neural network has interconnections between its units that create a directed graph along a series. Time series data handling is its principal usage. Sequential data is to be utilized by CNN. Because they complete the same task for each element of a sequence, CNNs are known as Convolutional networks. CNNs can also be explained by the fact that they contain a "memory" that stores data about previous calculations. An CNN's construction is graphically depicted in Figure 4.1 depicts the unfolding of Convolutional neural network during computation.

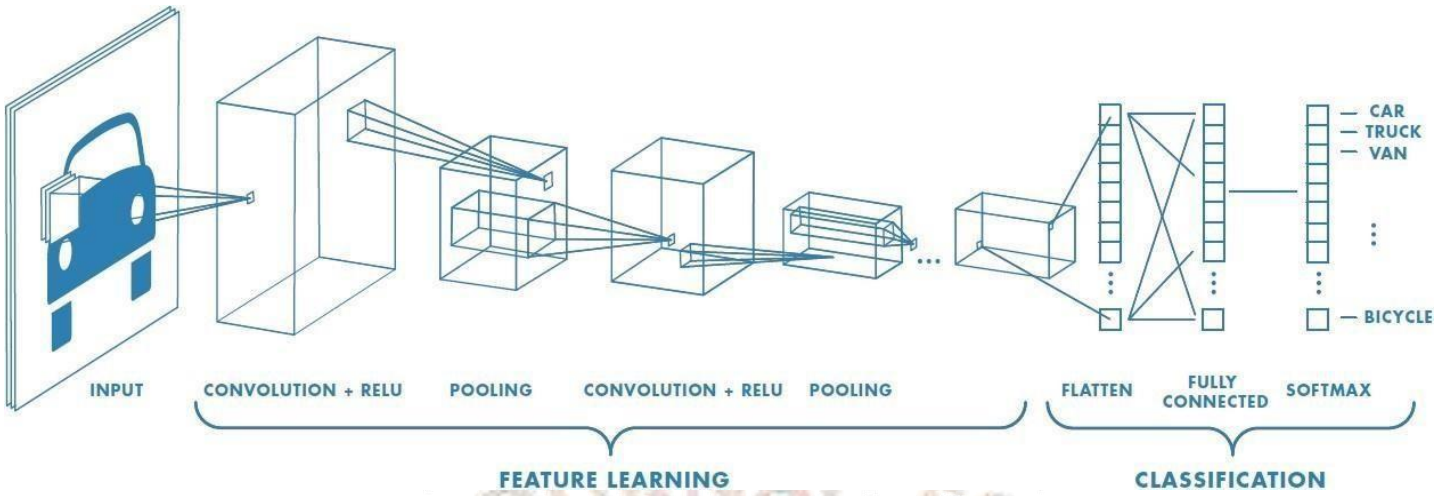


Figure 4.1 Framework of Convolutional neural networks

With the exception that activation is transferred to the hidden layer from both the existing external input & the hidden layer activations 1 stage backwards in time, the forward pass of the recurrent neural network is nearly identical to that of an MLP with one hidden layer. For We have the following as input to hidden units consider following equation.

$$a_h^t = \sum_{i=1}^{I} w_{ih} x_i^t + \sum_{\acute{h}=1}^{H} w_{\acute{h}h} b_{\acute{h}}^{t-1}$$

$$b_h^t = \theta_h(a_h^t)$$

For the output unit:

The recurrent neural network's back propagation is merely regular back propagation. By beginning at t = T and iteratively applying the following functions, reducing t at every step, it is possible to determine the entire series of delta values.

$$a_k^t = \sum_{h=1}^{H} w_{hk} b_h^t$$

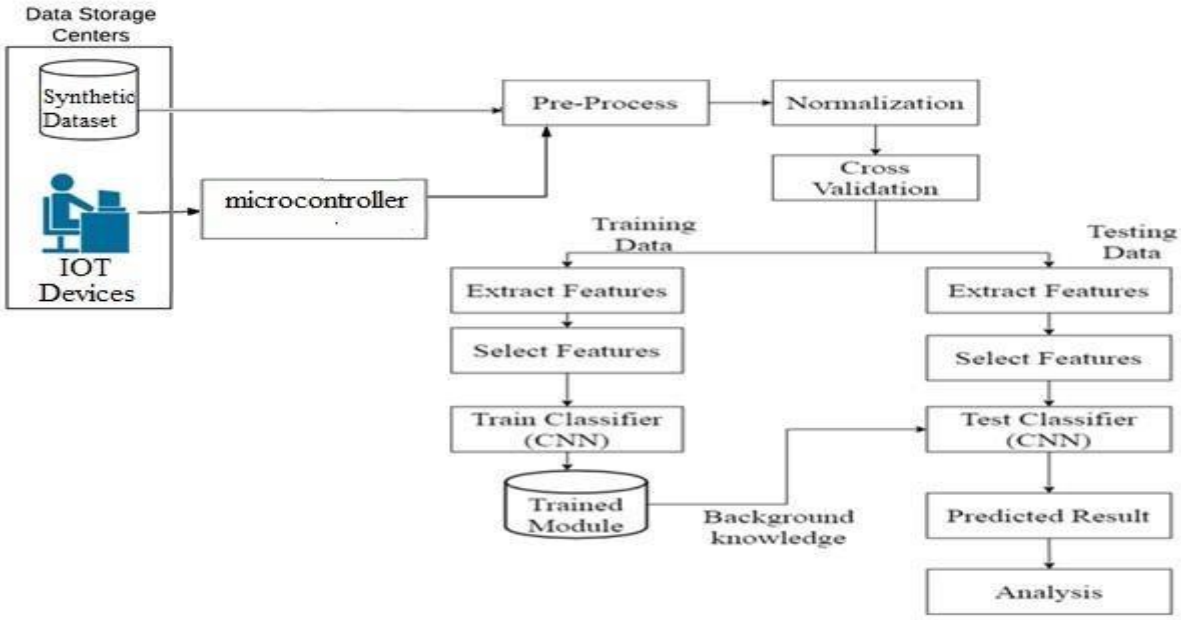
$\delta j \quad T+1 = \forall$ 0, j, because no error is obtained from over the termination of the sequence.

$$\delta_h^t = \theta^j(a_h^t)\left(\sum_{k=1}^{K} \delta_k^t w_{hk} + \sum_{h'=1}^{H} \delta_{h'}^{t+1} w_{hh'}\right)$$

$$\delta_h^t = \frac{\partial O}{\partial a_j^t}$$

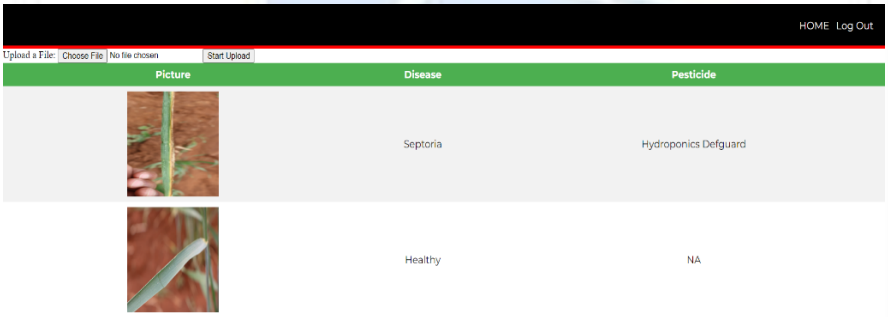
PROPOSED SYSTEM MODEL

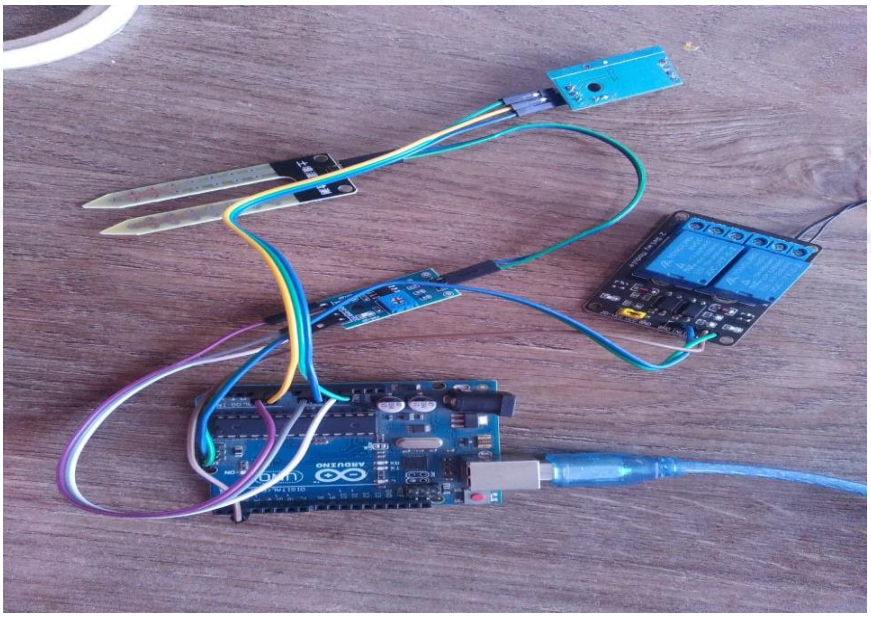
Fig. 4.1 shows the working principle of the proposed CNN model. Initially, a collection of IoT devices gather the images of the plant from the farming field. Then, image preprocessing takes place to raise the image quality to a certain extent.

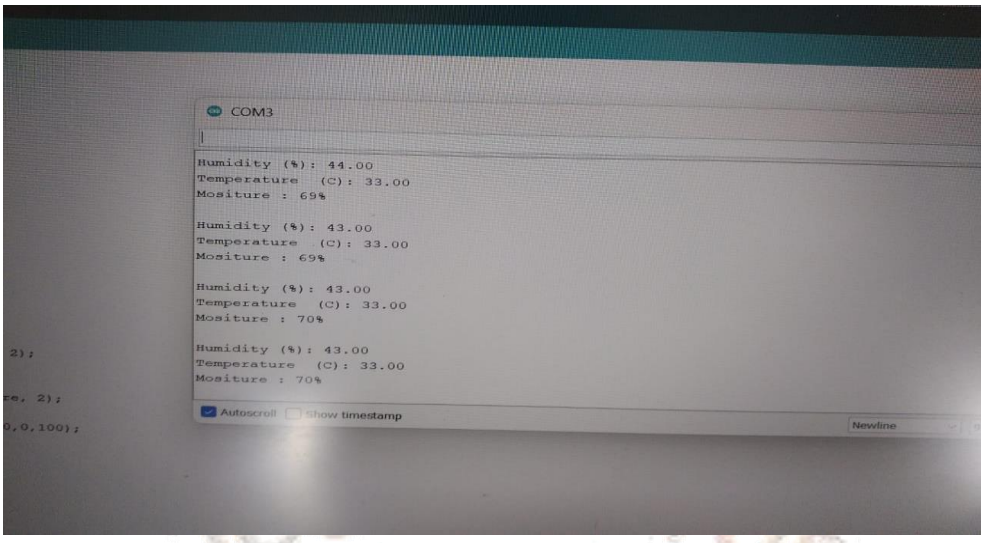


Fi gure 4.1: System Architecture

RESULT







CONCLUSIONS

A system for identifying and categorizing plant diseases is being developed using the algorithm CNN. Using deep learning algorithms, they created specialized models to identify plant illnesses using photos of healthy and sick Wheat plants. This can help the farmer for proper production of good quality crops. Deep Learning is recent research technique for image processing and pattern recognition. The proposed hybrid model produces more accurate results as compared to the existing system.

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