RESEARCH PAPER ON STUDY OF POTATO DISEASE DETECTION USING CNN

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Potato disease Detection Using CNN

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India.

Abstract: All of us are familiar with potatoes as a vegetable. When other nations are taken into account, it is clear that potatoes are the most popular vegetable worldwide, as several agricultural departments have been asserting more and more. Despite the fanfare, potatoes are seriously harmed by potato leaf disease. Numerous diseases, including early blight, late blight, septoria blight, etc., can affect potato plants and show their symptoms in the leaves. If these outbreaks are discovered at the primary stage and appropriate intervention is taken, the farmer would not be at risk of suffering significant financial losses. The suggested model would effectively identify and diagnose potato leaf stand illnesses using image processing techniques. The CNN model is utilized in this study to identify the disease from photos of the potato leaf since CNN is used for image classification and provides the best results when compared to other algorithms. The five algorithms used in this study are AlexNet, VggNet, ResNet, LeNet, and our recommended Sequential model. To distinguish between the normal and abnormal characteristics of potato leaves, normal and disorder-impacted leaves were used for the presented model. These images are then examined using the given algorithm, and the potato plant leaf is classified as either normal or infected. This model's 97% high precision was established.

I.Introduction

People all throughout the world are familiar with potatoes, which are also a staple cuisine in many other nations. The root of all veggies is another name for potatoes. As is well known, Bangladesh is an agricultural nation that produces a variety of crops, with potatoes taking up a sizable portion of our land. Bangladesh is ranked as the seventh-largest producer of potatoes. According to the Department of Agricultural Extension, about 5 lakh hectares of land are utilised to grow potatoes annually, with yields ranging from 0.70 to 1.09 crore tonnes (DAE). In both the agricultural economy and our system of economic balance, potatoes are crucial. The primary factor is expanding potato production because global demand is steadily rising and our region needs to export as much as possible. However, the reality is that during the past few years, the amount of potatoes exported and produced has decreased due to various significant potato leaf diseases, such as early blight, late blight, Brown spot, bacterial wilt, septoria blight, etc. The manufacturing level is severely hindered in that scenario.

Due of this, farmers too endure suffering. The disease can occasionally be seen on the infected potato leaf. The plant's leaves will occasionally develop spots as well.Small, oval, circular, and a variety of other forms can be seen in the manifestation of some diseases, including brown spots, early blight, and late blight. Bacterial wilt can affect any part of an infected plant, including the roots. Septoria leaf spot symptoms include grey centres and black margins on leaves. Early and late blight is a typical disease of potatoes. Early blight symptoms are typically tiny, black lesions, but late blight symptoms may appear blistered and eventually rot and dry up. Farmers will benefit greatly from the deep learning model that will be provided to differentiate between these pathologies and potato leaves.Since this study is largely concerned with visuals, several photographs are needed. There are three different categories of processed photographs available. They are healthy, early, and late blight. The total amount of photographs is divided into two groups: the training group and the testing group. The training segment contains about 70% of the photos, and the test section will have the remaining 30%. The suggested approach would categorise healthy and sick potato leaves. Farmers can quickly accelerate their growing momentum to prevent diseases from spreading throughout the civilized state.

II.Related Work

Researchers employed machine learning, Support vector machines, RGB image analysis, and many more machine-learning techniques to investigate the prediction of crop diseases. A multi-class support vector machine model has also been used by Islam et al. to identify potential potato illnesses. The model appeared in 300 different photographs. The effectiveness of the model investigator has been assessed using a variety of operating parameters, including sensitivity, precision, F1-score, and recall. A multi-class Support vector machine forecasting model was utilized by Dubey et al. to train and validate images for the categorization of apple illnesses. According to Sladojevic et al., a deep convolutional neural network model has also been developed to assess the infection of 13 folios while taking tomato and apple flora into account. The technique was utilized to separate 13 different ailments among healthy and damaged leaves. To differentiate between 25 distinct diseases, Ferentinos et al. used the deep learning framework of AlexNetOWTBn together with VGG. Region-based fully convolutional networks, regions with convolutional neural networks, and solid-state drives were also utilized for the real-time classification of tomato plant disease. Deep learning has been used in a few research for the majority of those categorization tasks. K-Means clustering was utilized by Leemans et al. They used numerous patterns to transform the actual image taken in RGB form into an image in CIELAB color space. The researchers also developed features at the feature level. The researchers provided segmented photos that were classified using random forest algorithms. Fruit illness was discovered after recognition, and this method was applied.

III.Methodology

A.Working Diagram

To identify potato leaf disease , a number of efficient steps must be taken. The model black diagram is display below

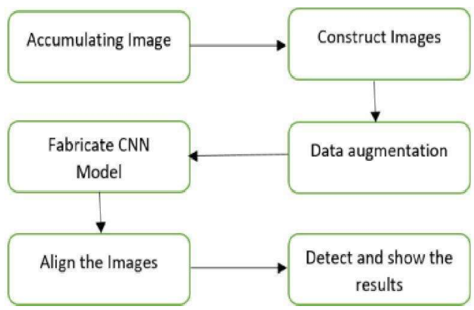

Fig.1. Block Diagram.

The photos are first obtained and then created to supplement the dataset. after adding to the dataset used to train and test the CNN model. The model ultimately identifies and displays the outcome after finishing the test and train.

B.Gathering Datasets

Data is the main part of our project. We require a lot of images because we work with photographs. Therefore, when gathering photographs, we must be conscious of a number of critical factors, including image sizes, resolutions, and quality, as well as the potato leaf disease condition. The initial step is to get the image data from Kaggle, Dataquest, and as many manually captured photographs as feasible. The combined photos of around 3000 were gathered. However, not all of the merged images are really useful to us. Some photographs' resolutions are so low that it's difficult to tell which ones are damaged and which ones aren't. This is why 500 photos each for early blight, healthy, and late blight are assigned for the training goal. Similarly, 300 photos from each directory are chosen to assess.

C.Neural Network

It is both watched and unmonitored how CNN learns. They can be utilised for classification or forecasting. But CNN mostly adhered to a controlled procedure. CNN categorises images based on their attributes. CNN uses activation functions to compute potential maps. The following is the function:

$$Y_{jl} = f(z_{jl})$$

Where Y_{jl} is referred to as the future graph and activation function. Convolutional neural networks (CNN) treat documents using two-dimensional convolution procedures.

$$O = \frac{(W-F+2P)}{(S+1)}$$

In this case, height/length, input height/ length, filter size, padding, and stride are represented in conjunction with O, W, K, P, and S.

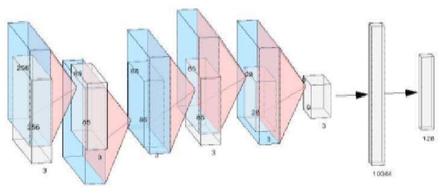

Fig.2. Convolutional Neural Network (CNN)

Fig. 2 shows the model's basic CNN structure through the employment of surface, lining, height, depth, and thickness.

D.Building the Model

The CNN algorithm is used to create the sequential model. Convolution two-dimensional layer for handling images & image input size (256,256) for whatever the size image entered. Keras aids in the section-by-section construction of this model. Between the dense layer and the two-dimensional layer of convolution, there was a flat layer that served as a bridge. ReLUs, or rectified linear units, are utilised in this approach in the form of an enabling function. SoftMax was proposed as an activation for forecasting based on maximal likelihoods in the framework. Below is the equation for the SoftMax function:

$$P(x) = \frac{e^{x^T w^l}}{\sum_{k=1}^{k} e^{x^T w^l}}$$

In this case, $X^T W$ denotes the internal product of X and W.

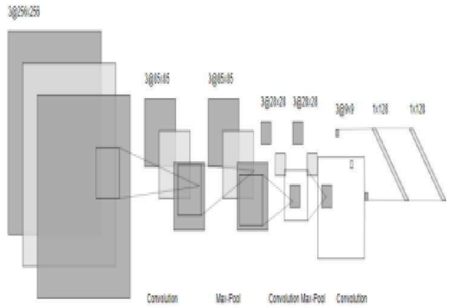

Fig.3. The sequential photographic view.

E.Compiling the Model

The use of the optimizer "adam." This is a useful optimization tool to adjust the learning rate during the training period. Categorical cross-entropy is used to train the system and includes an "accuracy"metric to reflect the accuracy score on the validation set. This makes it easy to realize our loss function.

F.Training & Testing

The function "fit ()" is used to train the model. Validation data testing on the dataset. The fit function, which rhythmically runs the system over the data, sets the number of epochs. After the training phase is finished, the testing method is configured. It approves of the trained CNN model's potential.

IV.Result

The Jupyter notebook is used to carry out the entire procedure. Different septic potato leaf pictures were generated in the first stage in order to classify them. The images are chosen from a dataset's folder. The outcome of the forecast is displayed after the photographs have been entered.

Fig.4. Early Blight.

Figure 4 illustrates how Early Blight has impacted the leaf. It's common to see a circle that overlaps the spots that is yellowish or bright green-yellow. Large spots can occasionally cause the entire leaf to turn yellow and die.

Fig.5. Late Blight.

Figure 5 illustrates how late blight has impacted the foliage. Leaf flecks start off as little, sporadic dots that range in colour from light to dark green. At cool, damp weather, the fleck quickly expands into sizable brown to purple-black regions. The disease can kill the above-mentioned plant by destroying entire leaflets or spreading into the stem from the petioles.

Fig.6. Healthy

Figure 6 illustrates a healthy leaf. As a result, the diseased and healthy photos may be reliably identified by our algorithm.

V.Conclusions

In order to identify potato diseases, we have implemented a convolution neural network based on the classification technique known as valid sequential model. To attain the necessary precision, two-stage testing was also done and included. There has been extensive research on the numerous potato diseases. There are numerous images of potato plants that were taken in a field where potatoes are planted. To determine the best performance based on the CNN architecture, various types of algorithms were tested. The proposed model correctly distinguishes between healthy and unhealthy plants. For farmers and those working in the agricultural industry, we merely briefly addressed two types of diseases. Therefore, in order to make it

more trustworthy for them, we decided to increase the number of diseases. We also chose to increase the amount of picture datasets in order to achieve the best results. In order to make it simple for everyone, we intend to create an Android application.

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