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Advanced Machine Learning Technique to Detect Disease in Potato

Girish B G[1], Narendra N[2], Nitish S[3], Manoj M D[4], R Virupakshagouda Patil[5]
Project Guide, Department of Computer Science and Engineering[1]
Projecties, Department of Computer Science and Engineering[2,3,4,5]
Sri Jagadguru Chandrashekaranatha Swamiji Institute of Technology, Chikkaballapura, Karnataka, India

Abstract: *With the enhancement in agricultural technology and the use of advanced machine learning techniques in diagnosing plant diseases become important. Potato is one of the major food crops all over the world. Potato cultivation has been very popular for last few decades but many diseases affecting the proper growth of the potato plants. Most of the diseases are seen in the leaf region of the potato plant. However, the diseases to the plant reducing the potato production in both quality and quantity .and manual interpretations quite time taking and difficult and also to do manual interpretation it requires certain level of experience. Examining the disease in the early stage of growing plant is very vital and then it will be helpful for getting the higher production of the crop. Otherwise, the plant will get spoiled. And eventually it reduces the potato production. To resolve this problem by detecting and analysing these diseases images using advanced machine learning is the best option. This paper proposes an advanced machine learning-based system that will identify and classify potato leaf diseases. And also suggesting remedies to the diseases. Through this system time taken to detect disease is very less.*

Keywords: Disease in Potato

I. INTRODUCTION

There are various types of occupations in the world but majorly agriculture is the primary amongst all. Indian economy also depends on agriculture a lot. It indicates the need of taking care of plants from seedling until the expected crop obtains. To get an improved crop production plants must undergo plenty of phases like whether condition, plant survival from the diseases and survival from the animals. During these above phases the crop is protected from the animals by providing the protection to agricultural land and next issue is whether condition which is not controllable and humans can only pray for better weather conditions. Final issue is protecting the plant from diseases to have better production. If the disease is identified within the early stages, then crop is often protected by using appropriate fertilizers. Potato is one of the major crop which contributes to about 28.9% of total agricultural crop production in India. Potato is a fourth largest agricultural crop in the world after maize, wheat and rice. India is the 2nd largest country in the production of potatoes and in the fiscal year 2021 potato produced across India was estimated to be around 53.69 million metric tons. Uttar Pradesh is the Indian State with the highest potato production in India, more than 30% of the total production of India followed by West Bengal, Bihar, Gujarat and Madhya Pradesh states.

Potatoes not contains high fibre but which can help you to lose weight. Fibre can help to decrease the risk of heart disease by keeping cholesterol and blood sugar levels in check. Potatoes are also full of antioxidants such as flavonoids, carotenoids and phenolic acids that work to prevent diseases and vitamins that help your body function properly. Potato also contains potassium, vitamin C, vitamin B6, potassium and manganese. The potato also contains calcium, magnesium and zinc which may help to create and maintain bone structure and strength. vitamin C works as an antioxidant to help prevent damage caused to skin by the sun, pollution, and smoke. The production of plant is decreased due to some disease for example late blight, early blight, virus, insect etc. The Phytophthora Infestans and Alternaria Solani are scientific names of late blight and early blight.

II. IMPLEMENTATION

To detect the diseases in potato we are planning to implement automated deep learning algorithms. In this project we have used the VGG-16 deep learning algorithm. VGG16 is a convolution neural network (CNN) architecture which was

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used to win ILSVR(ImageNet) competition in 2014. It is considered to be one of the excellent vision modelled architecture till date. Most unique thing about VGG16 is that instead of having a large number of hyper-parameters they focused on having convolution layers of 3x3 filter with a stride 1 and always used same padding and maxpool layer of 2x2 filter of stride 2.

2.1 VGG16 Configuration for Disease Detection in Potato

The idea behind using 3 x 3 filters uniformly is something that makes the VGG stand out. Two consecutive 3 x 3 filters provide for an effective receptive field of 5 x 5. Similarly, three 3 x 3 filters make up for a receptive field of 7 x 7. This way, a combination of multiple 3 x 3 filters can stand in for a receptive area of a larger size. But then, what is the benefit of using three 3 x 3 layers instead of a single 7 x 7 layer? Isn't it increasing the no. of layers, and in turn, the complexity unnecessarily? No. In addition to the three convolution layers, there are also three non-linear activation layers instead of a single one you would have in 7 x 7. This makes the decision functions more discriminative. It would impart the ability to the network to converge faster.

It also reduces the number of weight parameters in the model significantly. Assuming that the input and output of a three-layer 3 x 3 convolutional stack have C channels, the total number of weight parameters will be 3 * 32 C2 = 27 C2. If we compare this to a 7 x 7 convolutional layer, it would require 72 C2 = 49 C2, which is almost twice the 3 x 3 layers. Additionally, this can be seen as a regularization on the 7 x 7 convolutional filters forcing them to have a decomposition through the 3 x 3 filters, with, of course, the non-linearity added in-between by means of ReLU activations.

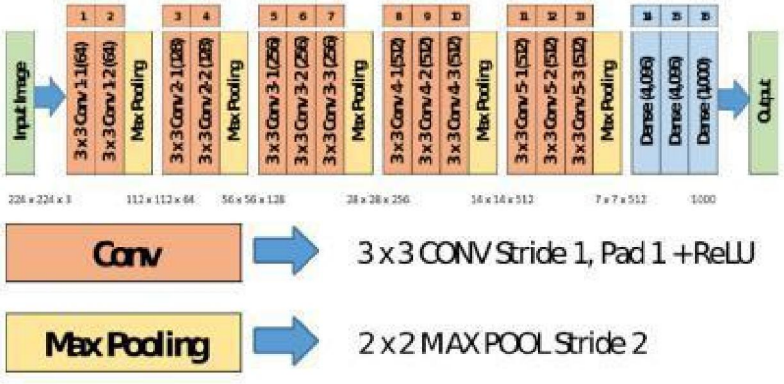

Figure 1. VGG16 Configuration

2.2 Proposed System Architecture

It follows this arrangement of convolution and max pool layers consistently throughout the whole architecture. In the end it has 2 FC (fully connected layers) followed by a SoftMax for output. The 16 in VGG16 refers to it has 16 layers that have weights. This network is a pretty large network and it has about 138 million (approx.) parameters. We have loaded potato dataset to our application. System will pre-process and extract the features using the CNN. It will split the dataset into trainset and testset. System will train the model using VGG16. It will apply VGG16 pre-trained model to class.

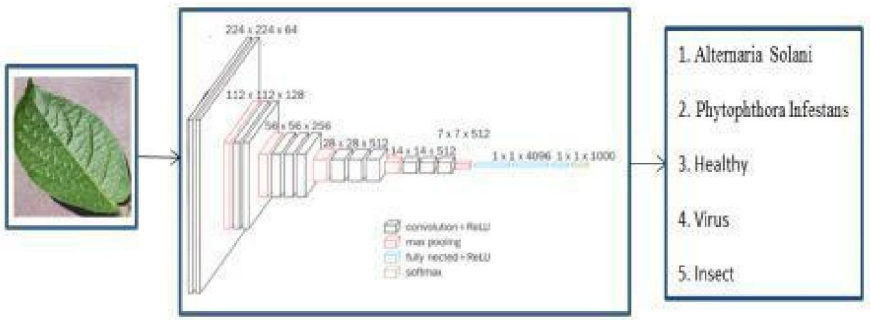

Figure 2. Proposed System Architecture

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2.3 Software Implementation

We are using potato leaf disease image dataset as input. System will use VGG-16 algorithm to predict the potato disease or not. We are using image dataset as input. System will use Image generator to extract the image features and train the VGG-16 model and shows the performance graph as output. In this project we have to take four types of image processing steps to normalize the image, change the colour of the image, and identify the properties, Image processing such as filtering and transformation of the image.

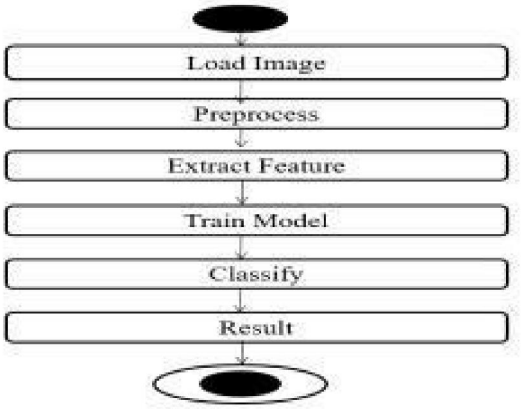

Figure 3. Flow chart of steps involved in software implementation.

We have used Python's OpenCV Library for this purpose. The features of the OpenCV library are:

- Read & write images
- Capture and save the image
- Image processing such as filtering and transformation
- Detection of feature of images or picture object detection.

The picture document is perused with the OpenCV work the request for colours is BGR. Then again, in Pillow, the request for colours is thought to be RGB.VGG16 thinks about piece by piece of picture. The pieces that VGG16 looks for are called highlights. It finding the harsh element matches in two pictures in similar positions, VGG16 improve at seeing closeness than entire picture coordinating plans. Each component resembles a smaller than normal picture, a little two-dimensional cluster of qualities. Give input photograph into convolution layer Choose boundaries, apply channels with steps, cushioning if requires. Perform Convolution on the picture and apply ReLU enactment to the rid. Execute pooling to decrease dimension size. Add as numerous convolutional layers until satisfied. Flatten the yield and feed into a completely associated layer. Output the class utilizing enactment and order pictures. By applying the CNN-VGG-16 model.

2.4 Proposed VGG16 Model Performance

We have done 300 epochs, this model has made the progress rate is 98.36% in train Dataset and 98.81% in preparing approval set that we make. Trial with arbitrary pictures the instructional meeting went easily after the end. It was best aftereffect of precision Overall. Subsequent to dissecting the result and disarray grid, it is perceptible that the exhibition of our model is satisfactory.

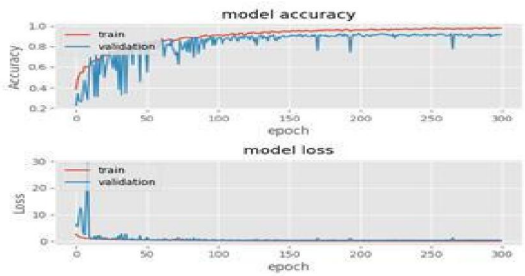

Figure 4. Graph of model Accuracy and loss

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III. CONCLUSION

Digitalization increasing across all the fields and it is high time to adopt digitalization into the field of agriculture as well to obtain better protection in terms of growth and yield. The proposed model to detect and classify the diseases affected and unaffected leaves of potato. The proposed system which helps farmers to get timely and accurate potato crop disease. The proposed system uses CNN based vgg-16 algorithm and achieved 99% accuracy.

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