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Deep Learning for Leaf Disease Detection using CNN

Abhinay Kumar Reddy[1], Sai Nitish Reddy[2], Eshwar[3], N. Srinivas Reddy[4]

[1, 2, 3]*Student,* [4]*Associate Professor, Department of Electronics & Communications Engineering, Sreenidhi Institute of Science and Technology, Yamnapet, Ghatkeasr, Hyderabad - 501301*

Abstract: ***Agriculture is the backbone of the Indian economy. About 70% of people rely on it and share a large portion of GDP. Diseases in plants especially in the leaves affect the reduction of both quality and quantity of agricultural products. The human eye is not so powerful to detect minute differences in the infected part of the leaf. In this paper, we offer a software solution to automatically detect and diagnose plant leaf diseases. In this we use image processing techniques for the diagnosis and early diagnosis can be done as elsewhere. This approach will improve crop production. It involves several steps. Picture detection, pre-image processing, percentage separation, extraction and neural features. Recently, many researchers have advocated since the success of in-depth computer literacy the idea of improving the effectiveness of diagnostic programs. Unfortunately, most of these studies did not use the latest in-depth formats and were based on AlexNet, GoogleNet or similar properties. Moreover, deep-seated mechanisms do not exist to take advantage of it, making these deep divisions invisible and suitable as black people boxes. In this project, we tested the many technological approaches of the Convolutional Neural Network (CNN) buildings using various learning strategies in the public database of plant diseases separation. These new structures exceed the high-quality effects of plant diseases in stages with very high accuracy. In addition, we have suggested the use of saliency maps as a way to visualize and interpret CNN classification.***

Keywords: CNN, Neural Networks, GDP, ResNet, Plant Leaf Diseases

I. INTRODUCTION

Countries which are developing, agricultural fields are mostly very large and people working in the fields are not able to see others' plants, daily. Farmers do not know about non-indigenous diseases. Expert consultation takes more time and is expensive. Using pesticides more than required with water, soil etc. can be dangerous and expected to be there requires minimal storing and taking of food made with the help of pesticides. Major features of Machine Learning technologies for plant diseases can be overcome through accuracy and speed. Need to develop strategies classified as automated Plant diseases Detection and varying using Leaf Processing methods. It helps the farmers' process will also inform them in a timely manner before diseases spread over a large area. It can be solved through four main stages; we create color in first stage the transition shape in RGB image of leaf and after that we use color conversion through space with change in the color structure.

K-means combination process is used to separate the image. The unwanted area present inside the leaf is removed in the second stage. Third phase counts composition of an infected material with components. Finally, in the file phase four extracts are transmitted through a pre-trained neural network.

Diseases in plants cause serious damage to agricultural areas and crops that reduce productivity remarkably. Early injuries are common and diseases significantly reduce growth. As a result in a very hot environment, injury is often delayed by other highly debilitating diseases that are able to touch all parts of the tree such as fruit, to ensure the crop quality and quantity by protecting plants from diseases. An effective defense plan is used at the starting stage to diagnose and to stop the spread of the diseases. We should use the right treatment at the right time. Normally, these findings are made by professionals with academic experience strengthened by practical experience in cause and effect symptoms. Moreover, to stop the spread of the diseases the experts should monitor the plants consistently. This ongoing checking of plants represents hard and time—taking tasks for people, making Automation of Plant disease detection and diagnosis are important to protect plants .Some studies [10,11,12] identify and use image processing and ML to classify the diseases. The above methods attempt to create disease isolates using plant images taken from it. The methods are made up of hand crafted materials that specialize in extracting the data related based on image separation. Because of these reasons the dividers may suffer because of less amount of automated equipment due to the dependence of handicrafts .In addition, the separation should be trained by using the photos numbered professionally.

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II. LITERATURE SURVEY

Various ways to diagnose plant diseases are discussed in this section. The plant specifications from hyper spectral data are indicated by indirect plant monitoring diseases. These are not able to differentiate between the diseases in a plant. Identification of winter wheat diseases in plants Wenjiang developed some new visual indicators. In their study they look at three various insects (Powdery mildew, yellow rust and aphids) in the winter wheat.Too big too small wavelengths suitable for various plant diseases are taken using the RELIEF-F algorithm.

The specification of the separation of the new indicators of infected and healthy leaves is carbon dioxide powdery, lice and yellow rust were 86.5%, 85.2%, 91.6% and 93.5% respectively. Making the images of higher clarity and quality than the original image. Green, red and blue are the primary colors of the color images. Programs using RGB are difficult to use because scope of those are e.g. 0 to 255. So they are converted into gray images. After that a histogram scaling that classifies image intensity is applied to the image to change and enhance the pictures of plant diseases. To diagnose fruit packaging Monika Jhuria uses image processing.

They have been using neural networks to diagnose diseases. They established two data that are separated, one retrospective training and other the making of question images. For weight loss of training information we use back distribution. Experts look at vectors of three dimensions, namely, morphology, texture and color. They discovered that the morphology factor provides a better outcome than two other factors Zulkifli Bin Husin et al [13], in his paper, consists of the photo of a chilli plant and is used to find the health condition of the plant. Their process ensures that the chemical will only work on the chilli plant that is infected. We used MATLAB to find the pattern extraction and recognition function. In this paper, preprocessing is carried out with the aid of a Fourier filter, morphological feature and edge detection. Computer vision also extends to the processing of the images, the paradigm of the object for separation. Here is the digital camera used to take a picture again.

III.PROJECT FLOW

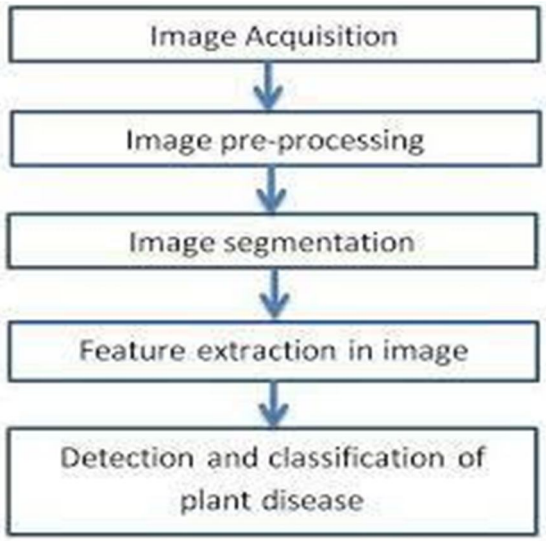

Fig-1 Project Flow

A. Image Acquisition

Images of the leaves are being captured with the camera. These images are in RGB (green, redAnd the blue of the form. The Color, the structured changes to the sharp images of an RGB-image, and after that color space transformation is done, the unit is being used, changing the color of the texture.

B. Image Preprocessing

To eliminate the noise, for when you remove the pictures and other objects, which are considered the primary treatment of primary . Crop the images,that is the agriculture of the image of the leaf in order to have all things that are of interest in the image. Image smoothing is performed with the use of a smoothing filter. The processing of images is carried in order to all of the accessories. The RGB image is of grey images, using color changing techniques. After equalizing the histogram, which spreads the image of the intensity, apply an image enhancement of images of plant diseases. The combination of all distribution functions is applied to spread the intensity of the host.

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C. Image Segmentation

Image segmentation is division of the image into different parts of the same features, or even less, in some cases similar to the cases. Image segmentation can also be done with the help of a variety of methods, such as the otsu method, the K-Means clustering, an RGB image to life, ITS patterns, and so on. image segmentation, with the help of the edge, and the place of the discovery of the Algorithm: RGB-image is transformed to HIS model. Found in the borders and locations are going to help you, to find the number of as a part of the sheet, as described in this section. For the limit of detection, consider the connection of the 8 pixels and, to apply the style to the detection algorithm.

D. Feature Extraction

Feature selection plays an most important role in a given model. Many of these users are the images are software, use of feature extraction. The color, the composition, the morphology, border, etc and these are the in particular, as it can be used in the case of plant diseases. The composition-this is how the color of the image has been awarded the irregularities of the surface, and the hardness of the photo. It can also be used in order to detect the infected areas of the plant.

IV. CONVOLUTIONAL NEURAL NETWORKS

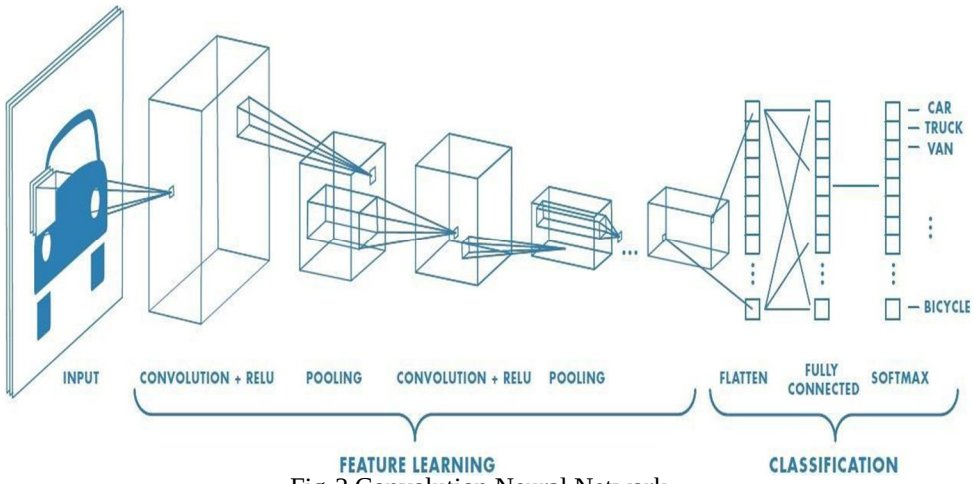

Fig-2 Convolution Neural Network

Artificial intelligence is experiencing a tremendous growth in the gap between the elimination of the opportunities, the people and the machines. Scientists and enthusiasts are involved in the many aspects of this field, in order to get you to do amazing things. In many areas in the field of Computer Vision.

Major Challenge in this area is giving machines the ability to see the world, how you take it in that way, and also use the knowledge of the many tasks like Video Recognition and Image, Classification and image analysis, Recovery, and Media system, natural language processing, and so on. advances made in Computer Vision, Deep Learning,are being developed, And it appears to have evolved over time, primarily based on a special algorithm, a Convolutional Neural Network.

Convolutional Neural Network (CNN/ ConvNet) is an algorithm for Deep Learning that can be added to a photo of the corresponding material (trainable biases and weights), the various objects/aspects, images, and also able to separate 1 from others. The primary to the Processing required in a CONVNet is relatively less than that of the others systems, algorithm, and classification. These primitive methods filters are the layihələndirilir manually is not enough, Training, CONVNET's, the capability to learn these characteristics/filters.

ConvNet Architecture is similar to the mode of communication of the Neurons in the Human Beings brain, were of the age of the organisation's Vision, and I will. Individual Neurons respond to a stimulus not only to a restricted area of attention, which is also known to be the receptive field. A set of these areas to bring its influence to bear on each other in order to cover the entire field of view.

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V. RESNET

The researchers said that, in this sense, the claim is "a long way down, the more the good" when we are using the Convolutional Neural Network. In this manner, the model must be even improved, and Resnet's ability to fit into any area increases as the parameter spaces in order to explore). However, it was said that, after a few tests, you may experience decreased performance.

It is a bottleneck in the VGG-16 that they cannot go in as far as I would like, as they've begun to diminish its ability to generalize.

Since the neural network has a better function approximator, it must be easy to clear the functions used to determine when the outputs of the functions become the inputs themself.

Below, in similar logic, we are past the start of the 1st model of layers, in order to get the outputs of recent model layers, the network must have the ability to tell that all that has been learned in the past is added to the input.

One of the problems to be solved by the Cilia, the well-known, renowned image. Because when networks are very deep, gradient, rate of Loss Function calculates the lightweight, with a growth rate of zero, and since a couple of rules for the use of snow chains. This is the result of the wave of never-to update its values, and, therefore, there is no exercise that is carried out.

Please use the ResNets gradients to flow through one of the forward transitions, a link back, and then the layers of the filter.So, let's explain what is the repeating of the name of it. For each, the ResNet layer is a combination of several different blocks. Because, when the ResNet delves deep, they have a tendency to increase the activity of a single one, but there is a total of the number of layers of the is — 4. This activity relates to the convolution, normalization, and activation of the ReLU access, in addition to the end of the operation, the block, it is ReLU.

Therefore, from a PyTorch, the distinction between the building blocks, which include 2 of the operational Base of the block and the block consists of 3 Operating Only one of the bottlenecks. Please note that, as a general rule, each and every one of these is referred to as a layer, but we used a layer as a group of blocks.

VI. RESULTS

The model which we trained parameters will be extracted and will be sent to user's machines (computers, mobiles...etc.) and can be used in two modes:

1) *Disease Detection:* The image which is taken using the devices used by the user will be given as an input to the trained model output of the trained model will be the disease from which the plant is suffering from so that the user can make the informed decision.
2) *Detecting Symptoms and Visualizing Them:* users can observe regions that help us to identify disease.Visualizing the symptoms can be useful for the user who are first time harvesting the crop so that they can be careful next time.

A comparison of the, ResNet, the performance of SVM, a decision tree, logistic regression, K-NN, the variables are on the basis of two indicators, which are clearly and correctly. The accuracy and precision of the values of the other samples, . The following subsections cover the two metrics of the classifier accuracy and precision of the .

Apart from the validation data we have collected 33 different images which were not the part of the given Dataset. We are giving these images as inputs which will indicate the final stage and also helps in determining the final deployment stage.

We are saving the model with the help of pickel which can help to save the parameters which can be run on any device and also can be run on cloud platforms if the available space in the device is very less. When we save the model there is no need to run the model every time we want to use it. Simply, we can give the input and get the outputs without any effort. Generally it will take almost 20 minutes to run the model online and it can take almost 40 mins to 1 hr in a low end device because we save the model within seconds we can get the results.

We have achieved an accuracy of 99.2% in the final epoch.

VII. CONCLUSION

We have analyzed the most trending systems which were able to classify the images based on various characteristics so we also built a system which was able to classify the plant diseases After going through the various various studies we were able to find a suitable Deep Learning model for our project. Finally we have chosen CNN as our model to classify our diseases in plants because CNN's have been proved as the state of art image classifiers. In CNN we have particularly chosen ResNet's which have tackled the gradient vanishing problem which has occurred due to going deep in neural networks. Above shown results indicate that we can classify the image perfectly 99.2% of the time. The remaining 0.8% is lost due to improper images which is always the case which we cannot avoid. The main reason for obtaining the perfect accuracy was due to proper tuning of hyper parameters which is the most important part in any Deep Learning model.

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We were also able to choose the proper filters for our model to detect the texture of the leaf in order to separate it from the rest of the leaf.This way of detecting diseases also helps the inexperienced people to learn more about the diseases occur in plants and helps them to take the preventive measures during next season while harvesting the crops. We can also collect the data from the farmers when they detect the diseases in this manner and analyze that data to use proper pesticides for their crops. Sometimes people use wrong pesticides just because of minor differences which cannot be observed through normal eyes whereas using a trained model we can easily differentiate even a minute variation in the pattern. using this technology can also be helpful in paving a path to implement various other technologies which can be helpful in the agriculture sector which were previously not implemented but will be helpful in improving the productivity of the crops thereby improving the share of agriculture sector share in the GDP of the country.

VIII. FUTURE SCOPE

This Model can be linked with pesticides dealers and Government. The pesticide dealers can give the best solution to the disease and at same time can promote their products. The Government will take action if the disease is widespread in the area and also takes preventative measures in order to stop the spread of the disease. Even though there are apps like Plantix they use manual method to determine the diseases which involves the lot of human intervention which can be lot of time consuming and also there must be proper network connection whereas with our project there is Zero Human intervention and there is no need of network connectivity we are looking forward to deploy this in market and also trying to contact the Plantix app developers to help to deploy our project which can help lot of farmers.

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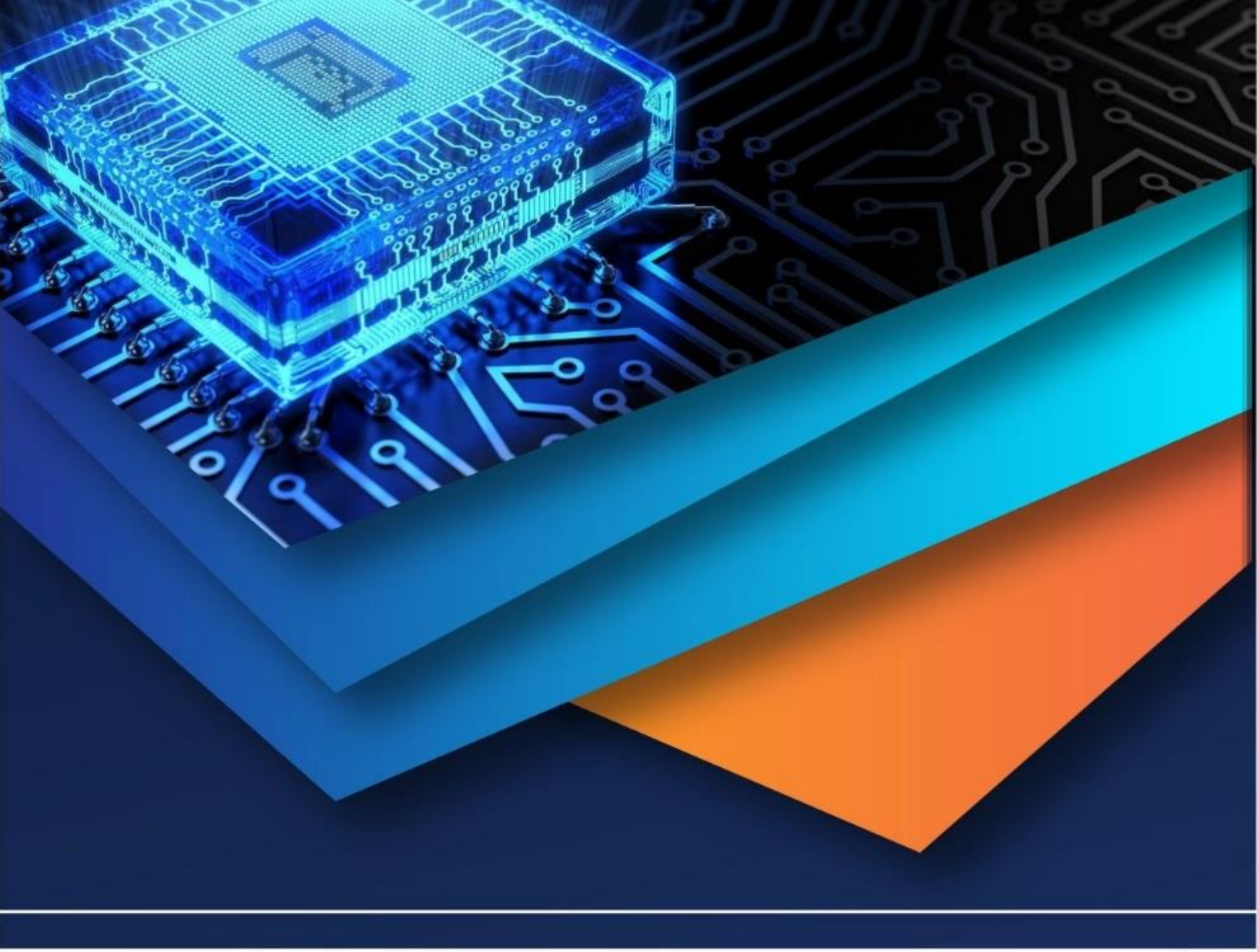

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