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Tomato Leaf Disease Detection

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***Abstract:** Tomato is an important crop in India and affects India's economy in many ways. It is observed that the development in agriculture is sluggish nowadays due to the attack of diseases. Many farmers detect diseases by their previous experience or some take help from experts. Traditional ways are often used to detect the diseases by the farmers. So, there is the possibility of an inaccurate diagnosis of diseases having very large similarity in their symptoms. So, it is essential to move towards the new strategies for automatic diagnosis and controlling of disease. So, there is a need for an automatic, accurate and less expensive machine vision system for detection of disease from tomato leaf images.*

I. INTRODUCTION

The production of tomatoes in India is reducing gradually over the years because of major tomato leaf diseases which may impact their production. Due to this many tomato cultivators get a huge drop in their production and income. This problem will be solved if the farmers get to know about the plants which are infected and diseased in early stages of their growth so that they can use pesticides and different medicinal equipment to sprinkle medicines over plants and save their crops from diseases in early stages of production. This project will help the farmers to recognize the tomato leaves which are Fresh and Diseased by simply uploading the pictures of the tomato leaf on the web app.In this project we have used the concepts of machine learning, deep learning .While implementing this project the concept of Flask which is a python library used to make web servers will be used along with front-end technologies like REACT JS.

II. LITERATURE SURVEY

Year	Author	Paper Name	Findings	
2021	Changjian Zou, Sihan Zhou, Jinge Xing and Jia Song	Tomato Leaf Disease Identification by Restructured Deep Residual Dense Network	Architecture	Accuracy (%)
			Deep CNN ResNet50 DenseNet121 RRDN	93.21 88.49 91.96 95
2019	Mohit Agarwal, Abhishek Singh, Siddhartha Arjaria, Amit Sinha and Suneet Gupta	Tomato Leaf Disease Detection using CNN	Architecture	Accuracy (%)
			MobileNet VGG16 InceptionV3 Propose model	63.75 77.2 63.4 91.2
2018	Prajwala TM, Alla Pranathi, Kandiraju Sai Ashritha, Nagaratna B. Chittaragi , Shashidhar G. Koolagudi	Tomato Leaf Disease Detection using CNN Remark: -The Architecture used here is LeNet	Epochs	Accuracy (%)
			10	90.41
			20	94.52
			30	94.85

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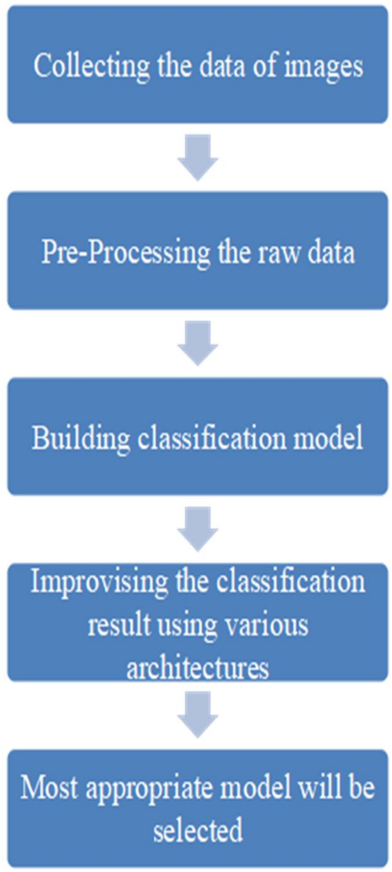
III. METHODOLOGY



This is the detailed explanation of Block Diagram

1) *Data Collection:* We have collected the data i.e. tomato leaves from google images.
2) *Data Preprocessing:* We have augmented the images by rescaling and rotating through different angles using keras.
3) *Building Model:* We have built a basic CNN model containing layers such as convolution, max-pooling, flattening and full connection.
4) *Adding Architectures:* We have tested four architectures VGG16, ResNet ,Inception and Mobile Net and we will be choosing the most accurate one
5) *CNN Output and connect to Output:* The CNN output given by the model will be next given to the backend server for further processing.

The network's input is a two-dimensional image (224, 224, 3). The first two layers have the same padding and 64 channels of 3*3 filter size. Then, after a stride (2, 2) max pool layer, two convolution layers of 256 filter size and filter size (3, 3). This is followed by a stride (2, 2) max pooling layer, which is the same as the previous layer. Following that, there are two convolution layers with filter sizes of 3 and 3 and a 256 filter. Following that, there are two sets of three convolution layers, as well as a max pool layer. Each has 512 filters of the same size (3, 3) and padding. This image is then fed into a two-layer convolution stack. In these cases, convolution and maximum pooling are used. We employ 3*3 filters instead of 11*11 filters in AlexNet and 7*7 filters in ZF-Net. It also employs 1*1 pixels in some of the layers to adjust the amount of input channels. After each convolution layer, a 1-pixel padding (same padding) is applied to avoid the image's spatial information from being lost.

In this project we are saving the money of farmers by solving the issue regarding the early detection of tomato leaf diseases. Our goal is to build an efficient and accurate model which will help to solve the above-mentioned issue. We are building a CNN model in which we will choose an appropriate algorithm and by hyper-parameter tuning we will achieve our goal to eradicate the problem.

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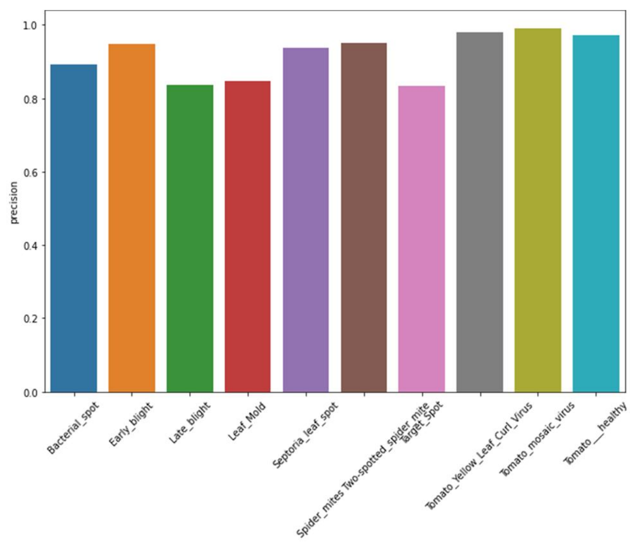
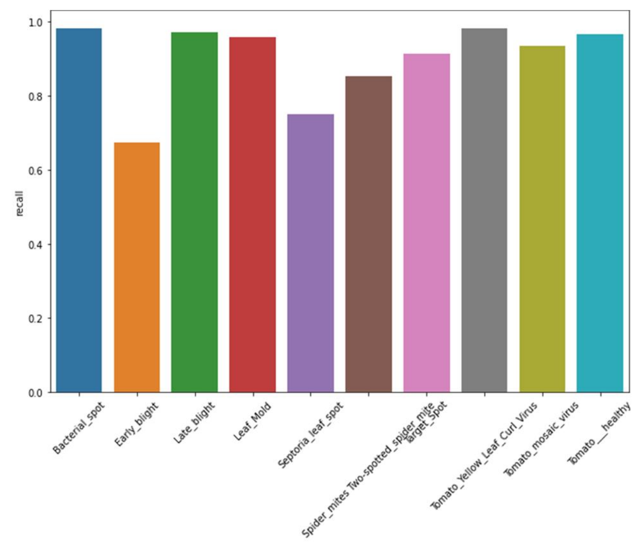
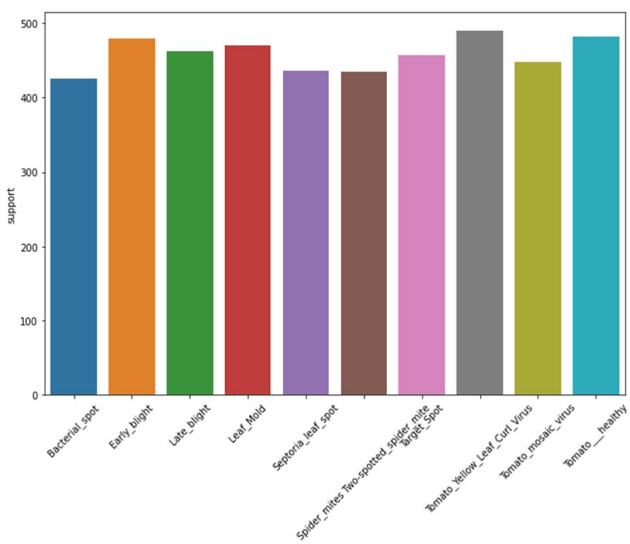
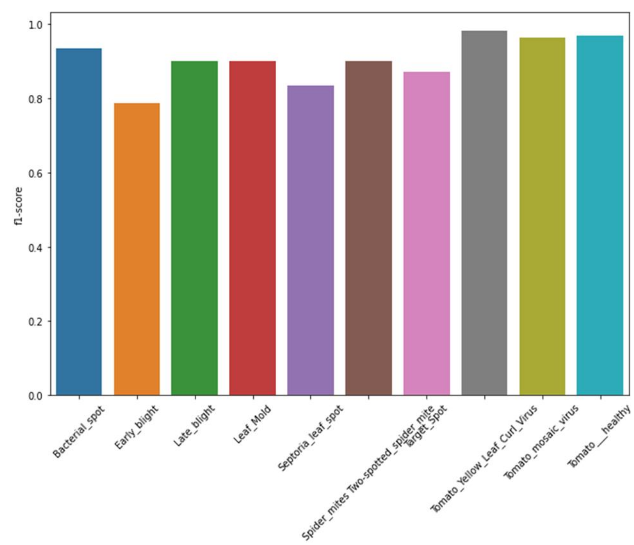
IV. RESULTS

DISEASE NAME	PRECISION	RECALL	FI -SCORE	SUPPORT
Bacterial_spot	0.90	0.99	0.94	425
Early_blight	0.89	0.77	0.83	480
Late_blight	0.94	0.80	0.86	463
Leaf_Mold	0.90	0.90	0.90	470
Septoria_leaf_spot	0.89	0.88	0.88	436
Spider_mites Two- spotted_spider_mite	0.94	0.85	0.90	435
Target_Spot	0.89	0.86	0.87	457
Tomato_Yellow_Leaf_Curl_Virus	0.98	0.94	0.96	490
Tomato_mosaic_virus	0.99	0.93	0.96	448
Tomato______healthy	0.95	0.98	0.96	482









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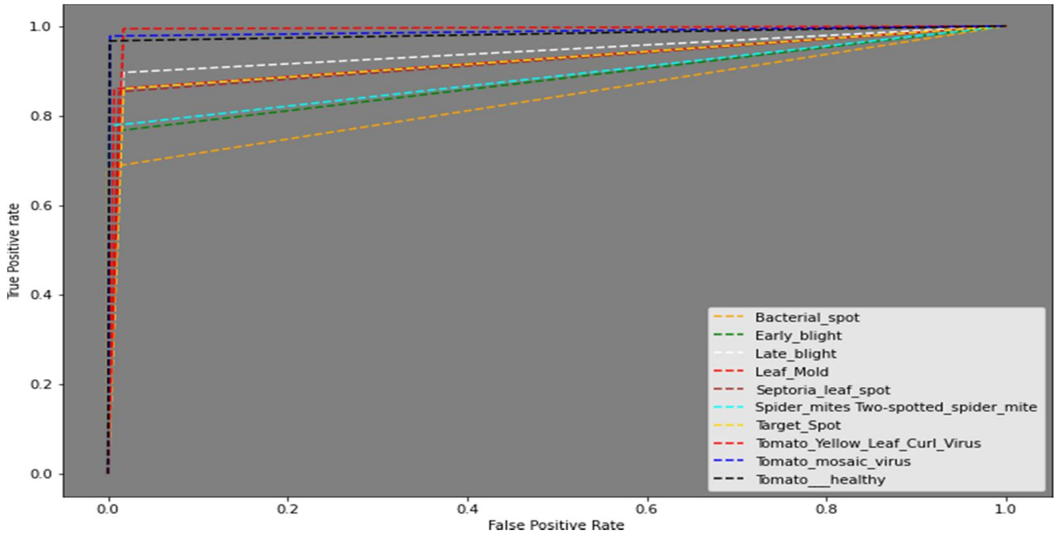
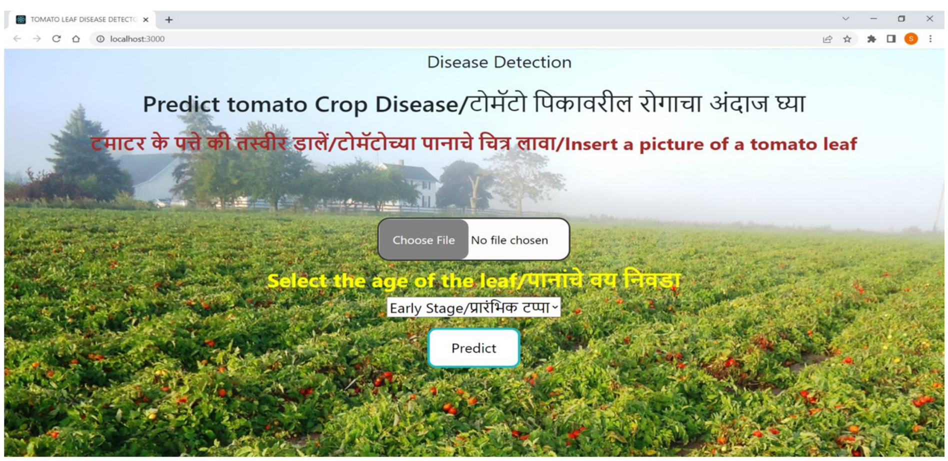
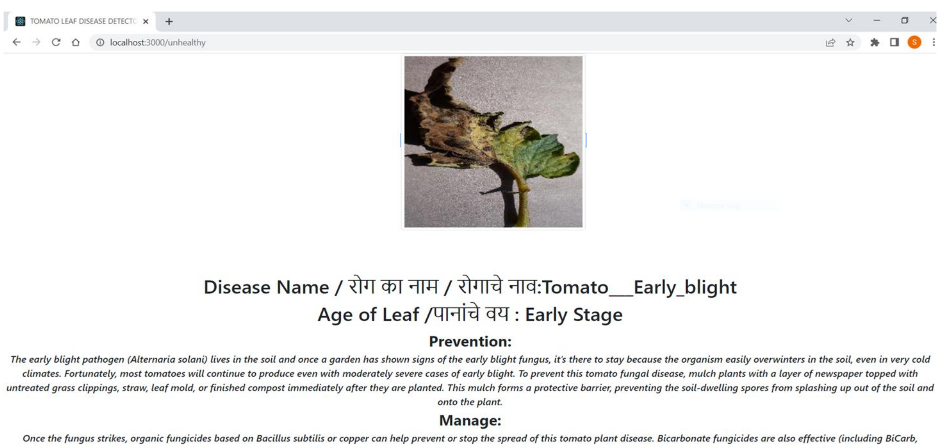


Roc Curve

V. OUTPUT IMAGES





VI. CONCLUSION

Agricultural sector is an important sector over which the majority of the Indian population relies. Detection of diseases in these crops is hence essential for the economic growth of a country. Tomato is one of the crops which has mass production in India. In this project we have detected and identified 10 different types of diseases. The project uses a convolutional neural network model to classify tomato leaf diseases and help the farmer identify the type of disease.

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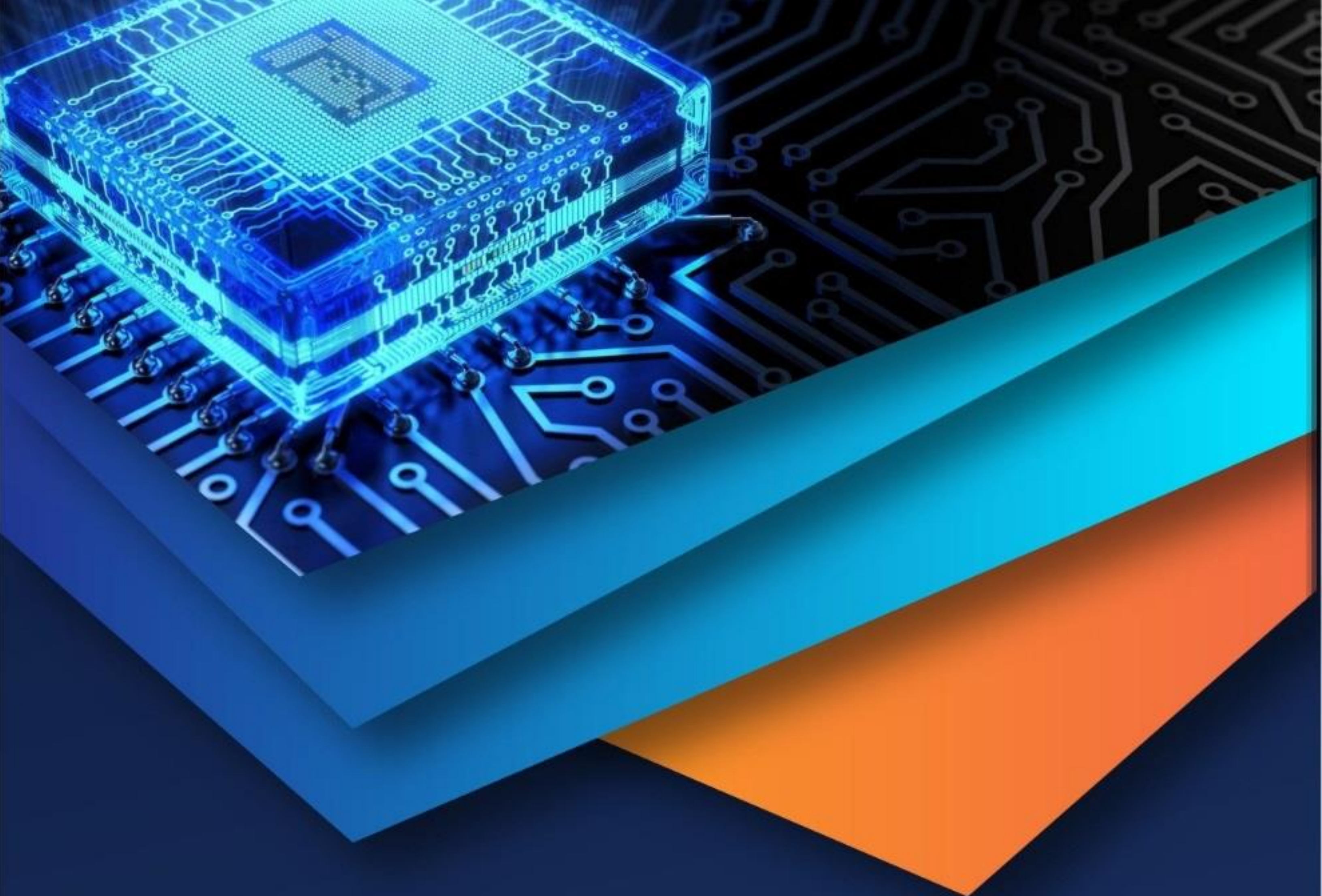

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