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Automatic detection of Plant Disease Using Machine Learning (Plant Doctor)

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Abstract: Agriculture contributed to the domestication of today's major food crops and animals thousands of years ago. Food insecurity, that may be a major reason behind plant diseases, is one amongst the most important world issues that humanity faces these days. Per one study, plant diseases account for around 16 % of worldwide crop yield loss. Persecutor losses square measure projected to be regarding 50 % for wheat and 26–29 % for soybeans globally. Fungi, flora like species, bacteria, viruses, viroid, virus-like organisms, nematodes, protozoa, algae, and parasitic plants square measure the most categories of plant pathogens. Agriculture is that the backbone of our nation. Plant diseases contribute to production loss, which may be tackled with continuous observation. Manual disease observation is each punishing and erring. Early detection of plant diseases machine learning will facilitate to scale back the adverse effects of diseases and additionally overcome the shortcomings of continuous human observation. During this work, we tend to propose the utilization of a deep learning design supported a recent convolutional neural network.

IndexTerms - Machine learning, deep learning, Plant diseases, Convolutional neural network

I. INTRODUCTION

The tomato is a major staple in the India with high commercial value and is produced in large quantities. The global annual production of fresh tomato is more than 170 million tons, ranking first in vegetable crop production. The United States, India, Turkey, Egypt and China are the main producers of tomatoes, India ranked 2 in the production of tomato. 9 out of 10 farmers grow tomatoes. Tomato diseases are the main reason for the high 8 – 10% of loss, due to climatic changes and global warming. Farmers are unable to identify the diseases prior due to which the spread of diseases increases. The tomatoes disease mostly difficult to identify with human eye. To ensure minimal losses to the cultivated crop, it is needed for early detection of the diseases and do the needful in order to cut down the loss of production and the spread of diseases is accelerated down.

The identification of tomato disease is done with the help of machine learning. Machine learning is the technology that allows machines to communicate with human beings and understand their needs. It also makes machines act like human beings and make the decision. On behalf of humans. It is one of the areas that have grown fast over the past few years. ML helps in classifying plant diseases. The use of this technology is seen as a significant beginning.

Image processing is machine learning technology which applied to images that helps us process, analyses and extract useful information from them. Basically a huge data set of plant disease i.e. images of affected part is processed and it classifies each and everything separately. Larger the data set more the accuracy. The combined factors of widespread smartphone penetration, HD cameras, and high-performance processors in mobile devices cause a situation where disease diagnosis supported automated image recognition, if technically feasible, can be made available at an unprecedented scale.

II. LITERATURE SURVEY

- [1] Image- Predicated Discovery of Plant Conditions from Classical Machine Learning to Deep Learning Journey by Rehan Ullah Khan, Khalil Khan, Waleed Albattah. Proposed in the time of 2021. - This paper highlights the use of computer vision (CV) and machine knowledge (ML) could meliorate the discovery and fighting of conditions. Computer vision is a form of artificial intelligence (AI) that involves using computers to understand and identify objects. It's primarily applied in testing drivers, parking, and driving of tone- driven vehicles and now in medical processes to descry and assay objects. One of the areas that CV has helped most is the discovery of the strictness of the conditions. Deep knowledge (DL), a part of the CV, is useful and promising in determining the strictness of conditions in shops. It's also used to classify conditions and avoid the late discovery of conditions. Factory conditions are slightly different from those that affect mortal beings.

- [2] Plant complaint discovery using crossbred model predicated on convolutional machine-encoder and convolutional neural network by PunamBedi, PushkarGole. Proposed in the time of 2020 - This paper mainly focuses on the peach shops to identify Bacterial Spot complaint. With the use of a crossbred model predicated on CNN and CAE was erected for automatic plant complaint discovery. CAE was used to reduce the training parameters of the crossbred model. The proposed crossbred model used only 9914 training parameters. The model achieved 99.35 training delicacy and 98.38 testing delicacy. Dimensionality reduction using CAE in the proposed model results in reduction of number of training parameters of the model. In order to test the proposed crossbred model, it's applied to descry Bacterial Spot complaint in peach plant, which is caused by a bacterium named *Xanthomonas Campestris*.
- [3] Discovery of plant flake conditions using machine knowledge by Mr. RishikeshR. Kulkarni, Ms. AshwiniD. Sapariya proposed in the time of 2019 - In this paper they presented, white and red mulberry fruit were classified according to maturity stage using image processing and artificial intelligence type algorithms. First, mulberry image segmentation was performed using the RGB colour space. Among the tested colour channels, the channel 'B' was named as the swish channel to classify fruit into three callow, ripe, and effete orders. In the coming step, colour, geometric, and texture features were pulled with two point selection styles, vicelike CFS and CONS. Comparing the performance of the two styles (ANN and SVM), the ANN showed a significant advantage over the SVM for the mulberry type. The swish type performance was attained by using the CFS subset point birth system (14 named features) with ANN.
- [4] Machine Knowledge- predicated for Automatic Discovery of Corn-Plant Conditions Using Image Processing by Budiarianto Suryo Kusumo, Ana Heryana, Oka Mahendra. Proposed in the time of 2018 - This paper presents the various image processing ways analogous as point birth and automatic discovery for the image. The check shows the effective and simple being methodologies. Several ways are illustrated also to gain the knowledge of different background modelling for pest discovery analogous as image filtering, median filtering for noise dumping, image birth and discovery through scanning. This paper depicts some promising results to present enhanced styles and tools for creating fully automated pest identification including the birth with discovery. Worldwide faces the challenge of crop product reduction by contagions, pathogens, beast pests, and weeds. Pest groups attack performing in the loss rates and absolute losses. Under high productivity, conditions lead to a high crop grown rate in tropic and sub-tropics regions

II. PROPOSED SYSTEM

Tomato disease detection can be done using various machine- learning classifiers and various techniques have been used in the past for this purpose. In this paper, the classifier or the dataset that are required for training were Convolution Neural Network (CNN). In this we have identified 10 common and need to concerned plant disease and trained using 200 – 300 photo samples of the affected area. Using the dataset collected, creation of the data model with well labelled machine learning model is prepared using the online software called Teachable machine which provides the code snippet and the ML model in easier way.

A. Assumption & Requirements

For Training a accurate Machine-learning model, we need a dataset sample more than 100, more the samples more the accuracy. The dataset is feed in teachable machine and labelled accordingly were these labels groups the each disease separately and efficient and easier for coding. User-friendly UX design so that it will be so easy for the users to navigate through the application to get the needs. Firebase will work as a database for the application were the user information gets stored and the location for the agricultural clinc gets stored in the database.

B. Datasets

The dataset chosen contains 500 images of tomato leaves with 10 different disease of tomato. Each categories contain the same number of samples. All the images are sized 256 x 256 pixels. The dataset is commonly referred to as the plant village dataset and can be found on the public website, Kaggle.

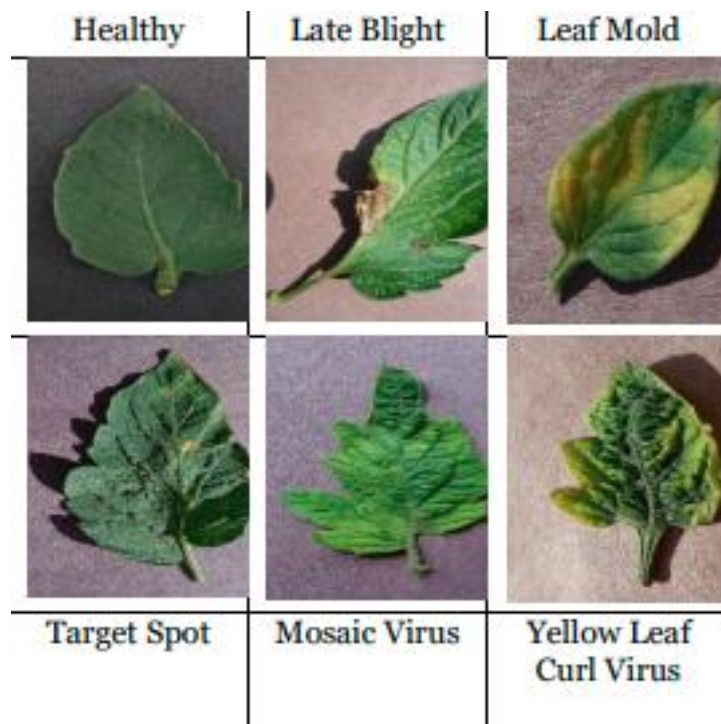


Fig 2.A.1 Plant Dataset

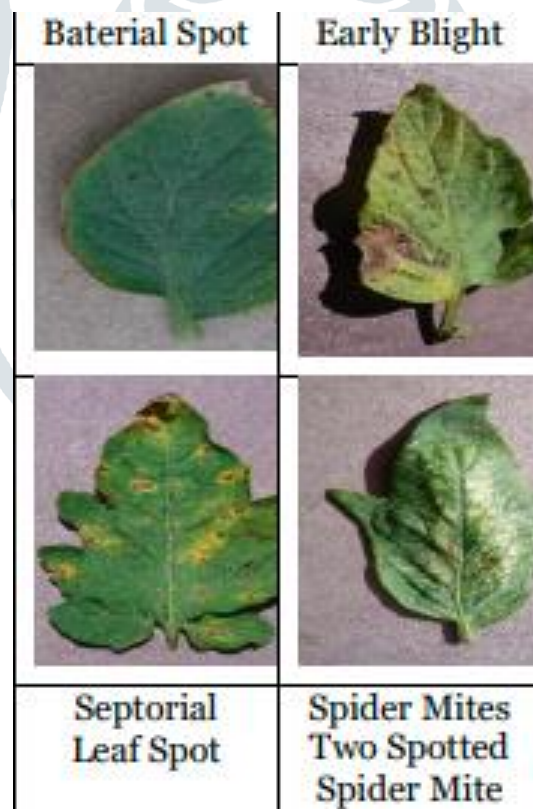


Fig 2.A.2 Plant Dataset

III. Libraries used

1. *Tensor Flow*

Tensor Flow provides a collection of workflows to develop and train models using Python or JavaScript, and to easily deploy in the cloud, on-perm, in the browser, or on-device no matter what language you use. Data API enables you to build complex input pipelines from simple, reusable pieces.



Fig 3.1.1 Tensor Flow

2. *Firebase authentication*

The Firebase Authentication SDK provides methods to create and manage users that use their email addresses and passwords to sign in.



Fig 3.1.2 Firebase Database

3. *Lottie Animation*

A Lottie is a JSON-based animation file format that enables designers to ship animations on any platform as easily as shipping static assets. They are small files that work on any device and can scale up or down without pixelation.

IV. PERFORMANCE ANALYSIS

This metric is calculated by dividing the total number of correct predictions which are the True positive and true negative outcomes, with the overall total number of samples. In this paper since the dataset chosen at hand contains labels that contain the same number of samples, accuracy proves as a useful measure. However, in scenarios where the dataset is imbalanced accuracy cannot be proven useful due to the paradoxical finding known as the Accuracy paradox.

V. CONCLUSION

The Plant doctor is an android application using which the stakeholders who can get to know the disease in the plant with just snap of the plant. They get to know the chemical and manual remedies. The users are provided with the nearby agricultural clinics.

Reference

- [1] Machine Learning-based for Automatic Detection of Corn-Plant Diseases Using Image Processing. IEEE, Authors: Budiarianto Suryo Kusumo; Ana Heryana; Oka Mahendra; Hilman F. Pardede

- [2] Convolutional Neural Networks for the Automatic Identification of Plant Diseases Authors: Justine Boulent, Samuel Foucher, Pierre-Luc St-Charles
- [3] Plant diseases and pests detection based on deep learning: a review Authors: Jun Liu & Xuewei Wang
- [4] Plant Leaf Disease Detection and Automated Medicine Using IoT. (IRJET) Authors: Nireeshma R
- [5] Using Deep Learning for Image-Based Plant Disease Detection Authors: David P. Hughes
- [6] Leaf Doctor – Application Builder : Seed pro
- [7] BioLeaf - Foliar Analysis Application Builder : Bioleaf crop
- [8] ML-based Image Processing by Vihar Kurama, <https://nanonets.com/blog/machine-learning-imageprocessing/>
- [9] App development by Google <https://developers.google.com/Support> Vector Machine Algorithm, <https://www.javatpoint.com/machine-learning-support-vector-machine-algorithm>

