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Leaf Disease Prediction Using CNN

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***Abstract*— Owing to changing climatic conditions, crops often get affected, as a result of which agricultural yield decreases drastically. If the condition gets worse, crops may get vulnerable towards infections caused by fungal, bacterial, virus, etc. diseases causing agents. The method that can be adopted to prevent plant loss can be carried out by real-time prediction of plant diseases. Our proposed model provides an automatic method to predict leaf disease in a plant using a trained dataset of potato leaf images. The test set is used to check whether an image entered into the system contains disease or not. If not, it is considered to be healthy, otherwise the disease if that leaf is predicted and the prevention of plant disease is proposed automatically. Further, the rodent causing disease is also identified with image analysis performed on the image certified by biologists and scientists. This model provides an accuracy of the results generated using different cluster sizes, optimized experimentally, with image classification using CNN. Our model provides useful estimation and prediction of disease causing agent with necessary precautions.**

***Keywords*— Crop, leaf disease, real-time prediction, potato leaf, using CN.**

I. INTRODUCTION

Farming is a very ancient way of obtaining food. It is an important source of income for people all over the world. No,one sur vives in our world without food. Plants are important not only to humans but also to animals that depend on them for food, ox ygen and other resources. Governments and experts have taken great strides to increase food production and have been succes sful in the real world. When the plant is infected, all the organisms in the environment are affected in some way. These diseases can affect all parts of the plant, including the stem, leaves and branches. Even the ty pes of diseases that affect plants, such as bacterial and fungal diseases, can be different. Diseases affecting crops will depend on factors such as climate.Many people are food insecure. This is the result of insufficient crop production. Even severe climate change can affect plant growth.

There are many photos of plants taken from the fields where the potatoes were grown. Various algorithms have beenapplied t o find the best performance based on the CNN architecture. Next generation convolutional neural networks (CNNs) have achieved great results in image recognition. A new method for automatic classification and detection of leaf dis eases is analyzed by this project using deep learning techniques. With 90 percent accuracy, the design can distinguish healthy leaves from eight visible diseases.

Based on this high level of performance, it is clear that convolutional neural networks are well suited for automatic diagnosis and facility detection. Samples are presented for separation from diseased and healthy plants. We're talking about only two ki nds of diseases, but that's not enough for farmers or people involved in agriculture. Therefore, we decided to decrease the nu mber of diseases to be more reliable for them while increasing the image datasets to be optimal. In the future, we plan to mak e a website that everyone can use.

II. LITERATURE SURVEY

Image processing and machine learning methods were also used to identify various plant diseases before the emergence of deep learning. To prepare images for the next steps, image-processing methods such as image enhancement, segmentation, colour space conversion, and altering are used. The image's key features are then extracted and used as input for the classifier. The overall classification precision is determined by the image processing and feature extraction techniques. However, recent research has shown that networks trained on generic data will achieve state-of-the-art efficiency. CNNs are

supervised multi-layer networks that can dynamically learn features from datasets. In almost all significant classification tasks, CNNs have recently achieved state-of-the-art results. In the same architecture, it will isolate features and classify them.

[01] Rozina Chohan & Murk Chohan, "Plant Disease Detection using Deep Learning."

The paper presents a deep learning model called the plant disease detector, which is able to detect different diseases of plants based on images of their leaves. This model is developed by applying advance neural network techniques. Initially dataset is augmented to increase sample size, and subsequently Convolution Neural Network (CNN) with multiple convolution and pooling layers is applied. A model is trained and then tested properly to validate its results.

[02] Sharada P.Mohanty & David P.Hughes, "Using deep learning for Image-based plant disease detection".

A public dataset of 54,306 images of healthy and diseased plant leaves has been used to train a deep convolutional neural network to identify 14 crops and 26 diseases. An accuracy of 99.35% was achieved for this model on a held-out test set, showing the success of this approach. The general approach of training deep learning models on increasingly large and publicly accessible image datasets presents a path toward the mass deployment of smartphone-aided crop disease detection.

[03] Vijeta Shrivastava & Indrajit Das, "Plant Leaf disease detection and classification using Machine Learning".

Image processing and machine learning can be used to improve plant diseases detection techniques, thereby reducing the time, effort, and knowledge necessary for the detection of infected plants. It involves image acquisition, filtering, segmentation, feature extraction, and classification. This paper proposes a way to best detect disease by detecting its appearance from plant images and, if present, evaluating its type among Alternaria Alternata, Anthracnose, Bacterial Blight and Cercospora Leaf Spot. As the minimum accuracy is 95.774 percent and the maximum accuracy is 99.874 percent, this process gives almost accurate results. The process detects the diseases by the area of disease, although it has a low affected region

[04] K P. Fereninos, "Deep learning models for plant Leaf disease detection".

A neural network was trained on simple leaf images of healthy and diseased plants in this study using deep learning to detect and diagnose plant diseases. The models were trained on an open database of 87,848 images from 25 different plants in 58 distinct plant disease combinations. The model architecture had a success rate of 99.53% in indicating the corresponding plant disease combinations (or healthy plants).

[05] Yan Guo & Jin Zhang, "Plant disease Identification based on Deep learning algorithm in Smart Farming".

A mathematical model is proposed that detects and recognizes plant diseases through deep learning, improving its accuracy, generality, and training efficiency. After recognizing leaves placed in complex surroundings, the region proposal network (RPN) is applied to extract symptom features from the pictures following Chan-Vese algorithm. The segmented images are then input into the transfer learning model with the training dataset of diseased leaves provided using three types of diseases (black rot, bacterial plaque, and rust). This paper presents a deep learning algorithm that is of great significance to intelligent agriculture, environmental protection, and agricultural production

[06] Marko Arsenovic & Mirjana Karanovi, "Solving Current limitations of deep learning based approaches for plant leaf disease detection"

The current shortcomings of current plant disease detection models are discussed. The new dataset contains 79,265 leaf images with the aim of being the largest dataset to contain leaf images. The images were taken in various weather conditions, under various lighting conditions and during daylight hours with an unreliable background resembling realistic scenarios. Tests were conducted to verify the effectiveness of training in a controlled setting and usage in the real world to accurately identify diseases of plants on natural and detection of multiple diseases in a single leaf. The trained model achieved an accuracy rate of 93.67%

[07] Sandika Biswas, Avil Saunshi & Sanat Sarang, "Application of Random Forest for Classification of Grapes Diseases from Images Captured in Uncontrolled Environments"

In this paper, a system was proposed for classifying three diseases affecting grapes– Anthracnose, Powdery Mildew and Downy Mildew and identifying the severity of these diseases using image processing and machine learning algorithms. Images of single leaf or bunch of leaves were captured with background from different distances and at different angles using mobile phone cameras with varying resolution starting from less than 1 megapixel to 13 megapixel. This proposed disease detection algorithm consists of 4 main stages: (a)Pre-processing of the input images, (b) Leaf extraction from the background, (c) Disease patch identification and (d)Background removal. Performance of four machine learning algorithms namely, PNN, BPNN, SVM and Random Forest are compared, for separating the background from disease patches and classifying between the different diseases.

III. METHODOLOGY

Plant diseases affect leaves, stems, roots and fruits; it also affects crop quality and quantity, causing worldwide food shortage s and insecurity. Things that affect plants and their products are categorized as disease and damage. Biological diseases are di seases caused by algae, fungi or bacteria, while biological diseases that cause diseases are rain, humidity, temperature and lac k of nutrients.

Identifying potato diseases requires several steps. Collect images, then generate images to support the dataset. Next, create th e dataset CNN model for training and testing purposes. The model is trained and tested to see and see the results. Gathered files from Kaggle, Dataquest and some photobooks. 500 images are divided into early blight, healthy and late blight. During image collection, we need to pay attention to some important factors such as image size, resolution, i mage quality, symptoms of potato diseases. But CNN generally uses conservative methods. CNNs classify images according to their characteristics

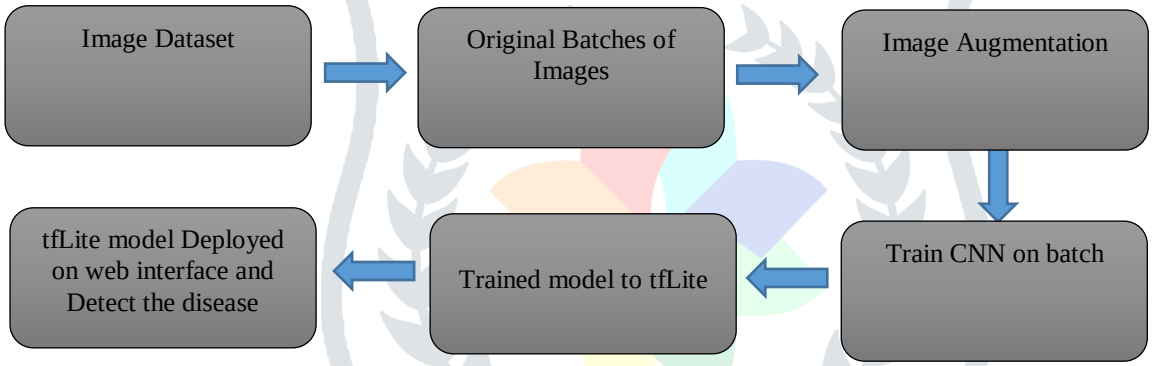

Fig.1 Block diagram of leaf disease prediction

We are building a neural network model for image classification. The model will be sent on the website to identify the leaf disease uploaded on the website. The recognition and classification procedures are depicted in Fig. 1
Fig. 1. Block Diagram Of Proposed System

(1) The first step is to collect data. We are using the PlantVillage Dataset, which is widely available. This dataset was released by crowdAI.
(2) Pre-processing and Augmentation of the collected dataset is done using pre-processing and Image-data generator API by Keras.
(3) Building CNN(Convolutional Neural Network) Model for classification of various plant diseases.
(4) Developed model will be deployed on an website with help of TensorFlow lite.

IV. EXPERIMENTAL RESULTS

A. Data Analysis

The dataset used in the project planning is the Plant Village dataset downloaded from the Kaggle website; The docu ment contains pictures of diseased and healthy plants. After searching, we found that there are no missing values in t he dataset. Read more to understand the various spices and diseases of the leaves. This file contains 14 different plan t species. The training data contains a total of 54305 images. The images are in RGB color space and are of size 256x256 pixels. Each image has a label associated with it that indicates the species and disease of the leaf.

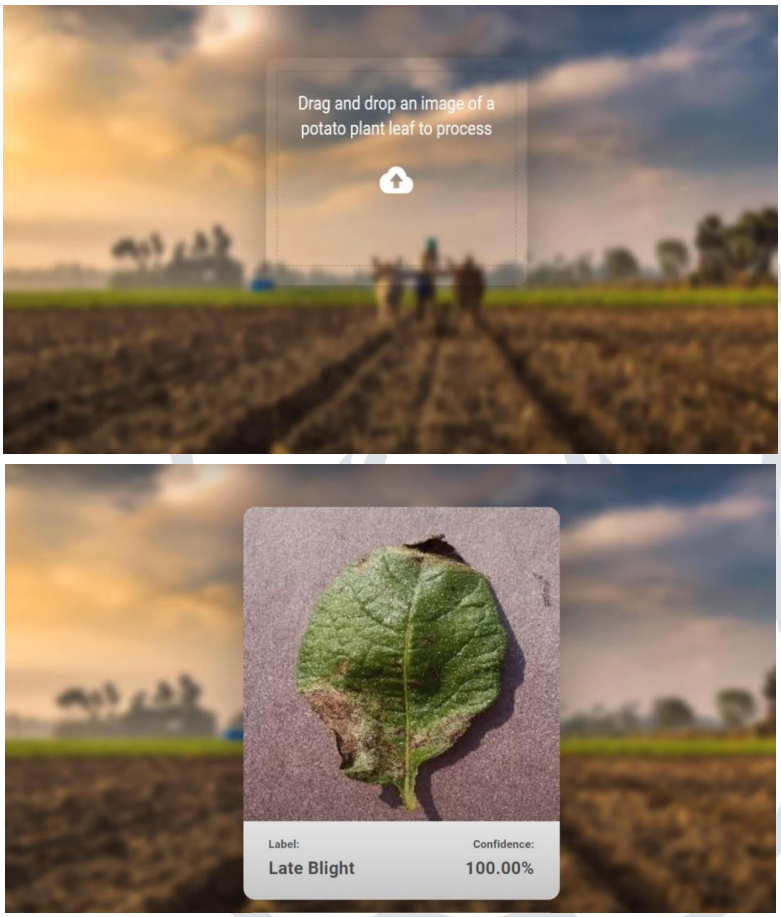

Fig2. Web Interface of Leaf Disease Prediction

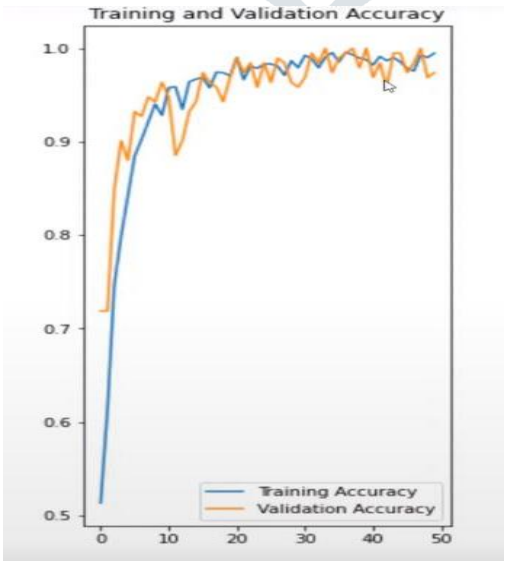

Fig3. Accuracy Graph

V. CONCLUSIONS AND FUTURE SCOPE

A. Conclusions:

A large part of India's population is dependent on agriculture, so detection and identification of leaf diseases that cause loss h as become important, as agriculture is so important to economic development. This project is based on a deep learning metho d called CNN to develop 3 different plant leaf disease recognition, detection and recognition systems. This approach uses a m inimal set of criteria to identify three types of organisms. The neural network was trained from the Plant Village dataset. The web interface is designed for this system.

The website allows users to select images from a dataset. Users can select an image from the dataset and upload the image, th en the virus prediction will be displayed in the interface. The convolutional neural network was trained to identify and identif y leaf diseases to accurately classify and predict disease for nearly all images, so there is little error and achieved 97.8% accur acy..

B. Future Scope:

As more people are not aware of all the plant diseases, so that it will be particularly useful among farmers to detect diseases time to time. The platform can continue to improve its functionality, offering more comprehensive predictions and integrating with real time prediction. Advanced models can provide different different predictions for many other plants, and improving the health of plants. With technology continuing to advance, in future their might be an application which may predict disease as well as solution of that disease.

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