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Plant Disease Detection Using Machine Learning

Gauri Bhosale[1], Atharva Atpadkar[2], Rutwik Kakade[3], Mr. V. U. Deshmukh[4]

Department of Electronics and Telecommunication, VPKBIET Baramati[1-4]

Abstract: Agricultural practises are essential to maintaining food security and sustaining our growing global population. on the other hand, plant disease pose a serious threat to crop harvests, causing financial losses and food shortages.

The study begins by collecting high resolution photos of plant leaves, paying particular attention to leaves that show signs of illness. The images then pre-processed to enhance their quality and standardize them for analysis. Various machine learning algorithms including Convolutional Neural Networks (CNNs), are trained on this dataset enabling accurate classification of healthy and diseased plant leaves.

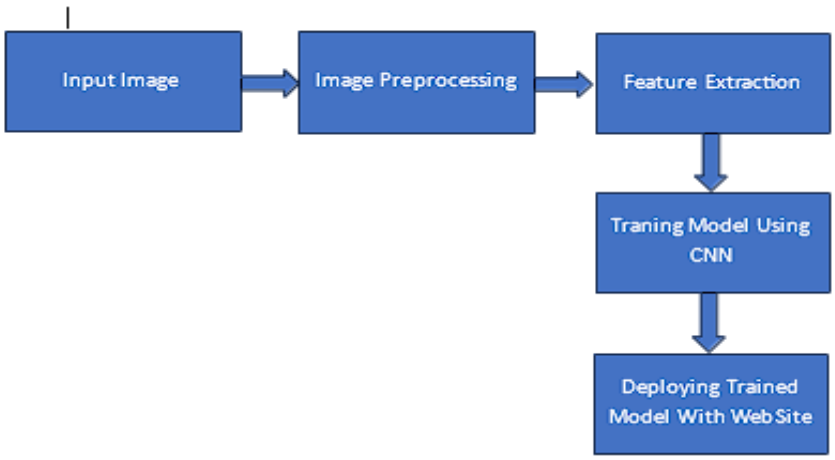
The best things is that by developing web-platform for field deployment of the trained machine learning models. This makes it possible to detect disease easily, which helps farmers manage their crops more intelligently. Furthermore, the detecting system made to be user friendly, offering a simple web platform for users to interact with the detecting system.

Keywords- : Plant disease Detection, Machine learning, Web developement, Image processing, Computer vision, Deep learning, Convolutional neural networks, Training dataset, Python programming, TensorFlow.

I. INTRODUCTION

Plant disease have been a persistent problem since many years. The conventional way of detecting the disease was done by farmers but it was not that much convenient because farmers do not have that much proper knowledge of some disease. This might cause their crops to be lost. Then some of the expertise in this field were also there to detect the disease but that process is too much time consuming. In recent years there is growing interest in using technology in the agriculture sector causing to develop in the plant disease detection system.

Flowchart of Methdology:



II. LITERATURE SURVEY

This paper reviews recent research focused on the intersection of Machine learning and Plant disease detection system. In a study, by Uday Pratap Singh , Sidhhart Chouhan, Sukrity Jain and Sanjeev Jain. They provides an overview of Anthracnose disease in mango trees, its symptoms, causes and the importace of early detection and classification of disease management. They explained why image classification is valuable tool for diagnosing plant diseases including “Anthracnose” in mango leaves. They used convolutional neural network for image classification. They described architecture, layers, and any novel techniques or innovations used the model.

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The paper includes detailed dataset including number of samples, data agumentation techniques and any specific challenges related to collecting and preparing the dataset. They also shared result convolutional neural networks (CNNs) and suggests potential future research directions in the area of mango leaf disease classification using deep learning[1].

In the paper of Peng Jiang, Yuehan Chen, Bin Liu, Dongjian He and Chunquan Liang they firstly gives introduction to apple leaf disease , their economical and environmental impact and importance of early detection and classification for disease management of apple orchards. Then they discussed the significance of image based disease detection in agriculture. Particularly in the context of apple leaf diseases. They Highlight the need of accurate and efficient methods for disease classification.Then they collect the dataset for their project which includes the images of apple leaves corresponds to five claases: Alterneria spot, brown spot, grey spot, mosaic, and rust. Then they developed some models for detecting this types of diseases quickly and more accurately. Then they provided result and conclusion of the project[2].

In the plant leaf disease detection using machine learning, the study by Amrita Tulshan and Nataasha Raul Maria delves into the fusion of matlab and machine learning algorithms. They used other classifiers such as KNN for classifying data more than two classes. Total seven diseases were detected by their systems. More additionally they assures that their system detects disease name as well as accuracy percentage of affected area. The discussed diseases in their paper are Down mildew, early blight, mosaic virus, leaf miner, white fly. Then they explain methodology which includes the working flow, pre-processing, image segmentation,etc. Then they trained dataset which includes training and testing data and performed experiments in matlab. After that they shared result, conclusion and future work and particular references which they had taken in their paper[3].

Furthermore, the work by Kaucher ahmed, Tasmia shahidi, syed alam and sifat momen emphasizes the rice as a stable crop and the impact of diseases on rice yeild and quality. They also explained why automated disease detection is crucial for early intervention and crop prevention. After that it includes the significance of machine learning techniques such as deep learning and traditional algorithms in automating the detection of rice leaf diseases. Then the paper includes literature survey consist of previous project studies that have used machine learning methods for detection of diseases. Then they provided the block diagram of their entire work flow. Then they created the dataset. The dataset was created by Harshadkumar, et al. manually by separating infected leaves into three classes:

Bacterial leaf blight, brown spot andleaf smut. Then they used some classifiers for classification like logistic regression,KNN,Decision tree and after that their paper concludes with results, conclusion, future work and references[4].

III. METHODOLOGY

The farmaX web platform was developed following a systematic methodology aimed at enabling efficient plant disease detection using machine learning technology.

i) Data Collection and Preprocessing:

High resolution photos of plant leaves were collected from various sources,paying particular attention to leaves exhibiting signs of illness. These images underwent preprocessing to enhance their quality and standardize them for analysis. Preprocessing techniques included normalization of pixel values and augmentation of the dataset with variations like rotation, flips, and brightness adjustments.

ii) Machine learning algorithms:

For disease categorization, Convolutional Neural Networks (CNNs) were the main machine algorithm used.CNNs are specially designed to recognize patterns and features in images, making them ideal for analyzing plant images and diagnosing disease.

iii) Functionalities of farmaX website:

The "Inspect" page allows users to upload images of plant leaves for disease detection. After uploading, the images are processed using the trained CNN model to classify them as healthy or diseased.

The "Supplement" page provides additional information or recommendations to farmers based on the detected diseases. This feature aims to assist farmers in understanding and managing plant diseases effectively.

The "Contact Us" page serves as a means for users to reach out to the administrators of the farmaX platform for inquiries, feedback, or support. Users can fill out a contact form or find contact information such as email addresses or phone numbers for direct communication with the support team.

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IV. RESULT

The evaluation of the farmaX web platform involved assessing the performance of the machine learning models in detecting and classifying plant diseases. Visual representations of the model's predictions provide valuable insights into its accuracy and effectiveness.

i) Model Training Images:

Following fig1 includes example images from the training dataset used to train the machine learning model. Each image is labeled with the corresponding plant disease class and fig2 includes example images from the test dataset used to evaluate the performance of the machine learning model. Predicted classes, actual classes, and confidence scores are displayed for each image.

Fig1

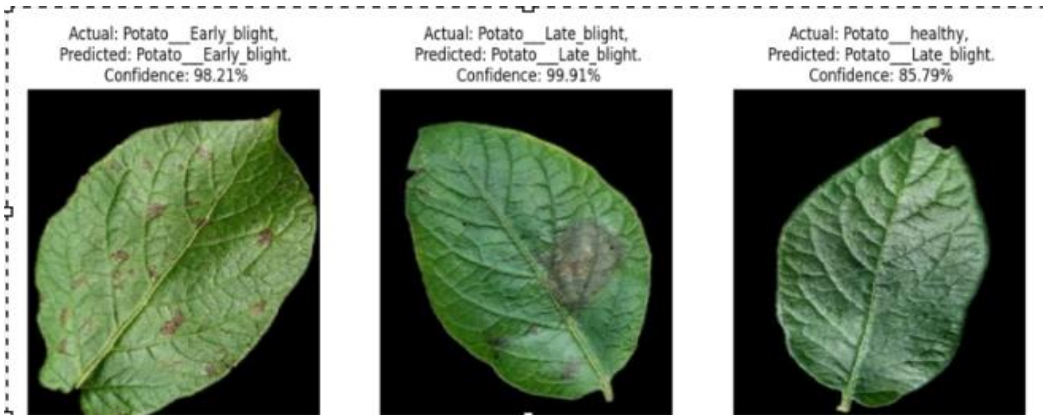
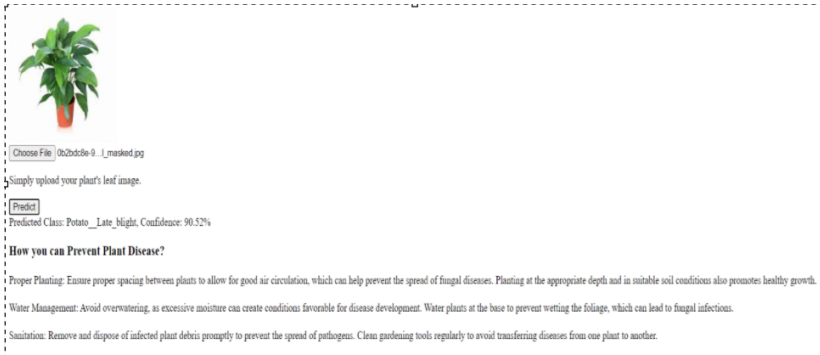


Fig2

ii) Output on the inspect page of website:

Following image includes screenshot of the farmaX website's "Inspect" page displaying the output of disease detection for an uploaded image. The result indicates the detected disease(s) along with any additional information



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V. CONCLUSION

The project on "Plant disease detection using machine learning" gives a noteworthy advancement in the field of agriculture and technology. This creative idea has the potential to completely change how we monitor and manage plant health by utilising the power of machine learning algorithms.

Through the project we have demonstrated the feasibility of creating an web-platform that can easily identify and diagnose plant diseases, there by enabling the farmers to take timely and targeted actions to protect their crops. It also has the potential to increase agricultural yeilds and reduce the reliance on chemical pesticides, promoting more sustainable, helpful and environmentfriendly farming practises.

Moreover, the project showcases the synergy between cutting edge technologies like machine learning and easily accessible web platform making it feasible to farmers in diverse region to adopt and benefit from this system.

Furthermore, there is room for further improvement and expansion of this project. Enhancing the accuracy of disease detection models, integrating more sensors for environmental modeling and extending the platform to cover wide range of plant species and diseases are all exciting avenues for future development.

Ultimately, this project is testament to the immense potential of technology to address real world challenges and it paves the way for brighter and more sustainable future for agriculture, one in which farmers can make informed decisions to ensure food security and environmental preservation.

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