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Vrundavan: Expert System for Plants

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ABSTRACT

Plant diseases are one of the most important reasons that lead to the destruction of plants and crops. Detecting those diseases at early stages enable us to overcome and treat them appropriately. This process requires an expert to identify the disease, describe the methods of treatment and protection. Identifying the treatment accurately depends on the method that is used in diagnosing the diseases. Expert systems help a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly. In this system, Images Processing or Computer Vision technology in the domain of AI along with ML and CNN for accurate disease prediction which can help the plants further growth, Various aspects of Deep Learning are used and by the help of a mobile application from where user input can be collected and tested against trained data set the python programming language is used along ML tools as required. Keywords: AI (Artificial Intelligence), ML (Machine Learning), CNN (Convolutional Neural Network), Image Processing, Computer Vision

I. INTRODUCTION

Early plant disease detection plays a significant role in efficient crop yield. affect the growth, crop quality of plants and economic impacts in the agriculture industry. To avoid the impact of these diseases, expensive approaches and the use of pesticides are some solutions the farmers usually implement. The use of chemical means damages the plant and the surrounding environment. Describe the methods of treatment and protection. An intelligent computer program that uses knowledge and inference procedures to solve problems that was difficult enough to acquire significant human expertise for their solutions. It is a computer application that solves complicated problems that would otherwiser equire extensive human expertise. To do so, it simulates the human reasoning process by applying specific knowledge and interfaces. Expert system also uses human knowledge to solve problems that normally would require human intelligence. It represents the expertise knowledge as data or rules within the computer. These rules and data can be called upon when needed to solve problems. Expert systems typically have three components viz., knowledge base, inference engine and user interface. The knowledge base is the component that contains the knowledge obtained from the domain expert.The user friendly software developed using windowing environment, provides enough facilities to identify the disease and to suggest the remake To build this expert system we are going to use images processing or computer vision technology in the domain of AI along with ML and CNN for accurate disease prediction which can help the plants further growth, we will also use aspects of deep learning and create a user interface from where user input can be collected and tested against trained data set the python programming language will be use along with TensorFlow and other ML tools as required.

II. RELEVANCE

Plant diseases and pests' detection is a very important research content in the field of machine vision. It is a technology that uses machine vision equipment to acquire images to judge whether there are diseases and pests in the collected plant images. At present, machine vision-based plant diseases and pests' detection equipment has been initially applied in agriculture and has replaced the traditional naked eye identification to some extent. In recent years, with the successful application of deep learning model represented by convolutional neural network (CNN) in many fields of computer vision (CV, computer-vision), for example, traffic detection, medical Image Recognition, Scenario text detection, expression recognition, face Recognition, etc. Several plant diseases and pests' detection methods based on deep learning are applied in real agricultural practice, and some domestic and foreign companies have developed a variety of deep learning-based plant diseases and pests' detection We chat applet and photo recognition APP software.

III. LITERATURE SURVEY

The above survey of various researchers of different algorithms of plant image processing and computer vision technology summarization KNN and HE were used to detect and categories the plant images based on percentage of abnormalities in leaves. And colour grading to enhance the quality of image.to get the accurate output for the given image. CNN and ANN which are the part of Deep Learning minimises the steps of pre-processing and directly creates

the neural network like neurons in human brain to identify the patterns and differentiating one pattern from another. from yellow spots to natural green pigmentation of the plant. CNN is the best and latest technology succeeded by KNN and other ML algorithms like SVM which were highly used in image processing in Early AI/ML models.

Author /Year of Publication	Title	Paper theme	Conclusion
Sunil S. Harakannanavara, Jayashree M. Rudagi, Veena I Puranikmath, Ayesha Siddiqua, R Pramodhini (IEEE) 2022	Plant leaf disease detection using computer vision and machine learning algorithms.	To predict the plant diseases at their early stage in the field of agriculture is essential to cater the food to the overall population.	The machine learning approaches such as SVM, K-NN and CNN are used to distinguish diseased or non-diseased leaf.
Nageshwar Jaiswal and Vivek Sarnaik Sinhgad Institute of Technology, Lonavala, (IRJES) 2021	Detection of Plant Leaf Disease Using CNN Algorithm	To build system which identify the correct disease and suitable pesticide for that disease	The accurately detection and classification of the plant disease can be done using image processing. This paper discussed various techniques to segment the disease part of the plant.
Ms. Mitali V. Shewale, Dr. Rohin Daruwala (IEEE) 2021	Leaf Disease Classification Using Convolutional Neural Network.	This paper presents a convolutional neural network based customized VGG framework and a lightweight architecture for the classification	This paper presented a customized light weight CNN model for the leaf classification of healthy tomato plant from multiple disease types.
JIANG HUIXIAN School of Geographical Sciences, Fujian Normal University, Fuzhou 350007, China (IEEE) 2020	The Analysis of Plants Image Recognition Based on Deep Learning and Artificial Neural Network	Plant leaf recognition technology based on image analysis is used to improve the knowledge of plant classification and protection	ANN Classification method based on backpropagation error algorithm is proposed to recognize plant leaves, and good results are obtained.

Author /Year of Publication	Title	Paper theme	Conclusion
Sammy V. Militante1, Bobby D. Gerardo, Nanette V. Dionisio (IEEE) 2019	Plant Leaf Detection and Disease Recognition using Deep Learning	This research paper provides an efficient solution for detecting multiple diseases in several plant varieties.	Early recognition and detection of these diseases are crucial to the agricultural industry. This paper has achieved its goal to detect and recognize 32 different plant varieties and plant diseases using convolutional neural network
Eftekhar Hossain, Md. Farhad Hossain and Mohammad Anisur Rahaman (IEEE) 2019	A Color and Texture Based Approach for the Detection and Classification of Plant Leaf Disease Using KNN Classifier	This paper proposed a technique for plant leaf disease detection and classification using K-nearest neighbour (KNN) classifier	This work proposed a method which uses KNN approach to detect and classify various diseases that are present in plant leaves.
Anuradha Sharma, Abhilash Sonker (IEEE) 2019.	Recognition of Diseases of Leaf using SVM with Radial Basis Kernel Function.	This research showcased a methodology for Recognition and Grouping of diseased leaf and healthy leaf by Support vector machine (SVM) classifier with radial basis function.	This work showcased a method which cast-off Multiclass Support vector machine (multi-SVM) with radial basis function kernel methodology to detect/recognize and classify/group several diseases that exists in plant leaves Diseases/ailments such as Cercospora leaf spot.

IV.METHODOLOGY

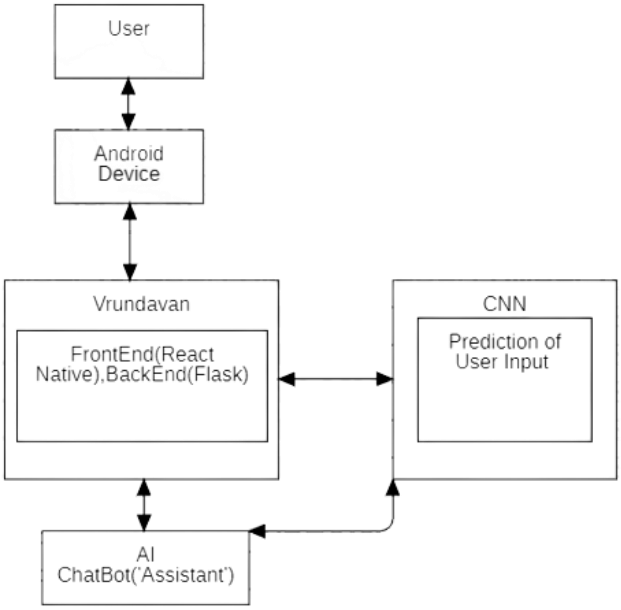

Fig.4.1 System Architecture

The block diagram in Fig. 4.1 gives an overview of the approach towards building a basic system for the system software architecture. Thearchitecture shows the working of software and the use of plant data to make accurate predictions as well as output via mobile application.

A. Input stage

Initially input of the plant image is provided to the deep learning model via mobile application which captures as well as selects the image from the user's gallery. then converts it in format suitable for the deep learning, which is build using Keras, TensorFlow and CNN (convolutional neural network) which differentiates healthy to unhealthy plants which then integrated with expert system gives suggestions to the user about the plant requirements.

B. Users

People in general like to have house plants or small gardens. Every year during monsoon people buy saplings which live for few months this is becausewe don't know what exactly plant requirements are the Vrundavan app helps you to analyse plant requirement with just picture. It uses Deep Learning model to analyse the image and mobile app is easy to use and handle which connects DL model with user interface via which user can capture image or select image from gallery and analyses weather plant is diseased or healthy and suggestions or recommendations are provided in next page.

C. Output & Display

Initial page of the application gives general information about plants in database and user can ask any questions to the chatbot which is integrated with deep learning model. the second pages provide.

D. Power Supply

In this project power to the DL model is supplied by server and capacitors or device battery. Computation time depends on server capacity. The mobile application runs on device battery.

System Components:

Plant Data Set:

The data set is collected from various online platforms and open-source applications as well from capturing directly from source. And this dataset is converted into vectorized embedding suitable for processing and handling via Neural Network.

CNN Model:

The data set is pre-processed and converted into appropriate format and given as input to the deep learning model. Here we are using keras library in pre-processing, optimization and in call back functions data set is divided into train and validation. TensorFlow is used to save the output of DL model the JSON file extension which is accepted by mobile applications developed in React-Native. CNN model which is unsupervised selects only leaf portion of the image and creates multiple images like with more exposure, angle, multiple perspectives of the leaf via ImageDataGenerator, then gives output weather the leaf is healthy or unhealthy as an output. The accuracy of CNN model is about 93%. But due to less dataset loss function is significantly large i.e., around 2.5%

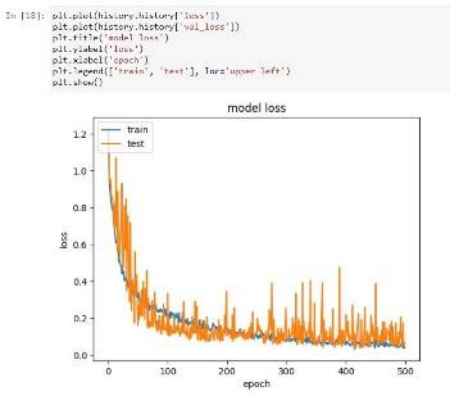

Fig.4.2. Model Loss.

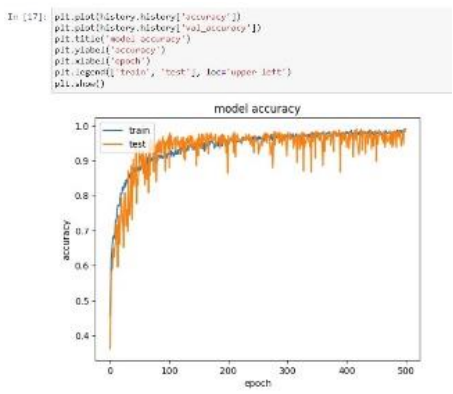

Fig.4.3.Model Accuracy

Assistant:

The chatbot which created with Artificial Intelligence is integrated into DL model and Mobile Applicationi.e., Vrundavan. The direct API of ChatGPT is used as chat bot which acts as virtual assistant and gives recommendations required for healthy upbringing of plant.

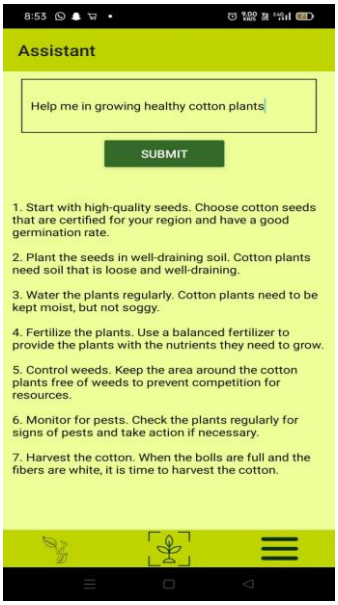

Fig.4.4. Assistant

Camera:

The computer vision technology is what this project is completely based on. The camera integrated with mobile application can capture plant or any image from the surrounding and also from user database and provide the image as input to CNN model which processes the image to give output to the user.

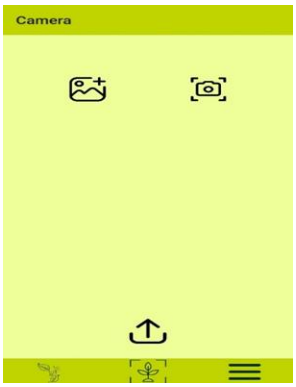

Fig.4.5. Camera

Backend Framework. Full stack development is completely based on React, JS, CSS, and Python backend. The app constitutes Chatbot and Camera as userinterface. The navigation through various tabs is smooth and error free. Application runs with 100% efficiency and captured plant images arestored in plant data set which helps CNN model to get more accurate results with every usage.

Fig.4.6. Capturing Image

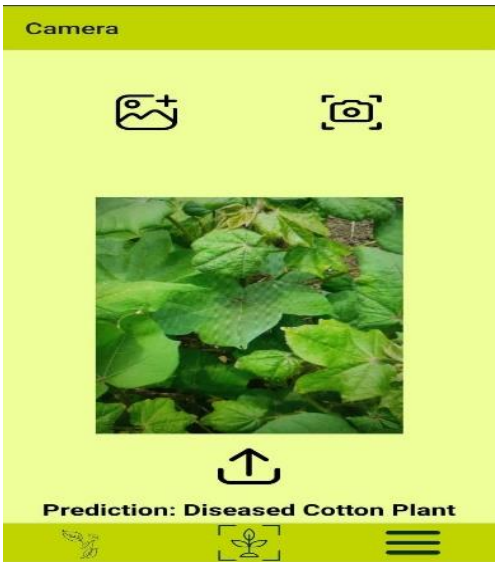

Fig.4.7. Disease Detected

Android Application:

The Android app that is Vrundavan Is completely build usingReact-Native programming language.CNN model is integrated with the mobile application via Kotlin python.

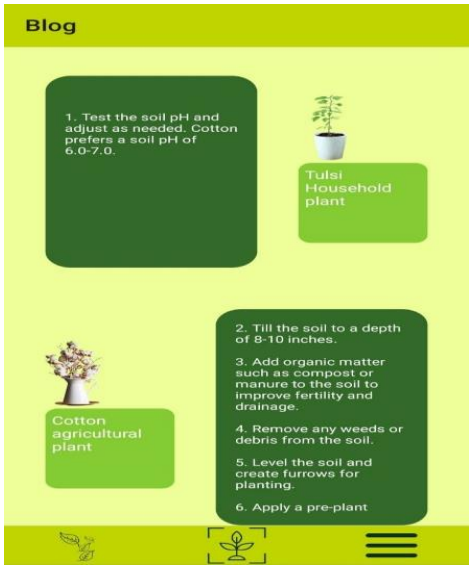

Fig.4.8. Blog model

Mobile Application:

The android application is alright running namely ‘Vrundavan’ along with mobile application we can create web application and add blogs for all the considered plants in the database

V. RESULT

The image captured by user is send toCNN model then the CNN model differentiates between healthy and unhealthy plant leaves. and gives output via mobile application and further assistance is provided by AI chatbot and Blog page integrated with plant dataset.

VI. FUTURE SCOPE & INCREMENTATIONS

CNN Model:

The CNN model can be further trained to detect all the plant diseases categorically with the availability of data set.

Recommendation System:

The Recommendations for individual plant diseases can be provided with the plant database

IOT Integration:

We can monitor plant health for 24 hours and create dataset as well as integrate it with CNN model for further analysis. the data in IOT can be collected via sensors and cameras. Can provide the complete condition of the plant health. It can be used to create smart forest or smart gardens as well.

Scale out to multiple Flora:

In the project we are only considering cotton and Tulsi leaf data set but we can use this model with all the flora with the appropriate data set.

VII. CONCLUSION

The previous papers used to traverse through various disease prediction techniques like ML, AI and other image processing while we directly use unsupervised deep learning Convolutional Neural Network to predict plant disease. Along with predictions we also give recommendations for what to do when plant is diseased with the assistance provided which is AI integrated with CNN. And the assistance is also in the form of blogs. the model prediction is accurate with the further scope.

VIII. REFERENCE

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