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Grape Leaf Disease Detection and Classification Using Machine Learning

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ABSTRACT: Grapevine diseases and pests can result in substantial financial losses for grape production and farmers when not promptly identified and addressed. In light of recent advancements in artificial intelligence techniques and machine learning technologies, computer vision and deep learning algorithms are now being employed to detect and categorize grapevine diseases efficiently. The objective of this research is to create an android application that can identify and detect Grape plant diseases using a deep convolutional neural network (CNN). In countries like India, where agriculture plays a crucial role, plant diseases cause significant losses in crop production annually. Detecting these diseases manually is challenging, making the development of an automated system essential. The proposed model takes an image of a Grape plant leaf as input, processes it using a deep CNN, and successfully identifies and detects the disease. The resulting model is both lightweight and efficient, enabling its integration into the android application. This user-friendly mobile application is specifically designed for farmers, allowing them to utilize its disease detection capabilities even without extensive technical knowledge. Additionally, the application offers potential solutions based on the identified disease.

KEYWORDS:CNN, Disease, Detection, Deep Learning.

I.INTRODUCTION

Idea of the project: The idea is to reduce the diseases and improve the farmer's profit.

Motivation of the project: India has gained recognition for its thriving agricultural sector, offering farmers a wide range of options for cultivating crops. However, to achieve optimal harvests and high-quality production, farmers have adopted a more technical approach. The utilization of technology plays a crucial role in increasing yields and enhancing the overall quality of crops. Typically, when a plant is affected by a disease, the leaves serve as the primary indicator of the ailment.Agriculture plays a vital role in ensuring global food security, but it faces various challenges, including climate change, resource limitations, and plant diseases. These diseases can result in crop losses and food insecurity, especially in developing nations, while traditional methods of disease identification can be inaccessible and time-consuming. To address these issues, we propose the development of a mobile application that utilizes deep learning and CNN technology to enable efficient and accessible plant disease identification and management. By swiftly and accurately detecting and managing diseases, farmers can enhance their yields and improve food security. The application will grant farmers easy access to expert knowledge, empowering them to make informed decisions and optimize their farming practices. Ultimately, this project has the potential to significantly impact the lives and livelihoods of millions of farmers worldwide, contributing to the establishment of a sustainable and resilient agricultural sector.

II.METHODOLOGY

System Overview: Figure 1 provides an overview of the proposed system. The user initiates the process by capturing an image of a leaf from the target plant using their phone camera. The captured image undergoes processing through the trained model, which is integrated into the "Grape Cure" application. Based on the image's accuracy, the application generates results indicating whether the plant is healthy or diseased. The results also specify the particular disease name and provide solutions for treating the disease. In case the situation becomes challenging for the user to handle independently, the application offers a feature to contact the nearest agriculture department for assistance.

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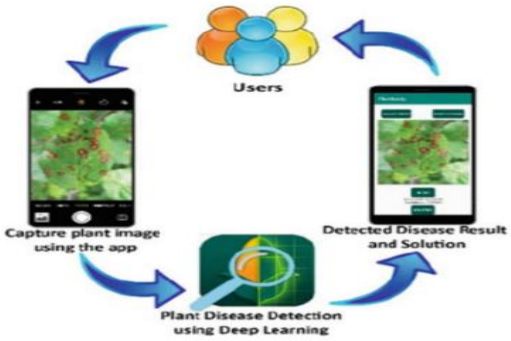
Fig. 1 System overview



Data Augmentation: To obtain the raw data, a total of 1075 images were gathered for leaf blight, 1383 images for black measles, 1180 images for black rot, 423 images for healthy leaves, and 250 images for phylloxera. To address any imbalances in the dataset and mitigate overfitting concerns during the training phase, we performed data augmentation on the healthy and phylloxera disease data by employing cropping techniques. Additionally, image data generator was utilized for further data augmentation. This approach aimed to enhance the overall balance and diversity of the dataset.

Renaming: Renaming is used to ease the data management for further evaluation. Image renaming in each category is done after cropping and augmentation, but before data shuffled randomly. After renaming, the images in each category fold are named as "class name sequence number"

Data Splitting: In this step, images are grouped into three datasets :
a) training dataset,
b) validation dataset, and
c) test dataset.

III.LITERATURE SURVEY

Literature survey, is a review of relevant research and literature on plant disease identification and management using digital image processing and machine/deep learning techniques. A method to classification of carrots based on shape analysis using machine learning technique. This method includes extraction of several features followed by convolutional neural network and k-nearest neighbours. The training accuracy of 96% was achieved and a validation accuracy of 77%.

External properties of fruits like colour, shape, size and the defects are considered as important features and the database comprises good quality mango images. The fruits are sorted and graded depending on these properties using t-artificial vision systems and image processing systems. The output product with maximum efficiency is obtained. This study aims to design a robust ai-based controller for tomato sorting processes as well as to provide a design for a budget tomato sorting machine. The performance of the most well-known convolutional and deep learning neural network algorithms was investigated in order to improve the classification accuracy of tomato sorting controllers. . The CNN algorithm yielded this accuracy using either rgb or grayscale features. Numerous ai-based algorithms were trained with the objective to assess their abilities to differentiate between those classes given that the highest detection accuracy values obtained using ann, svm, som and lvq networks are 100%, 90%, 68% and 62.2%, respectively.

IV.WORKING OF DEEP LEARNING

Deep learning, a subset of machine learning, utilizes artificial neural networks to autonomously improve and analyze computer algorithms. Unlike traditional machine learning approaches, deep learning networks are designed to mimic the

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structure of the human brain and learn from vast datasets. With advancements in Big Data analytics, these neural networks have become increasingly complex and sophisticated, enabling computers to recognize and respond to intricate scenarios more rapidly than humans. The application of deep learning has brought about significant transformations in various fields, including image classification, language translation, and speech recognition. Moreover, it possesses the potential to address pattern recognition challenges without requiring human intervention.

Artificial Intelligence (AI) and machine learning (ML) are integral parts of the future of computing. They rely on pattern recognition, forecasting future outcomes based on historical data, and automating decision-making processes. Deep Neural Networks (DNNs) are a specific type of neural network capable of executing intricate tasks like abstraction and representation, enabling comprehension of images, sound, and text. Deep learning has emerged as the most rapidly expanding field within machine learning, presenting itself as a truly transformative technology. Businesses are increasingly adopting deep learning to develop innovative business models and capitalize on its potential.

Convolutional Neural Network: Convolutional Neural Networks (CNNs) are a specific category of Deep Learning algorithms that excel in tasks involving image and video recognition. They possess the capability to automatically detect significant features within images and utilize these features to make predictions for new images. This attribute renders CNNs highly valuable across various applications, including but not limited to self-driving cars and medical diagnosis. The architecture of a ConvNet draws inspiration from the organization of neurons in the human brain. In a ConvNet, each neuron in a particular layer is exclusively connected to a small region, known as its receptive field, in the preceding layer. This enables the network to concentrate on local features within the image and contributes to the reduction of the number of parameters that need to be learned.

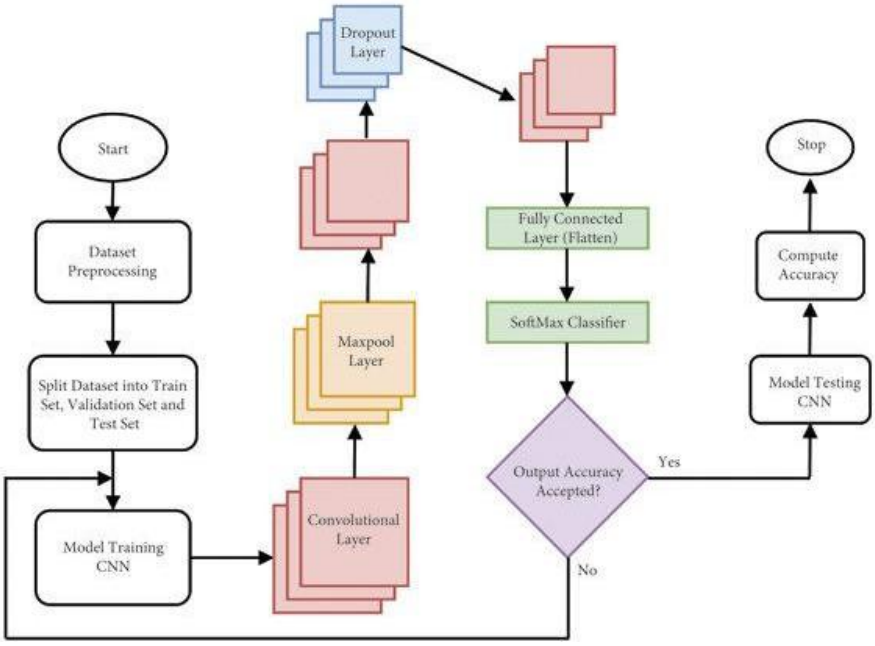

Fig.: Convolutional Neural Network

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V.CONCLUSION AND FUTURE WORK

Conclusion: In conclusion, the development of a smart farming system for plant disease and quality detection using machine learning techniques has been presented in this project. The system has been designed to provide accurate and efficient identification of plant diseases, which can help farmers to take timely measures to prevent the spread of diseases. Moreover, the system has also been designed to provide fruit and vegetable quality grading based on size and shape.The implementation of this system has shown promising results in the detection and classification of various plant diseases and the grading of fruits and vegetables. The system has achieved high accuracy in disease detection and grading, which is expected to lead to increased productivity and cost savings for farmers.

Future Work: We believe that there is a vast potential for the future scope of our project. With the increasing demand for sustainable agriculture, the implementation of technology- based solutions has become a necessity. Our project can provide a cost- effective and efficient solution for plant disease detection and crop yield prediction. The following are some potential future scopes for our project: Firstly, we can integrate our app with drones for monitoring large agricultural fields. The app can be used to control and guide the drones over the fields, capturing high- resolution images of crops. The images can then be processed using our algorithms to
identify plant diseases and predict crop yield. This can significantly reduce the time and effort required for manual monitoring and increases the accuracy of results. Secondly, we can expand our project to include more crop varieties and diseases. Currently, our project focuses on a few specific crops and their diseases. By including more crop varieties and diseases, we can cater to a wider audience and provide more comprehensive solutions. We can also collaborate with agricultural research institutions to gather more data and improve the accuracy of our algorithms.

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