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Potato Leaf Disease Detection Using Machine Learning

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Abstract - Plant phenotype is an important aspect of plant characterization for monitoring plant growth. This paper presents an efficient approach to identify healthy and diseased or infected leaves using image processing and machine learning techniques. Various diseases damage leaf chlorophyll and cause brown or black spots on the leaf surface. These can be detected using image preprocessing, image segmentation, feature extraction, and classification using machine learning algorithms. A convolutional neural network (CNN) improved the accuracy of detection.

Key Words: **Convolutional Neural Network (CNN), Confusion matrix, Machine Learning**

1.INTRODUCTION

In India, for economic development, agriculture is a valuable source. To increase the production of food, the agriculture industries keep on searching for efficient methods to protect crops from damages. This makes researchers search for new efficient, and precise technologies for high productivity. The diseases on crops give low production and economic losses to farmers and agricultural industries. For a successful farming system, one of the essential things is disease identification. Ingeneral, by using eye observations, a farmer observes symptoms of disease in plants that need continuous monitoring. Different types of disease kill leaves in a plant. For identifying these diseases, farmers get more difficulties. For disease detection, the image processing methods are suitable and efficient with the help of plantleaf images. Though continuously monitoring of health and disease detection of plant increase the quality and quantity of the yield, it is costly. Machine learning algorithms are experimented due to their

better accuracy. However, selection of classification algorithms appears tobe a difficult task as the accuracy varies for different input data. The objectives are to detect leaf disease portion from the image, extract features of an exposedpart of the leaf, and recognize diseased leaf through SVM. Further, Convolutional Neural Network (Alex net)is evaluated and compared for accuracy. The paper is arranged into five sections: the first section gives the introduction, the second section presents the literature survey, the third section discusses methodologies like feature extractions of images, SVM and CNN, the fourthsection shows the result of classification, and the fifthsection is about the conclusion and future scope. In thepaper, the sections are structured as follows. The literature related to the problem has been discussed in Section 2. In Section 3 the System Architecture is discussed. In Section 4 the Research Methodologies which consist of Data Set, Data Collection, and Preprocessing along with classification Techniques are discussed. The Theoretical and mathematical knowledge of feature selection and classification algorithms are discussed in detail. Further, the Conclusion and the Future Scope of the study have been discussed in detail in Sections 5 and 6 respectively. The last section consists of acknowledgment and references which made this study possible.

2. LITERATURE REVIEW

A previous study by Aditi Singh, Harjeet Kaur [1] has used Device is used as input and segmentation on a single plant leaf after context removal is carried out. The image segmentation of the diseased component is then analyzed using a high-pass for the leaf. And outcomes was Keeping this intention as the motivation for the proposed model to detect and classify the affected and unaffected leaves of potato. The proposed framework able to achieve an accuracy of 95.99%.

Another study by Tan Soo Xian , Ruzelita Ngadiran [2] uses algorithm Plant Diseases Classification using Machine Learning. The performance based on the accuracy rate of ELM classifier is expected to be on par to the with other classification models such as Decision Tree (DT) and Support Vector Machine (SVM). The complexity will be as well reduced. Overall, the result shows that ELM has a good result compared with decision tree classifier using proposed image features.In[3] Plant diseases and pests detection based on deep learning. Analyses the three kinds of plant diseases and pests detection methods based on deep learning according to network structure, including classification, detection and segmentation. Another paper[4] The objectives are to detect leaf disease portion from the image, extract features of an exposed part of the leaf, and recognize diseased leaf through SVM. Further, Convolutional Neural Network (Alexnet). The transfer learning and other CNN models can be evaluated to improve accuracy of detection of tomato leaves disease.

3. ARCHITECTURE

Dataset collection is the act of gathering information containing potato leaf images. we get this dataset fromkaggle dataset. we use some data cleaning and preprocessing process. As we are using some deep learning, we are using tensor flow library accurate results. We use tf dataset which help us to represents a sequence of elements, in which each element consists of one or more components. Data augmentation is used to get more data from the existing type of data and helps us to zoom out and zoom in for it. And after that we are using convolution neural network model for model building which extractfeatures from it and get accurate results.to create a website where we can click photos and upload it.

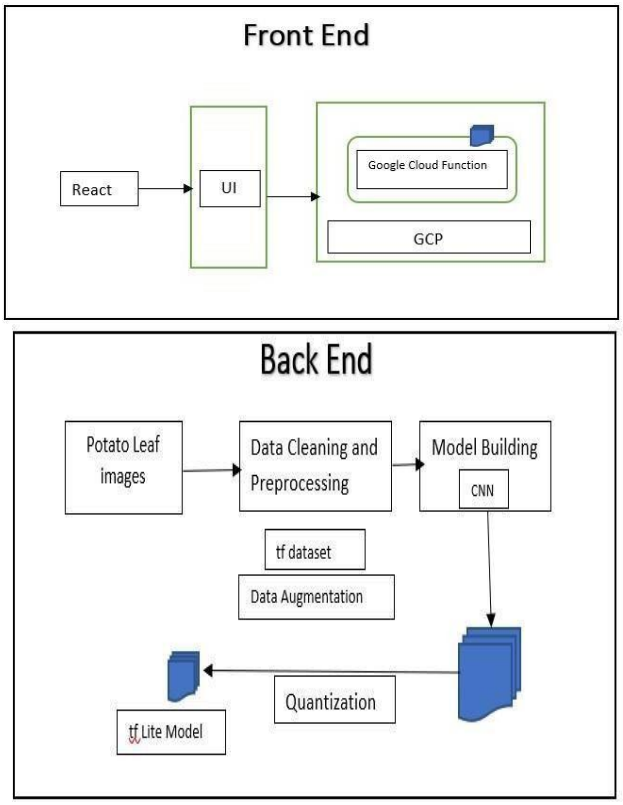

Fig 2.1 System Architecture

4. RESEARCH METHODS

A. Dataset:

The potato leaf disease detection is utilized in the study. It has been downloaded online from Kaggle. The dataset contains various input features, which are broken down into the following categories:

1. Potato healthy leaf
2. Potato early blind
3. Potato late blind

B. Data Collection and Preprocessing:

A collection of methods known as data preparation are used on data to enhance its quality. These methods include addressing missing values, changing the type of feature, and many more. There are two types of process.

1.TF Datasets: A collection of ready-to-use datasets. A Tensor Flow dataset is a group of ready-to-use datasets using Tensor Flow or other Python ML frameworks such as Jax. All datasets are provided as tf. data. Datasets enabling easy-to-use and influential input pipelines. Check out our guide and list of recordings to get started. The tf dataset can be used to transform blurred images.

2.Data augmentation: It is a process of artificially increasing the amount of data by generating new data points from existing data. We can generate new points from the existing points and can generate new type of data from existing data.it helps to predict accurate data. From the existing data and generating new type of data from it we can get zoom in zoom out details from different angles with the help of data.

C. Model building:

1.CNN (Convolution neural network)

To classify more complex images, we need to use more sophisticated artificial neural networks called convolutional neural networks (CNNs). In convolutional neural networks, each neuron in the next layer connects only to groups of neighboring neurons in the previous layer, usually called local approachable fields or patches. The next neuron in the hidden layer connects to the patch gained by shifting the patch by one pixel. Therefore, each occult neuron learns to analyze its specific local approachable field or patch. instead of all input neurons. Convolutional neural networks are more complex than fully connected networks. Convolutional neural networks differ from other neural networks because of their greater performance on speech, image, or audio signal inputs.

D. REACT JS :

The react is framework is an open-source JavaScript framework and library. With the help of it we are building an interactive website where we can drag and drop the leave images. And with the help of your CNN model, we can predict accurate results from its used for building interactive and web applications quickly and efficientlywith significantly less code than you would with vanilla JavaScript.

E. Google cloud Functions :

Google Cloud Functions is use for connecting and building cloud services. It is server less execution environment. Cloud Functions allows you to create simple, dedicated functions that attach to events emitted by cloud infrastructure and

services. The function is triggered when the observed event is triggered. Developers can use Cloud Functions to provide and update users with relevant information about their apps. For example, imagine an app that allows users to track each other's activity within the app. Every time a user adds themselves as a follower of another user, a write is made in the real-time database. Cloud Functions is a server less execution environment. it isused for create and connecting cloud services. Cloud Functions allows you to create simple, dedicated functions that attach to events emitted by cloud infrastructure and service

5.CONCLUSION

Disease detection and identification is done using image processing and machine learning algorithms. The data is collected from his Kaggle website called potato plant Diseases Dataset. This dataset contains different images of healthy and unhealthy crop leaves with over 12,949 images. Leaf diseased parts are segmented from the image and various features are extracted using the grayscale co-occurrence matrix (GLCM). The recognized part of the sheetis recognized by the SVM. SVM reports 80% accuracy. To improve accuracy, convolutional neural networks are used to identify plant diseases. CNN reported an accuracy of 97.71% for him against. This is better than the accuracy achieved with Hard coding technology. This work will aid in the automatic identification of plant leaf diseases, increasing agricultural production through early disease detection. Transfer learning and other CNN models can be evaluated to improve the accuracy of potato leaf disease detection.

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