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IDENTIFICATION OF PLANT LEAF DISEASE WITH SOLUTION USING CNN

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ABSTRACT: -Significant risk to agricultural sustainability is posed by the rapid spread of plant leaf diseases. Effective management of leaf disease depends on early identification. Early detection enables farmers to easily identify the disease in initial stage to take proper measures to prevent disease spread, and safeguards crop yield. This study presents an Automatic detection of leaf disease using Convolutional Neural Networks (CNNs) Integrated with an instinctive web Application and recommends remedies seemlessly. Extensive training on a large dataset with 38 classes of both diseased and healthy plant leaves, system attains 92% accuracy in classifying different plant diseases. By Leveraging CNN With web technology, creates an intuitive and accessible user friendly web application for individuals without extensive technical expertise.

KEYWORDS:-Plant Leaf Disease, Convolutional Neural Networks (CNNs), Web Application, Remedies.

1. INTRODUCTION

Traditional visual assessment could be a common component of conventional disease discovery procedures, but it can be difficult and inclined to human eye. To overcome this challenge, Identification of plant leaf disease

using CNN with solution is an efficient model to detect the disease of leaf along with its remedy in a user-friendly web Application. It can easily examine the uploaded leaf images and precisely identifies the existence of disease. Major component of this inventive approach is CNN Model, which undergoes training on vast dataset of plant leaf images. Dataset contains 38 classes of diseased and healthy leaves of 13 different types of plants. These leaf images undergo different layers for accurate identification of disease.

By uploading the leaf image, if it is diseased leaf: Web Application displays the name of the disease, Remedy and plant name of the leaf image, if it is healthy leaf: Web Application displays the plant name of the leaf image. Moreover, web application offers a comprehensive stage for clients to connect with the framework consistently. This system conserves farmers precious time and enhances the reliability of disease detection, by Recommending remedies to protect crop health. Through a natural interface, farmers can easily upload their leaf images from their

devices, to get required data about leaf image.

2. LITERATURE SURVEY

Provides a better solution to resolve the issues related to healthy crop yet it not been informed to farmers using convolution system and semi supervised techniques to characterize crop species and detect the sickness status of 4 distinct classes in the paper presented by Suma V et al., [1]. The paper presented by Dr. P.V. Rama Raju et al., [2] detects the pests name, lifespan of the pest, disease caused by the pest and the medicine to eradicate the pests using techniques of image analysis of Hue Saturation Intensity (HSI) and neural networks. Plant phenotyping is a critical aspect of characterizing plant for plant growth monitoring for that Utkarsha N. Fulari et al., [3] introduces an efficient approach to identify healthy and diseased or an infected leaf using image processing and machine learning techniques. An effective and efficient process to identify liver cancer is done by using neuro classifier (CNN) by using extracted parameters like entropy, contrast and energy functions of the image with better accuracy and performance is explained in the paper presented by Dr. P V Rama Raju et al., [4]. Melike Sardogan et al.,[5] presented a paper that describes a Convolutional Neural Network (CNN) model and Learning Vector Quantization (LVQ) algorithm based method that effectively recognizes four different types of tomato leaf diseases. The analysis of the deforestation rate in different regions from satellite images of any region using color segmentation algorithm on image and area of forest in a place is calculated and predicts deforestation has occurred over past years is explained in the paper proposed by G. Naga Raju et al., [6]. The paper presented by Rishikesh R. Kulkarni et al., [7] introduces the artificial intelligence based automatic plant leaf disease detection and classification for quick and easy detection of disease and then classifying it and This aims towards increasing the productivity of crops in agriculture. How to detect and diagnose diseases in plants by using a camera to capture images as basis for recognizing several types of plant diseases and the system was able to register up to 100% accuracy in detecting is explained by Sammy V. Militante et al., [8]. The paper presented by Santhosh Kumar.S and B.K.Raghavendra [10] did a survey on different plants disease and various advance techniques detect these diseases and they used image processing techniques to detect disease of various plants.

Tables shows the Comaparitive analysis between different models.

Papers	Title	Proposed Algorithm
proposed model	Identification Of Plant Leaf Disease with Solution Using CNN	Convolutional Neural Network
Paper1 [1]	CNN Based Leaf Disease Identification And Remedy Recommendation System	Convolutional Neural Network
Paper2 [5]	Plant Leaf Disease Detection And Classification Based On CNN With LVQ Algorithm	CNN With LVQ Algorithm
Paper3 [10]	Diseases Detection Of Various Plant Leaf Using Image Processing Techniques: A review	Image Processing
Paper4 [8]	Plant Leaf Detection And Disease Recognisation Using Deep Learning	Convolutional Neural Network

Papers	Classification Approach	No. Of Disease Classes and Plants
Proposed model	Supervised Learning	38Classes Of 13 Different Plants
Paper1 [1]	Supervised Learning	4 Distinct Classes of Various Plants
Paper2 [5]	Supervised Learning	4 Classes Of Only For Tomato Plant
Paper3 [10]	Encompassed Both Supervised And Unsupervised Techniques	9 Classes Of 8 Different Plants
Paper4 [8]	Supervised Learning	27 Classes Of 5 Different Plants

3. MAJOR CONTRIBUTIONS

3.1 DATASET

In image-based Plant Leaf disease identification, it is necessary to have huge data sets for accurate Disease Identification. Hence, the source of data is collected from kaggle. The images thus collected are labeled with different categories of 38 classes of diseased and healthy leaves. Correspondingly, a dataset comprising of more than 75,000 images are used to train and around 1000 images are further used to validate the same.

3.2 DATA PREPROCESSING

Data preprocessing is imperative task in any computer vision based system. To succeed correct comes around, so establishment of unsettling influences need to be removed in a few time. Image Preprocessing incorporates an course of action of essential steps pointed at refining the gotten pictures and they were energized into the CNN exhibit. At to begin with, the Pictures of plant takes off appearing side impacts of contamination are gotten through the Dataset. Consequently, the gotten Images encounter cleaning and clamor reducing techniques to arrange of any variations from the norm that might ruin the illness revelation handle. Taking after this, the pictures are resized and normalized to a standardized estimation and pixel regard amplify, independently, ensuring consistency over the dataset appear planning. Data extension strategies are at that point associated to broaden the dataset by displaying assortments such as turn, flipping, and scaling, along these lines progressing the model's capacity to generalize over unmistakable events. Though optional, picture division may in addition be utilized to isolated relevant areas interior the leaf pictures, help refining the center of the CNN show.

3.3 FEATURE EXTRACTION

Highlights relevant to disease side effects are extricated from the preprocessed pictures, and range of the leaf and edge of the leaf is calculated. The extraction of color, shape, and surface highlight of the ailing portion of the plant can be done employing a dark level co-occurrence network (GLCM). There are distinctive methods of include extraction that can be utilized for developing the framework such as gray-level co- occurrence network (GLCM), spatial grey-level reliance lattice, color co-occurrence strategy, and histogram-based include extraction. The GLCM strategy may be a measurable strategy for surface classification. The preprocessed dataset is in this way divided into preparing, approval, and testing sets to assess show execution precisely. The names of the pictures are encoded into numerical arrange, and instruments for effective information stacking and group handling are actualized to streamline show preparing. By completely executing these picture preprocessing steps, the input

information quality is improved.

4. CNN ALGORITHM

CNN is a type of deep learning algorithm, which is significant for image or object recognisation. CNN is made up of multiple layers such as convolutional layer, pooling layer, fully connected layer and activation function. The CNN architecture is developed by the motivation of visual processing of human brain and it is appropriate for finding hierarchical patterns within the images. These are trained using supervised learning.
Convolutional Neural Networks undergoes different layers.

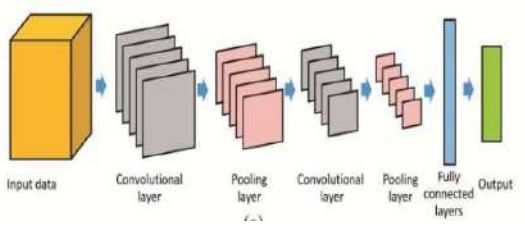

Fig1. Convolutional Neural Networks layers.

1. Convolutional Layer: convolutional layers apply convolution operation on input images. Each layer consists of a set of learnable filters called as kernels slip across the input image and performs element-wise multiplication, summing up the results to provide feature maps. Feature maps represent different features such as shapes, edges or textures.

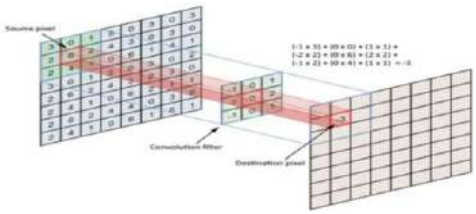

Fig2. Convolutional layer

2. Activation Function: Activation function is applied in the network to introduce non-linearity. There are Several activation functions such as sigmoid, linear, ReLU etc. But in CNN usually used activation function is nonlinear Rectified Linear Unit (ReLU), which helps the CNN to learn complex patterns and relationships in the data.

$$A(x) = \max(0,x).$$

if x is postive, output becomes same else output is 0.

3. Pooling Layers: This layer usually utilised after the convolutional layer. Dimensions of the matrix obtained from the convolutional layer is reduced in this layer. several pooling layers such as max pooling, average pooling are there but in this study we used max pooling. Max pooling operation is done by finding the largest value in the submatrix and this value is transferred to in a new matrix. The obtained new matrix contains important features.

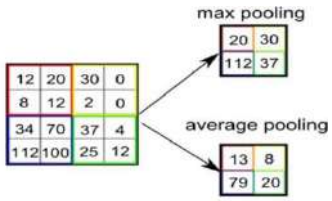

Fig3. Pooling Layer

4. Fully Connected Layers: The matrix obtained after convolutional and pooling layers is passed into one or more fully connected layers. Dense layer is also known as full connected layer. Recognisation and classification tasks is performed in this layer.

4. PROPOSED METHODOLOGY

1. Data Collection and Prepocessing : A dataset of various plant leaf images labeled with 38 different categories of diseased and healthy leaves are collected. This dataset undergoes data preprocessing before fed into CNN model training to normalize, reduce noise and resizing of image data.

2. CNN Model Training: CNN architecture

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includes convolutional, pooling, and Flatten layers for extraction features and classification. The dataset is split into training and validation datasets. Model is trained using the Adam optimizer. The trained CNN model is saved and loaded for inference on the test dataset. And it generates the predictions and evaluation metrics such as accuracy, confusion matrix, and classification report to assess the model performance.

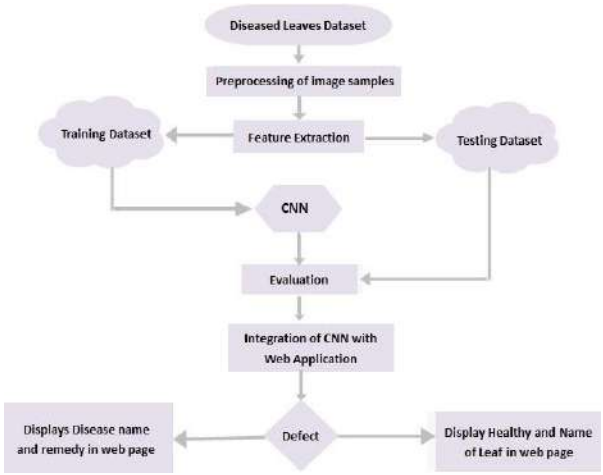

Fig4. Work flow diagram

3. Development of Web Application: HTML, CSS and Javascript are utilized to develop the web application. Creat the buttons for upload and predict using HTML. CSS and Javascript are utilised for styling the web page. when an user enter into the web page it shows an upload button for uploading the test image after uploading image it sends the image for prediction via AJAX Request and shows another button predict to predict the disease. after clicking it shows the disease name and remedy in the web page.

4. Integration of CNN Model with Web Application: Flask application serves as a web interface for plant disease prediction by using a pre-trained Convolutional Neural Network (CNN) model. The model is loaded using saved h5 file. After receiving image from the user, it processes the image and fed into the CNN model to predict the disease. the predicted disease is mapped to the corresponding cure. This application send Json response containing the disease name and remedy and it also provides external information of team details.

5. Web Application: when an user enter into the web page it shows an upload button for uploading the test image and guide and team infromation. By uploading the test image, if it is diseased leaf: Web Application displays the name of the disease, Remedy and plant name of the leaf image, if it is healthy leaf: Web Application displays the plant name of the leaf image.

5. RESULTS

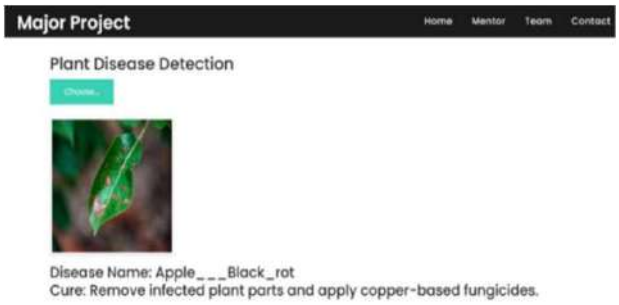

Fig5. Shows the web application which displays the disease of the apple leaf along with its remedy.

Fig6. Shows the web application which displays the disease of the grape leaf along with its remedy.

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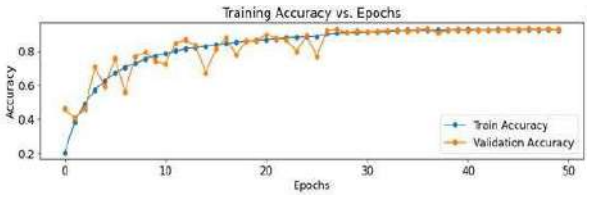

Fig7. Shows Epochs Vs Training Accuracy.

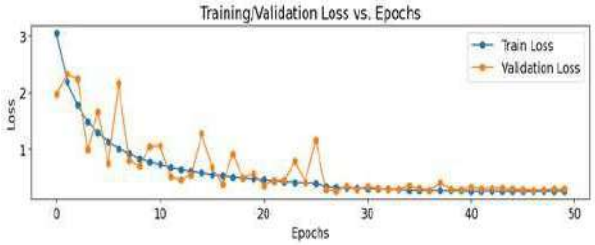

Fig8. Shows Epochs Vs Training/Validation Loss.

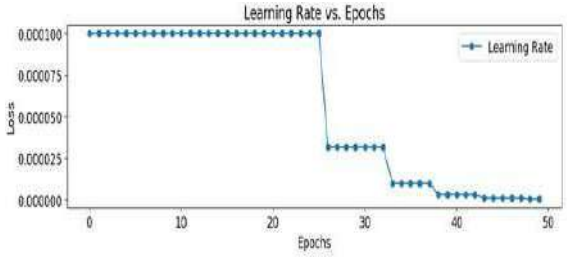

Fig9. Shows Epochs Vs Learning Rate.

6. CONCLUSION AND FUTURE SCOPE

The proposed CNN Model successfully Implemented to train the system. Initially Images are acquired from the dataset, these image undergoes preprocessing, feature extraction is done before the dataset is trained. Dataset is divided into training and testing dataset. Next the system, trained on a diverse dataset featuring 38 classes of diseased plant leaves and achieves 92% accuracy in identifying various plant diseases. Finally, CNN algorithm is integrated web application by uploading the test image in web application and displays the disease of the leaf along with remedy. By using this study in future we can make the web application mobile-responsive for accessibility.

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