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PLANT LEAF DISEASE DETECTIONUSING DEEP LEARNING

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Abstract- Agriculture is a very significant field for increasing population over the world to meet the basic needs of food. Meanwhile, nutrition and the world economy depend on the growth of grains and vegetables. Many farmers are cultivating in remote areas of the world with the lack of accurate knowledge and disease detection, however, they rely on manual observation on grains and vegetables, as a result, they are suffering from a great loss. Digital farming practices can be an interesting solution for easily and quickly detecting plant diseases. To address such issues, this paper proposes plants leaf disease detection and preventive measures technique in the agricultural field using image processing and two well-known convolutional neural network (CNN) models as AlexNet. Firstly, this technique is applied on Kaggle datasets of potato and tomato leaves to investigate the symptoms of unhealthy leaf. Then, the feature extraction and classification process are performed in dataset images to detect leaf diseases using AlexNet model with applying image processing. Finally, a graphical layout is also demonstrated to provide a preventive measures technique for the detected leaf diseases and to acquire a rich awareness about plant health.

1.INTRODUCTION

The huge population of the world depends on their large economy. As well as the economy growth plays an important role in the development of any country and their GDP. The impact of this economy depends entirely on agriculture. But, different factors of cultivation affect the quality and quantity of grains and vegetables. These grains and vegetables come in contact with different diseases due to different climates and conditions in different places. As a result, cultivators in any country face severe losses because of these diseases. For leaf disease, the amount of crop production is decreasing day by day. The main challenge is to identify the leaf disease in the agricultural field and to increase the quality and quantity of the production rate. First of all it is necessary to consider two crops leaf to identify disease. Tomato and potato can be considered as two important crops that are used in our daily food items and to replenish nutrients in human body. Any disease is naturally created which can have some serious effects on grains and vegetables, as well as it can ultimately reduce productivity, quality and quantity of products. So, proper classification and identification of leaf disease may be a key issue in agricultural erosion prevention. Different grains and vegetable leaves carry different diseases such as viral, fungal and bacterial. The most common plant diseases are Alternaria Alternata, Anthracnose, Bacterial Blight, Cercospora Leaf Spot, Powdery Mildew, Black mold, Downy Mildew and Rust. When the infection occurs on the plants leaf, the symptoms are exposed by the quality of texture, color, shape and size of plant leaf. Most of the symptoms are microscopic, so the identification of diseases is not possible due to the limited capabilities of human vision. However, it is necessary to develop a very efficient technique to detect disease symptoms using scientific knowledge and experience. Initially, the captured crops leaf images of tomato and potato are collected from Kaggle datasets for this paper. The images could be captured using a regular laptop camera or high resolution mobile phone camera.

Then, image processing is applied on the collected leaves of the tomato and potato. Various image processing techniques such as acquisition, preprocessing, restoring, segmentation, augmentation, feature extraction, classification are performed for detecting the plant diseases. In preprocessing phase, the color conversion technique is applied on RGB images which are converted into gray images. However, several contrast enhancement algorithm are used to increase the contrast of images after removing different types of noise. These images can be changed into aligned forms according to flipping, cropping and rotating ways of image augmentation technique and various properties such as portion, color information or boundaries are traced in the image. In addition, the classification algorithm can be applied on the color image section for disease recognition. In this paper, we use convolutional neural network (CNN) model such as AlexNet classify the healthy and unhealthy leaf images and recognize the various diseases of leaves. Besides, in the area of agriculture, many existing systems can detect some plant leaf diseases but provide no process of preventive measures. For this reason, this paper proposes a system that can detect diseases and also provide a preventive measure using the mechanism of graphical user interface. The following contributions are the main synopsis of proposed framework: Firstly, we perform image processing technique on leaf datasets for disease detection. Secondly, we classify the processed leaf images using AlexNet. Thirdly, this paper analyzes the overall leaf disease classification accuracy. Finally, we evaluate and develop the graphical layout for disease detection with preventive measures.

2. LITERATURE REVIEW: -

Paper by Saradhambal.G, Dhivya.R, Latha.S, R. Rajesh give solution to the plant disease with image classification. In their approach they collect 75 images of different diseased plant leaves such as Bacterial Blight and more. There were total of 5 classes that include 4 disease classes and one normal healthy leaf class. Removal of noise is done with some image preprocessing and then conversion into lab color model was done. They segmented the image with clustering and Otsu's method. After that some feature extraction is done on the basis of which class is determined. They have not discussed the accuracy that they have achieved as well as dataset was small [1].

Another paper named "Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm" clarifies that they have used CNN model for the leaf disease classification. In their methodology they have used a dataset of 500 images divided into 400 training and remaining 100 testing. Total classes for classification were 5 including one healthy class as well. Images size used was quite well that is 512*512. Three matrixes for R, G, B channels were used as input to CNN model and the output was feed into neural network known as LVQ (Learning Vector Quantization). Average accuracy of around 88 percent was achieved. Their proposed model was only for tomato related diseases [2].

"Plant Disease Classification Using Image Segmentation and SVM Techniques" by K. Elangovan, S. Nalini uses the svm for the classification purpose. In their methodology image was converted into another color space. After that image was cropped and with image preprocessing techniques noise was removed and smoothening was done and converted into 978-1-7281-2791-0/20/$31.00 c 2020 IEEE 480 greyscale images. Segmentation was also performed and then features were extracted. They considered color, morphology and texture as features and they were used for classification. They also does not mention about the accuracy of their suggested model [3].,

3. METHODOLOGY: -

The proposed framework depicts the concepts of proposed approach with leaf image collection. The leaf images of tomato and potato are taken from Kaggle dataset. Image processing techniques namely Image preprocessing, image augmentation, feature extraction, feature selection and classification are applied on leaf image dataset. Then it is designed a

supervised machine learning which trains the dataset image and extracts the data from it. This paper introduces a leaf diseases detection system using CNN architectures such as and AlexNet. Besides, it has also developed a preventive measures layout of leaf diseases. The proposed method controls the following procedures step by step to identify leaf diseases.

A. Leaf Image Dataset: - The role of quantitative or qualitative datasets is very essential to ensure the integrity of the research, the performances of field study or data preference. However, Leaf images for datasets can be collected by high resolution digital camera or smart camera. But, we have taken the leaf images of tomato and potato as samples from Kaggle dataset for our research performance analysis which contains healthy or unhealthy leaf images. The dataset contains over 4000 specimens of leaf images that are affected by four types of disease. These diseases are classified as Potato early blight, Potato late blight, Tomato early blight, Tomato late blight. In this dataset, there are also 2000 sample images of healthy leaf to construct the leaf disease classification and detection model.

B. Image Preprocessing: - The process of pre-processing technique transforms raw input leaf image datasets into desirable process datasets format to develop the quality of leaf images and to eliminate the undesired portions from the leaf images. These processes occur in various phases such as data cleaning, integration, reduction and transformation In the data cleaning phase, it eliminates the undesired distortion, manages the missing data and rectifies the inconsistent data. At the integration stage, multiple and heterogeneous data as well as data redundancy in leaf image datasets is an ordinarily encounter situation of data retrieval strategies which resolves multiple data conflicts and arranges a unified representation of data. A large size datasets increases the storing space size and computational difficulty due to the different feature dimensions. In the process of data reduction, a large volume of data is reduced to increase the performances and efficiency of image processing. The operations of data transformation perform the data smoothing, aggregation, feature construction, data normalization and discretization to inhibit the dependability of the attributes in the data assessment structures and units for data images conversion. These leaf image datasets are resized and converted into 256×256 dimension for training datasets and testing datasets analysis. So, pre-processing technique can provide preparing datasets to identify leaf diseases through the leaf image datasets.

C. Image Augmentation: - Image augmentation is involved for changing and facilitating of the leaf image representation to accurately identify leaf disease. Thus, the training and testing leaf image datasets are augmented to diminish the chance of over-fitting and to enrich the simplification of the model. The process of augmentation is applied to resize the original leaf image dataset using flipping, cropping and rotation techniques as well as to convert the leaf images into RGB using color transformation technique. However, the augmented leaf images are created to maintain the balanced quality and size of images in the healthy and unhealthy leaf datasets.

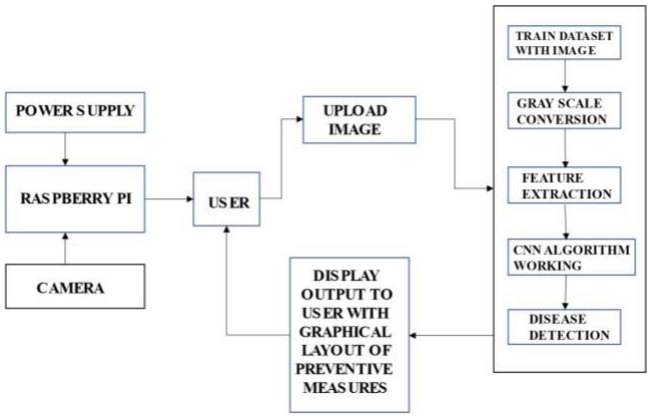
D. Feature Extraction: - Feature extraction is the very important phase of the image processing technique to provide a suitable platform and optimal constraints. The feature extractor of the CNN [19] based detection framework can extract the image feature vectors of the leaf disease. The feature extraction technique analyzes the properties of a leaf image such as color, shape and texture in a convenient way. So, this extraction technique is able to assist in proper classification of different leaf disease classes. For the leaf diseases, the feature extraction mechanism extracts the features of various lesion shapes and colors.

E. CNN Model: - The key purpose of this paper is to classify the leaf diseases from image datasets using convolutional neural network (CNN). The deep learning approache: AlexNet architectures are used to identify the various diseases in the tomato and potato leaves. Mainly, classification based CNN model in the image processing system involves with

trained data and tested data of leaf images to categorize the leaf diseases class. The disease class of four leaves with two healthy leaves of potato and tomato are shown In this paper, AlexNet pre-trained network models are performed to automatically classify the leaf images of potato and tomato plants in healthy, early blight and late blight disease classes. At first, AlexNet architectures is executed on 6000 different leaf images dataset to classify into two different classes such as healthy and unhealthy leaf images. There are 2000 healthy and 4000 unhealthy leaf images which are obtained from this dataset. Then, these architectures are applied on unhealthy leaf images to separate into four different disease classes such as potato early blight, potato late blight, tomato early blight and tomato late blight. Therefore, these techniques can detect leaf disease group from the leaf images of potato and tomato plants.

F. Graphical Layout of Preventive Measures: - After applying the leaf disease classification system, the user's graphical layout is designed in such a way that it can display the message of leaf disease and provide preventive measures for a rich awareness about plant health to farmer. Fig. 4 illustrates leaf disease detection and user preventive measures layout using AlexNet pre-trained network models for potato early blight, potato late blight, tomato early blight and tomato late blight.

4. BLOCKDIAGRAM



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