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Identification and Detection of Plant Diseases by Convolutional Neural Networks

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Abstract - Agribusiness is the foundation of Indian economy. Plant health and food safety goes hand in hand. The health of green plants is of vital importance to everyone.Plant* diseases *being an impairment to the normal state of a plant, it interrupts or modifies plants vital functions. The proposed system helps in identification of plant disease and provides remedies that can be used as a defense mechanism against the disease. The database obtained from the Internet is properly segregated and the different plant species are identified and are renamed to form a proper database then obtain test-database which consists of various plant diseases that are used for checking the accuracy and confidence level of the project .Then using training data we will train our classifier and then output will be predicted with optimum accuracy. We use Convolution Neural Network (CNN) which comprises of different layers are used for prediction.CNNs provide unparalleled performance in tasks related to the classification and detection of crop diseases. They are able to manage complex issues in difficult imaging conditions A prototype drone model is also designed which can be used for live coverage of large agricultural fields to which a high resolution camera is attached and will capture images of the plants which will act as input for the software, based of which the software will tell us whether the plant is healthy or not. With our code and training model we have achieved an accuracy level of 78%. Our software gives us the name of the plant species with its confidence level and also the remedy that can be taken as a cure.

Keywords -Convolution Neural Networks, Diseases, Feature Extraction, Agriculture, crops, Image Classification, object detection.

1. INTRODUCTION

Agriculture is the backbone of Indian economy. In India, around 70% of the population are dependent on agriculture. The recent betterment in information and communication technologies has allowed farmers to acquire a vast amount of site-specific data for the fields. The main activities involved are data collection, processing,

and variable rate of application of inputs. Plant health and food safety are closely related.Plant health is a frequently used but ill-defined term. Image processing can be described as a type of signal processing. In image processing, the input is applied in form of an image like a picture or video format. The output of image processing will be either an image or a suite of features or metrics in relevance of the given image. This approach is used to extract some valuable information from the raw images obtained from different places.

2. EXISTING SYSTEM

The digital images are acquired from the environment using a digital camera. Useful features are extracted from images using the techniques available in image processing for further analysis. After that, images are classified according to specific problem using analytical discriminating techniques. Fig.1 depicts the basic procedure of the proposed vision-based detection algorithm in this research. Ancient days crop disease identification process through the laboratory condition. However, this requires continuous monitoring of experts which might be prohibitively expensive in large farms. Existing learning techniques discussed

yields low precision rates, high dimensionality, identification of disease consumes more time. Initially the two images has been taken one for the healthy leaf other for the defected leaf. The second step of detection of plant diseases starts with the training process. In the training process, resizing of the healthy and defected image of rice leaf has been done. Then convert RGB to Gray scale image, because canny edge detection cannot be applied directly on RGB. Then apply stem, stairs, canny edge detection, surf, entropy, warp, images. This technique is applied on both the samples healthy as well as defected. Once the training process of first phase samples is finished, Comparison has been done on the basis of values obtained for all the parameters used.

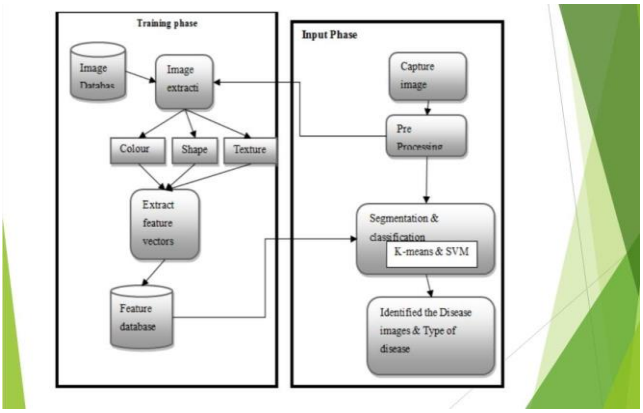


Fig.1.Architecture of Existing System

3. PROPOSED SYSTEM

These proposed works are more focus on Detection of disease on the Plant leaf using Android. First capture image from digital camera (mobile camera). Most probably the camera with some limitations and criteria will be considered. The captured image will be considered for further feature extraction, using one of the above algorithms.

There are many features of images that are to be extracted, but we in our proposed system are going to consider some of them. The below system architecture shows the actual work flow of the concept that we are working on. The main focus of this proposed work is to help the farmers, distress from loss due to imperfect information of a choice of diseases.

The concept should be more user-friendly so, it is focused on language translation too.Image processing is used to get helpful description that can prove important for additional process. With image processing, CNN convolutional neural network has been used.

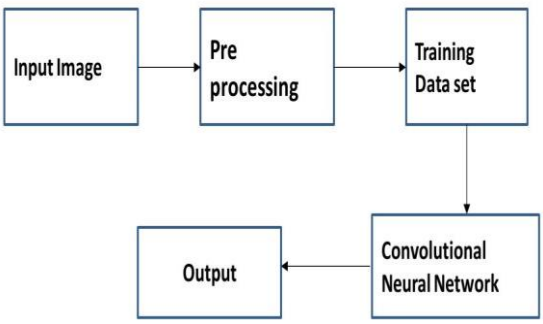


Fig.2.Block Diagram of Proposed system

4. DATASET & NETWORK FOR DISEASE DIAGNOSIS TRAINING

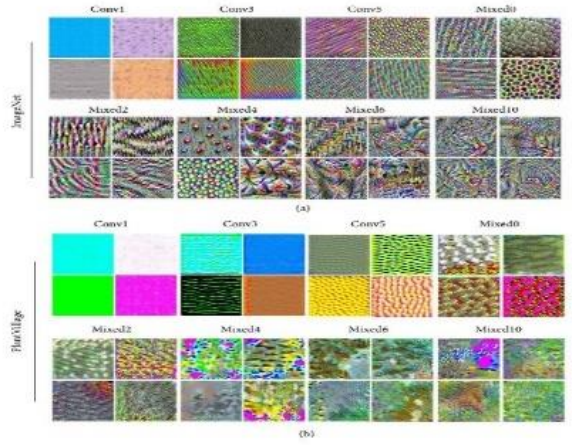
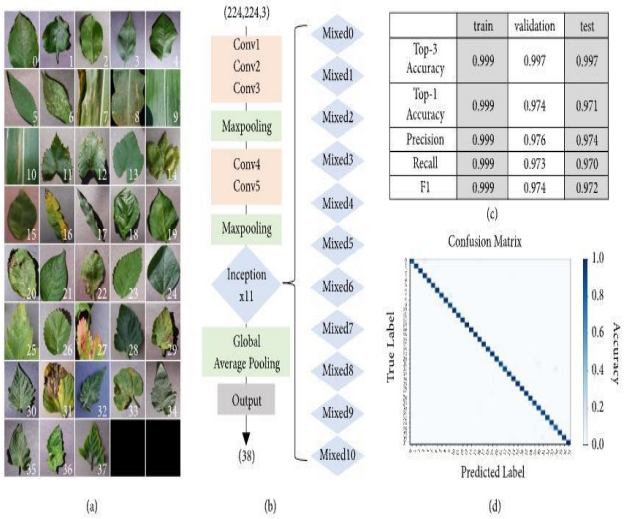


Fig. 3: Dataset for disease training

Images used in this report were adopted from the Plant Village dataset (https://github.com/spMohanty/PlantVillage-Dataset). This dataset comprises healthy or diseased leaf images classified into 38 labels (54,306 images, 26 diseases, 14 crop species) (Figure 4(a)). Images were split into training, validation, and test datasets with a ratio of 6:2:2. Using such images, we prepared a CNN based on InceptionV3 which receives a three-channel input image of 224 x 224 resolution and returns a 38-dimensional vector .This network architecturecomprises of repeated convolution blocks without any complex layers. For testing phase Network weights with the lowest validation loss (16th epoch) are used. The accuracy and loss values of the training, validation, and test datasets are summarized .The confusion matrix is used to indicate that there is no imbalanced accuracy in any class . This set of weights to interpret how the neural network has learned to diagnose the plant disease.

Training of CNN was performed using a Python library called Keras with Tensorflow backend [48], which is a deep learning framework. Pixel values of input images were divided by 255 so that they range within [0.0, 1.0]. The network was initialized with random weights.Adam optimization algorithm are used for optimizing network weights with a learning rate of 0.05.

For each iteration a set of 128 images (224 x 224) were fed to the network. In the experimental setup it took 3 to 4 minutes (single GPU; NVIDIA GTX 1080ti). After a successful training of the CNN, the feature extraction layers were optimized to capture specific features from the image for the diagnosis of the plant disease.



	train	validation	test
Top-3 Accuracy	0.999	0.997	0.997
Top-1 Accuracy	0.999	0.974	0.971
Precision	0.999	0.976	0.974
Recall	0.999	0.973	0.970
F1	0.999	0.974	0.972

Fig.4 : Training and Validation

5. CONCLUSION

The proposed system was developed taking in mind the benefits of the farmers and agricultural sector. The system developed will detect the plant disease and also suggest remedial action. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant.

The proposed system is based on Matlab and gives an accuracy of around 78%.As the main focus of this application is user-friendly, the application id designed in such a way that is supports Multi-Lingual concept. This application is helpful for farmer and laboratory where they are can easily protect their Plants and there will be increase in growth of production.

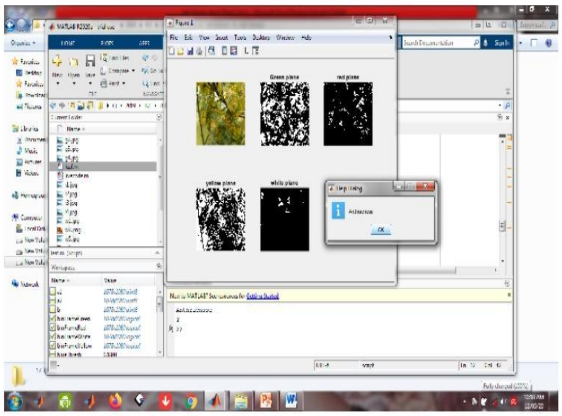


Fig.5 Simulation Results

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