DISEASE DETECTION AND EXPERT SYSTEM FOR FARMERS

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Abstract **—** The proposed system helps in identification of multiple plant diseases and provides remedies that can be used as a defense mechanism against the multiple diseases with help of expert system for farmers. Our paper covering the work on multiple plant diseases detection on different plants and fruits, and present an expert system based on important criteria of agriculture. Various options of web portals, mobile applications need to be explored to enhance the effectiveness of the traditional approaches of extensive education on agriculture. Our expert system helps farmers to communicate with Experts in agriculture industry in their own space. In this paper we have also described the development of an application feature that gives users or farmers the capability to identifying the multiple crop leaf diseases based on the photographs of plant leaf with help of application.

Keywords— CNN (Convolutional Neural Network), Plant Disease, Deep learning, Test database, Expert system.

I. INTRODUCTION

India is an agricultural country and the position of any country in the world depends on its agricultural production. In India the farmers have wide variety to select their plant for cultivation to produce maximum yield depending on environment available. Then also the farms gets affected by diseases of the crop. The diseases of the plant are caused by pathogens, insufficiency of nutrients, fungus etc. Detecting diseases at early stages facilitates to overcome it and treat it appropriately. For this an expert is required for identifying the disease, describe the method of treatment and protection. Identifying the plant disease is not easy task. It requires knowledge of plants and their diseases. It also requires correct result in describing the symptoms of plant diseases. A person can depend on an expert which has experience and knowledge. An expert system can be: Agricultural advisor, excellent farmers and Electronic or Computerized expert system.

If farmers decide to take advice from expert regarding the treatment of incidence of pest /disease/plant in order to increase the crop productivity then he may face following situations: Sometimes they have to go long distances for approaching the expert. Expert may not be present at that time even though they go long distances. Sometimes, the expert whom a farmer contacts, may not be present in that location to give opinion to the farmer with the information and knowledge. In this quest the expert advice is very costly and time consuming. Electronic

Expert systems facilitates farmers in identifying type of diseases for selecting the proper treatment. The expert systems are smart computer programs that are capable of serving solutions or suggestion related to specific problems in given area. One of the advantages of using Electronic expert systems is its capability to reduce the information that users need to process, reduce personnel costs and increase throughput. Expert system performs work more consistently than human experts. Many MNCs are investing hugely in using technology in agriculture. Artificial Intelligence, Machine learning, Deep learning and IOT technologies are adopted by start-ups and tech companies to boost the crop yield. Here we present a technology called Deep Learning algorithms for disease identification in the crops.

The Primary objective of the research are: a primary objective to design and develop such a technique which will focus on mobile farming technology to solve the various limitations of agriculture.

The Major objectives of the research are: 1. To construct a database to store disease information. **2.** To find out the affected crop based on disease infected crop images using deep CNN**.**

II. LITERATURE SURVEY

To assess farmers' awareness levels on agricultural production along with their knowledge gaps for developing effective extension education strategies to promote synergies between agricultural production and natural resource conservation survey was conducted. [2].

A survey was carried out using a structured questionnaire by applying both qualitative and quantitative methods of data collection and analysis. The questionnaire assessed characteristics, cropping pattern, awareness and sources of information on use of inputs, perceptions about adverse impacts on agriculture, problems faced in farming by the farmers and information on progressive technologies/ practices.

According to taken survey in 11districts across five agro-ecological zones of north-western India. The survey was conducted according to usage by percentages and means to facilitate the description of farmers' awareness on seeds, seed treatment, methods of sowing, fertilizer use, use of machinery-use, marketing, agro-chemicals& others and perceptions about impacts of intensive agriculture such as groundwater depletion, decline in drinking water, soil quality, micronutrient deficiency, deterioration in air quality, water-logging, toxic residues in food and identification of problems faced by them in farming. Because of these problems we need expert system for farmers and agricultural purpose.

III. PROPOSED SYSTEM MODEL

In this paper we have described the development of an application feature that gives users or farmers the capability to identify the multiple crop leaf diseases based on the photographs of plant leaves taken from an application. The leaf provides the most important information or data which provides us to know which type of crop it is and which type of disease is infected on that leaf. The crop play an important role in the

biological field. Detecting multiple diseases on leaf of ,multiple types of crops crop at early stages gives strength to overcome it and treat it appropriately by providing the details to the farmer that which prevention action should be taken.The proposed system Disease Detection Management model is based CNN to create an web application. The developmental approach of the proposed system includes two modules:

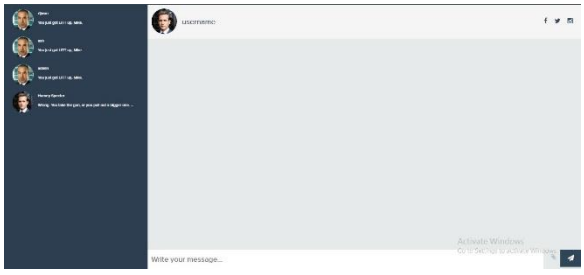
- **Disease Identification:**

  This module will have identification system for disease affected crop. Local user will have access to disease detection system.

User will have to upload image of leaf to check if it has any disease on it.

- **Expert system :**

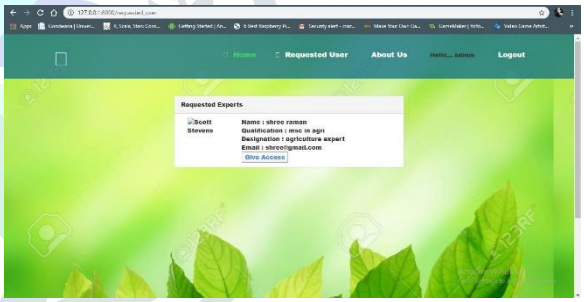
  Remedial measure for disease Identification with help of Chat with experts in this application. Local user and expert user both will have access to chat option to interact with each other.



Expert will also have option to post information about any particular disease or technology according to their will.

Local users can see those posts from their home page with detailed information about who uploaded that post with what cause on this web application.

. Whenever any expert registers it has to be authenticated and authorized for security purpose to avoid the wrong use of this application. So, in this web application admin will authenticate and authorize the expert and give them access to use this web application by logging in it.



In such way, with help of this web application local user and expert user will be able to use disease detection and expert system to interact with each other and spread awareness in agriculture field.

3.1. Crop Disease Identification and Expert System

The multiple disease identification process is implemented with the help of application. It is a four step process namely: 1) Image selection 2) Image zoom and crop, 3) Upload image and 4) Disease detail.

Image selection: Multiple snapshots are to be taken for choosing the appropriate affected area. A clear image has to be choose such that the disease affected areas are clearly visible. In case of same crop issue, choose images from the database which was created earlier.

Image Zoom and crop: Choose the best portion of the disease affected image and crop it.

Upload Image: Cropped image is to be uploaded in the remote server using the application.

Disease detail: Once image has been uploaded in the remote server, pattern matching is performed with the available datasets using pattern matching algorithm, and will get direct detail of disease on application. User can chat with Expert for further solutions.

The input test image is acquired and preprocessed in the next stage and then it is converted into array form for comparison. The selected database is properly preprocessed and then renamed into proper folders. The model is properly trained using CNN and then classification takes place on it. The comparison of the test image and the trained model take place with help by the display of the result. If there is a disease on the plant the software displays the disease.

3.2. Preprocessing and Training the model (CNN): .we can collect the images to create our own database. The database is preprocessed such as Image reshaping, resizing and conversion to an array form. Similar processing has to be done on the test image. A database consisting of about 41 different type of crops species and every species has larger amount of images in database. Out of which any image can be used as a test image for the software. The train database is used to train the model (CNN) so that it can identify the test image and the disease it has .CNN has different layers that are Dense, Dropout, Activation, Flatten, Convolution2D, and MaxPooling2D. After the model is trained successfully , the software can identify the disease if the plant species is contained in the database. After successful training and preprocessing comparison of the test image and trained model takes place to predict the disease. Database collection: Initial step for any image processing based project is acquiring proper database which is valid .we can collect the images and can form our own database. The database is accessed from crowd-AI which is plant disease classification challenge. Data available here is not labeled .So the first task is to clean and label the database. There is a huge database so basically the images with better resolution and angle are selected for database. After selection of images we should have deep knowledge about the different leaves and the disease they have. Huge research is done from plant village organization repository. Different types of plant images are studied. After detail study, labeling in done by segregating the images and with different diseases.

Convolutional neural network comprise of convolutional layers, which are sets of image filters convoluted to images or feature maps, along with other (e.g., pooling) layers. In image classification, features are extracted through convolution and other processing layers repetitively. Given a training dataset, CNN, unlike traditional machine learning techniques that use *hand-crafted* features, optimizes the weights and filter parameters in the hidden layers to generate features suitable to solve the classification problem.

3.2. Method

We can create our own database to classify plant diseases by large collection of the plant's leaf images which is required. In this section the methodology followed is discussed in detail. Proper and large dataset is required for all classification research during the training and the testing phase. The dataset for the experiment is downloaded from the Plant-Village database which contains different plant leaf images and their labels. It contains a collection of 17,015 images taken at different environment. A dataset containing 41 types of crops leaf images .every type of crop consist of 415 images of leafs including healthy leaves is downloaded. Let's take example of soybean leaf which is one of the crops in our database.

Figure 1: Sample images from the own database are: a) healthy leaf image taken under a constant background b) healthy leaf image taken under uncontrolled environment. Leaf images from a plant are affected by as follows: c) septorial leaf blight d) frogeye leaf spot e) downy mildew.

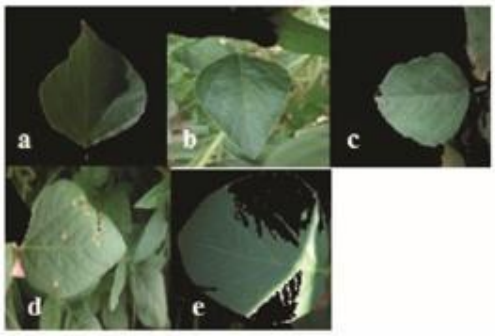


Figure 2: Sample segmented images resized are as follows: a) healthy leaf image taken under a constant background. b) Healthy leaf image taken in uncontrolled environment. Leaf images from a plant affected are as follows: c) septoria leaf blight d) frogeye leaf spot e) downy mildew. Few samples from the database are shown in figure (1). To prepare the dataset for the training and the images originally at different resolution are re-sized to 128x128 pixels. For testing, the experiment was also performed using the grayscale and the segmented version of the own database. Sample images of the gray and segmented leaf images has been shown in figure (3) and figure (2).[3]

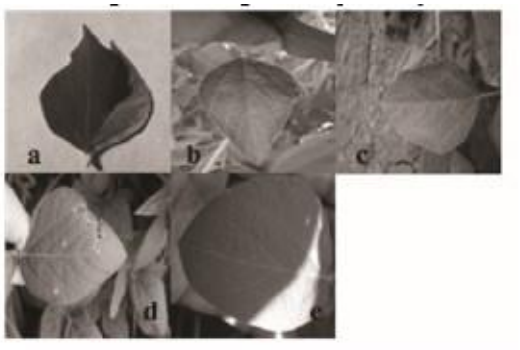


Figure 3: Sample grayscale images are: a) healthy leaf image taken under a constant background b) healthy leaf image taken in uncontrolled environment. Leaf images from a plant affected: c) septoria leaf blight d) frogeye leaf spot e) downy mildew.

Using this method, we can train database with help of collection of images and the database will be used for training the model (Convolutional neural network).

VI. CONCLUSION & FUTURE WORK

The system was developed taking in mind the benefits of the farmers and agricultural sector .The system can detect disease in plant and also provide the remedy that can be taken against the disease. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant. In future, we can create a disease detection system for animals too. And can have information portals and direct access to experts can be made available with chatting or direct calling for animal husbandry the proposed system is based on python. In this study convolutional neural network is used to detect and classify plant diseases. The Network is trained using the images taken in the natural environment and achieved 99.32% classification ability. This shows the ability of CNN to extract important features in the natural environment which is required for plant disease classification. Which used the images taken in the wild environment and achieve the proposed system is based on python.

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