COTTON CROP MONITORING SYSTEM USING CNN

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Abstract-The huge number of individuals relies upon cotton crop. The identification of cotton leaf disease and cotton boll disease are necessary because these diseases ruin the quality and yield production. The proposed work facilitates the development for classification of disease in cotton leaf, cotton stages and weed using images. A deep learning approach using different convolution neural network model is employed to classify cotton leaf disease, cotton stages and weed in cotton with high accuracy. Here VGG16 CNN, RESNET50 model is trained using 3000 samples

Keywords – Cotton, Convolution Neural Network, VGG16, RESNET50

I. INTRODUCTION

Agriculture is one of the most prime occupations of India. Cotton known as “White Gold” could be a major agricultural crop in India and plays a dominant role within the industrial and agricultural economy of the country. Cotton in Republic of India provides direct livelihood to six million farmers and regarding forty-fifty million folks square measure utilized in cotton trade and its process. Indian cotton cultivation is additionally riddled with many attended doubts relating to crop cultivation, protection, picking, transportation and storehouses. In recent days, huge amount of loss in quality and quantity of cotton yield due to different diseases affecting the plant. Disease classification could be a vital step, which may be helpful in early detection of insects, controlling of diseases, increase in productivity etc. Early disease detection will assist the control of disease through correct management approaches such as spraying of pesticide, fungicide etc., which will improve production. Employing people in cotton disease classification task in quiet laborious and time consuming. Here, an automatic cotton disease classification technique and cotton stages using the idea of convolution neural network (CNN) is proposed.

II. RELATED WORKS

In recent year, limited number of works has been done related to cotton disease classification, cotton stage identification using deep learning models.

Namrata R.Bhimte, V.R.Thool [1] established image processing approaches for automatic detection of cotton leaf spot disease. Classification, feature extractions like colour, texture of image using SVM classifier and various preprocessing steps were done and colour based segmentation is used to obtain the segmented part of leaf spot disease.
S.Batmavady, S.Samundeeswari [2] focused on applying image processing and neural network techniques to identify the diseased cotton leaf. The leaf images are taken from village plant dataset. Segmentation is done using FCM techniques and classification is done by RBF Neural network.

S. Supriya et al [3] surveyed cotton leaf disease detection technique. Red spot disease, White spot disease, Crumple leaf diseases are taken as references. Many techniques like f-means clustering, neural network, Median filter; Otsu thresholding, Active contour model etc are reviewed.

Patil Tushar et al [4] established IOT application using image processing steps like image acquisition, image preprocessing, image segmentation, feature extraction and classification of plant disease. These steps are all performed by Net beans. After completion of each of the above phase, Waterfall model is used to check the project.

S.Vijay et al [5] analyzed the cotton leaf disease and applied the image enhancement and k means clustering techniques. Image processing technique is easy and accurately for leaf disease.

CNN can learn appropriate features by them automatically, which leads to good object recognition and classification accuracy. Hence CNN model is employed for cotton leaf, cotton ball disease detection and cotton stage classification. The rest of the papers are organized as follows, Section III describes the methodologies, Section V includes the dataset preparation, Section V includes the implementation steps and Section VI describes the result and discussion. Scope for further research in this work is detailed in the final section.

III. METHODOLOGY

In this work, a multilayered VGG16 CNN model is used. It has 16-19 hidden layers. It is a simple network having only3×3 convolutional layers stacked on top of each other in increasing depth. Reducing volume size is handled by max pooling. Two fully-connected layers, each with 4,096 nodes are then followed by a softmax classifier. Another model RESNET-50 is used to classify the cotton crop images. Skip connection named as residual block are used in the model. It is used to avoid vanishing gradient problems and dead neurons. Residual block is also used to increase the number hidden layers from previous models without worrying about vanishing gradient problems. RESNET-50 has 23 million parameters to learn.

Fig 1: Basic Layers of CNN

Basic operation of CNN layers are Convolution which consists of the following three basic operations in which, input image is detected first then the second process is feature detection; here the input image is converted into a
feature matrix. Here, feature detection is also called as filtering. The filter is usually 3 x 3 and could also be 7 x 7. Third process is the application of activation function, which is used to reduce the size of an image and image detection is to be unique to identify the specific object or to detect the location of disease in the cotton image. ReLU layer is used as the third layer to increase non-linearity in CNN. Pooling layer becomes fourth layer, which enables the CNN to detect various image features irrespective of lighting difference and angle of a diseased image. It helps to reduce the over fitting problem in CNN. Flattened layer become fifth layer and it is used to transform Pooling feature map into single column. Fully connected layer become sixth layer. Softmax function is used to obtain the output class.

IV. DATASET PREPARATION

Real time images are taken from kudipatti cotton farms, Madurai district. In the database have cercospora leaf spot, fusarium wilt, verticillium wilt, and cotton boll rot, bacteria blight disease images. Cotton stages like flower stage, cotton boll, matured cotton images and barnyard grass, lambs quarters weed images are captured using realme 2 bro phone camera.

V. IMPLEMENTATION

Implementation steps used in Google colab (Google colaboratory) is described below

5.1 Data set collection
5.2 Uploading the dataset into drive
5.3 Accessing colab
5.4 Mounting drive in Google colab
5.5 Coding implementation, testing and training.

5.1. Data set collection-

Real time images are collected using web camera and stored in database. Stored database images are converted into test images and train images.

5.2. Uploading the Dataset into Drive-
In the Google drive, the upload folder option is used to upload the test and train dataset which are named as test cotton and train cotton.

5.3. Accessing Colab-
- First, sign in the Google accounts.
- And proceed to the Google colab welcome page.
- Click on the newpython3 notebook option to start the session fresh.
- Select runtime menu option or notebook option to select GPU.
- Configure notebook instance, to download the necessary packages.

5.4. Mount Drive in Google Colab-
Click on mount drive option, an authorization code is generated and it is entered in Google drive, which generates the image folder path

5.5. Code Implementation, Test and Train-

Python coding implementation based on different CNN model like VGG16 and RESNET50. We should train the above CNN model and test the images to get better accuracy and get the predicted disease.
VI. RESULT AND DISCUSSION

The trained VGG16 and RESNET50 model is tested with different cotton disease; cotton stage and cotton weed image dataset. Parameters like accuracy value, loss value, ETA (Estimated time of arrival value) are computed. Diseases like cercospora leaf spot, fusarium wilt, verticillium wilt, and cotton boll rot, bacteria blight are recognized. Cotton stages like flower stage, cotton boll, matured cotton and barnyard grass, lambs quarters weed are also recognized.

One Epoch is defined as the total of all images processed one time forward and backward individually in the convolution neural network. Epoch are used once to update the weights

\[
one \text{epoch} = \frac{\text{number of iteration} \times \text{batch size}}{\text{total number of images in training}} \quad (1)
\]

Fig2: Mounting drive in Google colab

Figure 2 shows the mount drive option to get all the folders and files in the Google drive

Fig3: Epoch calculation
Fig 4: Performance measure of VGG16 & RESNET 50

6.1. USING VGG 16 MODEL AND RESNET50 MODEL-

Fig 5: Cercospora disease is confirmed

Fig 6: Fusarium wilt disease is confirmed
Fig 7: Verticillum wilt disease is confirmed

Fig 8: Barnyard grass is confirmed

Fig 9: Lambquaters grass is confirmed
6.2. USING RESNET50 MODEL:

Fig 10: Cotton is confirmed

Fig 11: Barnyard grass is confirmed

Fig 12: Cercospora disease is confirmed
Fig 13: Flower stage in cotton is confirmed

Fig 14: Cotton boll is confirmed

Fig 15: Matured cotton is confirmed
Table 1: Comparison table of VGG16 and RESNET50

<table>
<thead>
<tr>
<th></th>
<th>VGG16</th>
<th>RESNET50</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAYERS</td>
<td>16 LAYERS</td>
<td>50 LAYERS</td>
</tr>
<tr>
<td>ETA/EPOCH</td>
<td>26s/25</td>
<td>40s/25</td>
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<tr>
<td>ACCURACY</td>
<td>92.5%</td>
<td>96.2%</td>
</tr>
<tr>
<td>LOSS</td>
<td>0.72</td>
<td>0.43</td>
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<tr>
<td>OPTIMIZER</td>
<td>RMSPROP</td>
<td>SGD(lr=0.0001,momentum=0.9)</td>
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<td>CATEGORIAL_CROSSENTROPY</td>
</tr>
<tr>
<td>METRICS</td>
<td>ACCURACY</td>
<td>ACCURACY</td>
</tr>
</tbody>
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Table 1 show the comparison features of VGG16 and RESNET50 like layers, accuracy, loss and so on

VII. CONCLUSION

Pre trained VGG16 and RESNET50 model is used to identify the cotton leaf disease, cotton stage and weed in cotton with improved accuracy. RESNET50 has better performance compared to VGG 16. In future the same network can be trained with additional diseases in cotton, dataset count will be increased and the model will be implemented in FPGA in real time and its performance will be studied for continuous monitoring and detection in cotton farms.

REFERENCES


