Computer Vision (CS-301)

Semester Project

Course Instructor:	**Mam Qurat ul ain**
Project Title	**Cotton Disease Detection Using OpenCV**
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Introduction

Cotton is one of the most important fiber crops which is used as raw material in textile industries. But now-a-days cotton is facing number of problems related to the healthy growth of crop due to diseases. These diseases are reducing the productivity of cotton crop and farmers are getting suffered financially due to this crop loss. Agriculture is an important source of livelihood where 65% population is dependent on it. The crop loss due to disease is increasing day by day which effects on the quality and productivity of crop. As diseases on the crop are certain, the early disease detection of the crop plays major role to control the loss in agriculture. In the proposed disease detection system, the work is carried out on cotton leaves. Initially the infected region is captured and pre-processed. During segmentation, leaf as well as diseased part is segmented using thresholding clustering method. Finally, classification technique is used for detecting the diseases with the help of Deep Learning Convolutional Neural Network

Statement of the Problem

Detecting these diseases with bare eyes increased the complexity of cotton crops productivity which decreased the accuracy in identification precision. Even an expert would fail to assess and diagnose the diseases with their bare eyes.

The researchers forwarded the following research questions with consideration of the issues cited in the statement of problems:

1. What is the suitable technique used for diagnosing cotton disease and pests?
2. How to develop an automatic cotton disease and pests diagnosis system?
3. How to determine the acquisition of the model?

Deep learning incorporates image processing and data analysis as a path for more possible findings. As it has been a successful application, it has now entered the domain of agriculture. Today, several deep learning-based computer vision applications such as CNN (convolutional neural network), RNN (recurrent neural network), DBN (deep belief network), and DBM (deep Boltzmann Machine) are performing tasks with high accuracy. However, the most prominent application for this research work is CNN

Scope and Limitation of the Study

This research study focused on developing an identification model for cotton leaf diseases and pests using deep learning technique called convolutional neural networking.

Three common types of disease and pests such as

- Bacterial Blight
- Leaf Miner
- Spider mite

They have been affecting cotton productivity and quality. Also, the model applied made a supervised learning technique on datasets with four prime feature extraction process and 2400 datasets. The datasets are limited to four different feature descriptors.

Taking into consideration the time constraints and reach of the regions that grow cotton, the research focused in the southern part of Ethiopia such as Arba Minch, Shele, and Woyto. MelkaWorer agricultural research center was also proposed as a focus area because it is responsible for cotton farms in SNNPR. Deep learning techniques were used to perform the automatic feature eradication from the different input datasets.

Data Collection and Sampling Technique

We used purposive or judgmental sampling techniques, selecting three infected and a healthy sample from the population, which is nonprobabilistic. During data collection, 2400 images of data are captured and distributed into four equal classes such as bacterial blight, healthy, leaf miner, and spider mite used to train with balanced dataset

Bacterial Blight

Leaf Miner

Spider mite

Software Requirement

- Python == 3.7.7
- TensorFlow == 2.1.0
- Keras == 2.4.3
- NumPy == 1.18.5
- Flask == 1.1.2

Advantages

- Low complexity and better features discrimination
- Better classification accuracy

Applications

- Computer vision
- Agricultural field

Design and OPERATION

Step 1: Image Acquisition

This is the very first step for the proposed disease detection system. In this step, the database images of cotton leaves are collected to process on it. These database images are captured through the high-resolution camera and stored in jpg format.

Step 2: Image Pre-processing (Resize Image 224x224)

The collected database is then processed through the computer system for pre-processing. Captured images stored in RGB format are then cropped and resized to some standard size. Image processing in agricultural applications consist of three

- Image enhancement
- Image feature extraction and
- Image feature classification

Step 3 Image Segmentation

The leaf spot in the captured image generally contains reflection from source, which forms some intense spot in the Cotton leaf, but pixel value within the cotton leaf is over a particular threshold then it is replaced by the pixel value of some neighborhood pixel.

Step 4 Image Enhancement

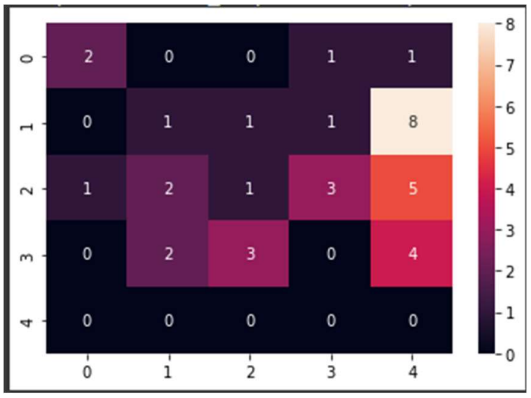
The image enhancement of normalized image has been carried out due to reasons of low contract, background Illumination, and non-uniform brightness. This type of problem can be overcome by the removal of background Illumination in order to get a good, distributed texture image.

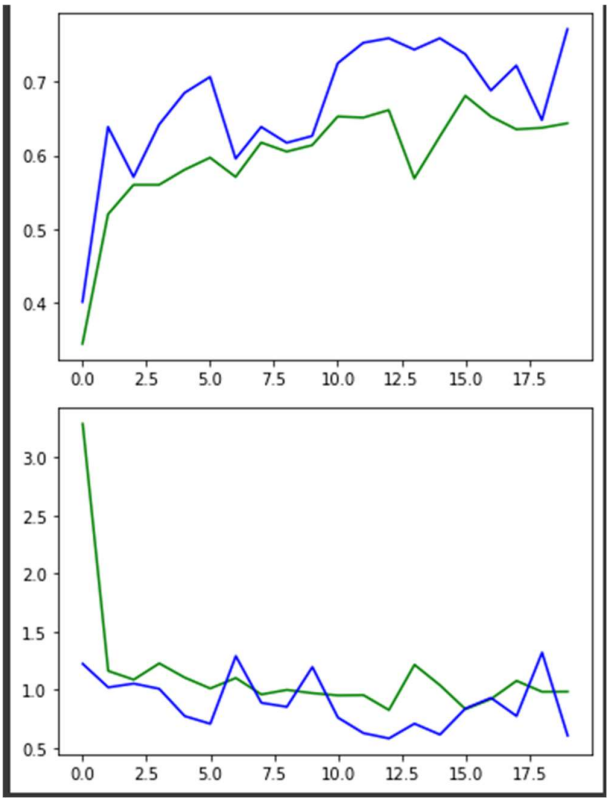
Step 5 Feature Extraction

In this, color feature variance is used for matching the train image features to database images.

Step 6 Classification

Instance-based classifiers, such as the k-mean classifier operate on the premises that arrangement of unknown instances can be done by concerning the unknown to the known considering to some distance/match function. The instinct is that 2 instances distant separately in the instance space defined by the appropriate distance function are less probable than 2 closely located instances to belong to the similar class. The objective of the k-mean clustering algorithm is to use a database in which the data points are separated into several separate classes to predict the classification of a new sample point. The non-parametric k-mean classifier is tested in this study. It classifies a test sample to a class according to most of the training neighbors in the feature space by using the minimum Euclidean distance criterion.





The Architecture of CNN for the Model

CNN architecture consists of two broad sections such as feature learning and classification section. In general, the cotton images feed into an input layer and end with an output layer. The hidden layer consists of different layers.

Here, a cotton leaf and the output will be the class name of such an image also called the label of cotton leaf diseases or pests. In general, for this proposed architecture, each cotton leaf images with addition of neurons are augmented with considerable weights. Output of the augmentation process to the upcoming layers are processed and duplicated to next layer. Output layers show the prediction tasks for calculating neurons for this research

Conclusion

This deep learning-based model was implemented using Python and Keras package, and OpenCV was used as a development environment. Different experiments have been undergone in this research study to get an efficient model by customizing various parameters such as dataset color, number of epochs, augmentation, and regularization methods. RGB-colored image dataset with augmentation provided 15% best performance for the model. The numbers of epoch and regularization methods are very significant to boost the model performance by 10% and 5.2%, respectively. The proposed prototype has achieved the highest efficiency of 96.4% for identifying each class of leaf disease and pests in cotton plants. Developments of such automated systems are used to assist the farmers and experts to identify cotton disease and pests by leaf visual symptoms. Obtained results evidence that the designed system for the farmers is much helpful to reduce the complexity, time, and cost of diagnosing the leaves from any diseases.