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Effective pomegranate plant leaf disease detection using deep learning

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Abstract
Pomegranate may be a fruit that grows with an awfully high yield in many nations of Asian countries and one in every one of the foremost profits gaining fruit within the market. However, because of numerous conditions, the plants are infected by numerous diseases that destroy the complete crop departure terribly less product yield. So, the work proposes a picture process and neural network strategies to agitate the most problems with Phytopathology, i.e. detection and classification of wellness. Pomegranate fruit is also attributed to the fact that.
That leafs are affected by disease caused by plants and weather. These diseases are like blight microorganism, plant spots, seed places rot and leaf spot. The system uses some pictures for coaching, some for testing functions, and so on. The colour picture is pre-processing and endures k-means clustering segmentation. The feel options are extracted victimization the GLCM technique and given to the factitious neural network. The general accuracy of this technique is ninetieth. The results are well-tried to be correct and satisfactory in distinction to manual grading and hopefully, take a powerful rise in establishing itself within the market jointly of the foremost economical processes.

Keywords: microorganism, accuracy, GLCM, classification, detection

1. Introduction
Numerous trends have emerged in the horticultural sector in the past few years and become a good source of income Generation. Age. Varieties of the fruit are exported all over the world with the growth of cold storage and transport facilities. It is important to maintain required quality of export quality, which is mostly carried out by the visual inspection by exports this is expensive and time-consuming due to the geographic location of the farms. Precision Agriculture helps farmers to equip oneself with sufficient and economic information and control technology due to development and exposure in various fields. The objectives are the rise in profits, the systematization of agricultural inputs and the reduction of environmental damage [3, 7]. Pomegranate (*Punica granatum*) is a deciduous tree grown in arid and semi-arid regions [13]. It grows well in areas with temperatures ranging from 25-35 degrees and an annual rainfall of 500-800 mm. In recent years, diseases have resulted in huge losses in pomegranate produced. These diseases are usually caused by micro-organisms like fungi, bacteria, and viruses.
The major diseases are Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. These diseases are very severe and destroy orchards. The business of fruits indeed belongs in the high-risk category [5]. An intelligent decision support system uses some high-tech and practical technology to appropriately detect and diagnose the plant diseases for the prevention and control of plant diseases [11]. Anand Singh Jalal *et al*. [3] used Complete Local Binary Pattern (CLBP) for Apple fruit disease detection. Their proposed approach comprises of k-means clustering algorithm for feature extraction and images were classified using a Multiclass support vector machine. DaeGwan Kim *et al*. [5] classified the grapefruit peel diseases using color-texture feature analysis. The Spatial Gray level Dependence Matrix (SGDM) is used for extracting texture features while the HSI model is used for color. The HSI texture feature model gives better accuracy, so it becomes the robust model for classifying the fruits according to the peel conditions. Tejal Deshpande *et al*. [4] used the Grading System built by Machine Vision useful for the identification of grading of pomegranate plant diseases. In section IV. Section V concludes the paper.

2. Related works
Machine learning may be a machine manner of detection patterns in an exceedingly given

dataset so as to create inferences in another, similar dataset [5]. A classical textbook example is that the machine recognition of handwriting like communicating addresses on envelopes. In recent years, the generic visual perception has created tremendous advances and is currently approaching human accuracy. Within the paper, author Mrunalini represents the technique to classify and establish the various diseases through which plants area unit affected. Within the Indian Economy [7], a Machine learning-based recognition system can sway be terribly helpful as it saves efforts, money, and time too. The approach given during this for feature set extraction is that the color co-occurrence method. For automatic detection of diseases in leaves, the neural networks area unit used. The approach projected will significantly support a correct detection of the leaf, and appears to be a very important approach, just in case of steam, and root diseases, swing fewer efforts in computation. In paper they incorporated all the hybrid options of a leaf color, texture form (geometric feature) by the individual methodology. Plant Village: a tool for crop health; an internet platform dedicated to crop health and crop diseases, referred to as Plant Village [8]. The content has been written by plant pathology consultants; reflective data is sourced from the scientific literature.

3. Proposed system

To reduce this loss of the crops production we present one android app that recognizes and identifies the symptoms of plant-leaf diseases. Our app works on plants that are infected with any fungal disease, viruses, and classifies plant diseases by using Deep Learning techniques. This defines the particular type of disease and accounts for its prevention steps and recovery. Notations are displayed by using CNN. And finally, we get information regarding that disease its symptoms, its preventive mechanism and recovery suggestions in a more economical way.

Algorithms

In our previous work, we developed a CNN model, which achieved accuracy greater than 93% for 15 different plant types. This study will investigate the model in more detail. Once images are read, 256x256 pixel random parts of the images are extracted and noise, distortion, flip, or rotation transforms are applied. By controlling stride lengths (spacing interval for placement of the filters/masks), dimensions of masks, multiple convolutions, and pooling steps are applied. Pooling involves the application of a mask to each pixel and then selecting a single value (eg. maximum) from with the mask

Experimental and technical design

To unveil the characteristics of visual image approaches for CNNs for disease designation, we tend to adopted numerous ways on a trained CNN model employing a plant disease dataset. We tend to compared four classes of visual image ways, (I) hidden layer output visual image, (II) feature visual image, (III) linguistics wordbook, and (IV) attention map

Dataset and network for disease diagnosis training

This dataset includes healthy or pathologic leaf pictures classified into thirty eight labels (54, 306 images, twenty six diseases, fourteen crop species, pictures were split into coaching, validation, and take a look at datasets with a magnitude relation of 6:2:2. victimization such pictures, we tend to ready a CNN supported InceptionV3 that receives a three-channel input image of 224 x 224 resolution and returns a 38-dimensional vector. We tend to selected this specification as a result of it's comprised of repetition convolution blocks while not advanced layers like residual connections which will build the interpretation of the intermediate layers tough.

Visualization: hidden layer output visualization

We 1st used one in any of the naivest ways to identify the learned options and remove the hidden layer output (i.e. intermediate output); we tend to pass an image to CNN and avoid the layer of interest calculation. Since the extraction layer of a feature passes only the positive values to the continuous layer as a consequence of our network, the corrected linear layer is applied Measurement (ReLU) Activation operates, simply visualizing the intermediate outputs will give a rough implementation of 'Which part of the image was vital to the inference. As regards implementation, the connected work [6] specifically targeted at the output of the primary convolution layer,

4. Results and discussions

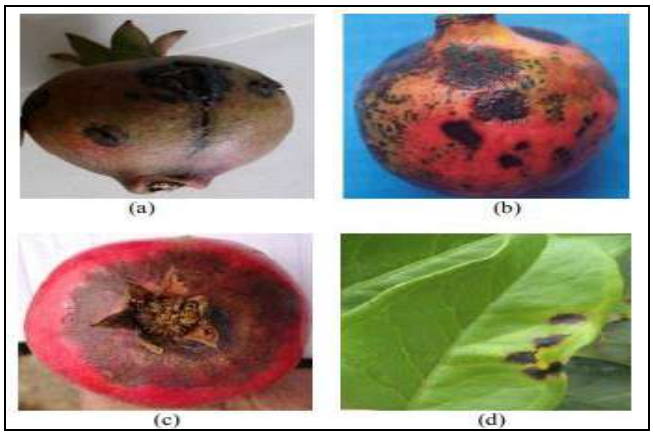

Fig 1: Sample Images of pomegranate plant leaf which consists of disease symptoms showing in image.

Here in the above Fig 1 we collecting the pomegranate plant leaf for testing purpose that the leaf is suffering from the disease or not.

Fig 2: Input Image to classify the disease.

Here in the above Fig 2 we taking a single sample image for testing purpose.

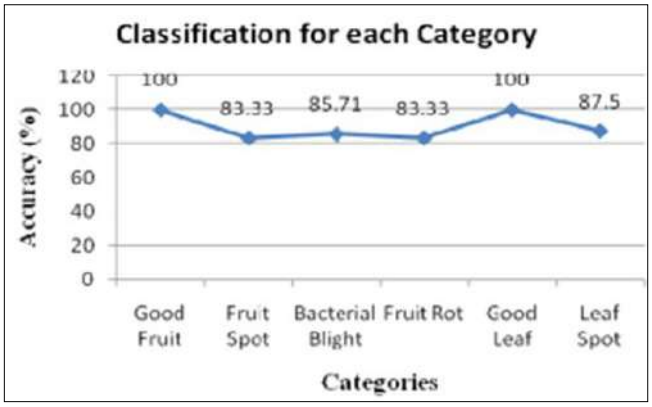

Fig 3: Classification for different Category, accuracy we will see in above Image.

Here in the above Fig 3 we are comparing the classification for the different categories with their accuracy. By this model performance we are getting the 87% to 100% satisfactory results.

5. Conclusion

From this proposed work, four diseases of mainly pomegranate plants can be classified and identified using digital image processing and neural network techniques. Bacterial Blight, Fruit Spot, Fruit Rot and Leaf Spot are diagnosed using the above technique. Experimental results showed good fruit and good leaf yield with almost 100%, leaf spot 87.50%, bacterial blight 85.71%, fruit spot and fruit rot 83.33%. The proposed work gives accurate and satisfactory results and 90% accuracy. Further, it helps in the import and export of fruit.

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