An Automated Detection and Classification of Tree Plant Using Convolutional Neural Network (CNN)

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1 Abstract

Image recognition means the ability of detecting object in image. We work with a Image dataset of fruits image. Our model detects specific fruit from an image with high accuracy. Our model based on Convolution neural network(CNN) to recognize different fruits using mobilenetv2.

2 Introduction

Leaves and fruits are the main compound detecting a tree. Every tree has different pattern leaves and fruits on its. Human mainly detect tree by its leaves and fruit. We also have artificial brain called neural network. With the help of method called transfer learning we can easily classify our desire tree. In this paper we are going to classification of Fruit tree using their fruit and apply recognizing method to see they can predict it or not. There is lots of methods such as Alexnet, Resnet, Le-net, MobileNet, vgg16, vgg19 etc. We are going to apply mobilenetV2 for an automated Detection and Classification of Tree Plant.

3 RELATED WORK

Golhani et al. in [1] describe numerous research of neural network techniques used for disease identification and classification from plant leaf photos. This paper introduces the many models, types, methods, and classifiers used and the further they have presented the various concepts of imaging with respect to hyperspectral pictures. For the identification and classification of plant leaves, Ferentinos in [2] presented a VGG convolutional neural network. The proposed approach divides the photos into two categories: healthy and unhealthy. The correctness of the deep learning approach was demonstrated by the outcome, which was validated on a large dataset. Kaur et al. in [3] provided a research

of the computer vision principles and methodologies used for plant leaf identification and categorization. The advantages and disadvantages of the various studies were explored separately. Gandhi et al. [4] developed a smartphone application that used Generative Adversarial Networks (GANs) and CNN to identify diseases from plant leaf photos.

4 PROPOSED WORK

The flowchart of our proposed work is shown in Fig. 1. And the procedure of proposed method is revealed by the algorithm given in TABLE 1.

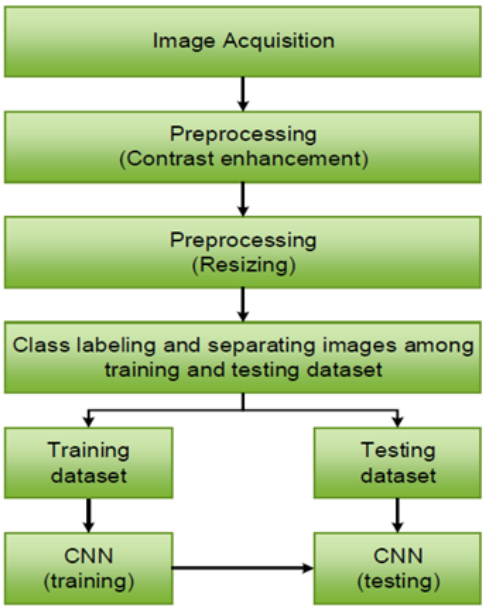

FIGURE 1. Flowchart for the proposed work.

Algorithm for the proposed work.

1. Collecting the images of Apple, Banana, Carambola, Guava, Mango, Orange, Peach, Pitaya, Pomegranate, Tomato. 2. Preprocess all the images for contrast enhancement using histogram equalization method and rescaling using central square crop method.

3. Assign the class labels to the images.

4. Categorize the images among training and testing dataset selecting from all the class labels.

5. Train the CNN with the help of training images.

6. Test the CNN with the help of testing images.

7. Validate the performance of the proposed model and compare the results with the other state-of-the-art approaches.

5 MATERIALS AND METHODS

5.1 DATASET

A total of 1672 images are used in this work. These images categorized among ten classes namely Apple, Banana, Carambola, Guava, Mango, Orange, Peach, Pitaya, Pomegranate, Tomato. Here, TABLE 2 shows the details of the images.

$\text{Image}_{t}ype$	$\text{Class}_{l}abel$	$\text{Number}_{o}f_{i}mages$
Apple	C_0	160
Banana	C_1	160
Carambola	C_2	176
Guava	C_3	161
Mango	C_4	168
Orange	C_5	168
Peach	C_6	168
Pitaya	C_7	175
Pomegranate	C_8	168
Tomato	C_9	168

TABLE 1. Details of image categories.

5.2 CONVOLUTIONAL NEURAL NETWORK

A convolutional neural network is a deep learning model that is used to solve complicated pattern recognition and classification issues using huge datasets. The model is made up of four different layers namely convolution, max pooling, fully connected, and output layer. This model consists of one convolutional layer and this layer followed by a Rectified Linear Unit (ReLU), one dropout layer, One Global Average Pooling layer, and one dense or fully connected layer last layer acting as an output layer with a SoftMax activation function. A flatten acting as a hidden layer is used to convert the images in a 1D array, thus enhancing the performance and making it simpler to handle the data. The size of convolutional layer is 3×3 and Global Average Pooling is 2×2.

1) This model is a sequential model having a series of layers to convert the standard size image into a feature set for further processing.
2) The first layer of this model is convolutional layer with 32 filters and ReLU as the activation function.
3) The first layer of this model is dropout layer and dropout is a technique used to improve over-fit on neural networks.
4) The third layer is the Global Average Pooling layer that will reduce the size of the convoluted image by (2, 2).
5) This dense layer act as the hidden layer of the artificial neural network having 10 hidden neurons and the activation function is SoftMax. This model is designed in such a way that every input neuron is connected to every other hidden neuron forming a fully connected layer.

6) The output of this layer is the predicted class label which is used to evaluate the overall accuracy of the proposed model.

5.3 TRAINING AND VALIDATION

The training and validation datasets are initially separated from the main of the dataset. This is conducted by randomly dividing the dataset into two sets: the training set, which contains approximately 80

6 RESULT

The proposed model consisting of training and testing process were implemented using Google Co-lab with an open source software framework known to be Tensor-Flow with Python programming language.

The method we use call MOBILENETV2 The learning rate is set to 0.01, dropout rate varies from 0.2 to 0.5, and the momentum was chosen to be 0.09, with weight decay of 1e-6 respectively. Training was finished in about 7-day training and testing. The training process was implemented on the GPU of an NVIDIA GTX1660TI card, using the CUDA platform. In the experiments for testing the proposed algorithm is implemented on a desktop computer with AMD Ryzen-5 3600 clocked at 4GHz, Windows 10 Pro (64 bit) operating system with 16.0 RAM.

The results of presented methodology focus on:
1. Labeling all image make sure all images are perfectly categorized
2. Shuffle all the images make sure they are correctly labeled
3. Applying CNN (Convolutional Neural Network) based on MobilenetV2
4. Train according to model. 10 times.

loss	accuracy	Validation loss	Validation accuracy
1.9189	0.4556	0.8543	0.6586
0.6611	0.7427	0.5313	0.8066
0.4061	0.8635	0.3628	0.8701
0.3048	0.8896	0.3553	0.8610
0.2693	0.9023	0.2777	0.9154
0.2300	0.9023	0.2531	0.8882
0.1967	0.9045	0.2024	0.8912
0.1289	0.9381	0.1108	0.9849
0.0340	0.9993	0.0484	0.9849
0.0126	0.9985	0.0500	0.9849

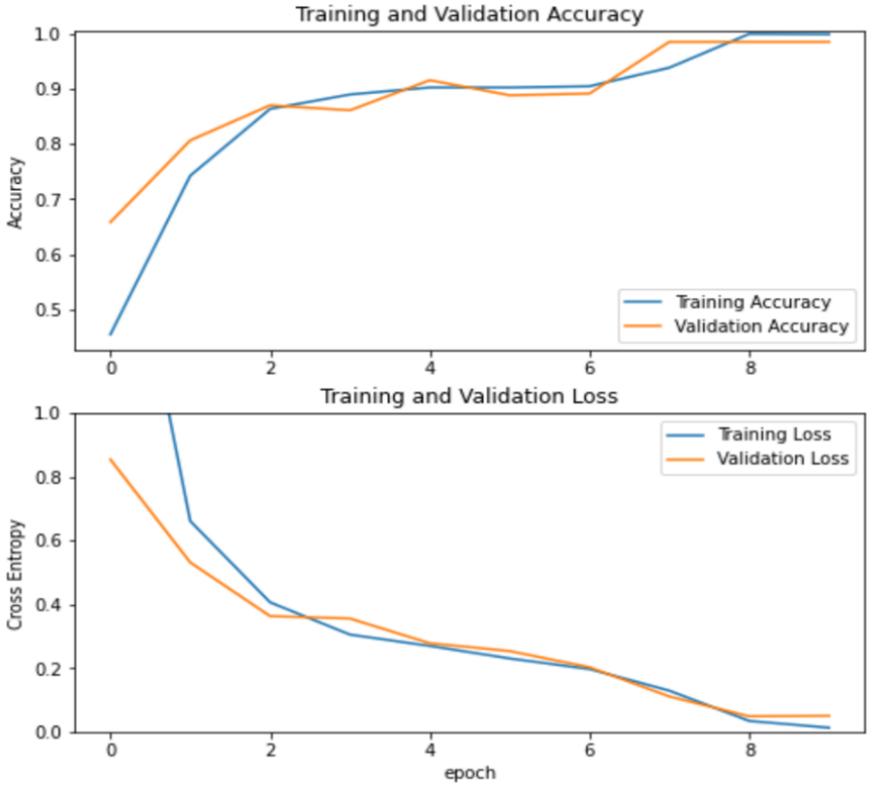

FIGURE 2. Traning and Testing accuracy.

FIGURE 3. Image of actual and prediction accuracy.

7 CONCLUTION

In this work, we proposed and evaluated an approach for the detection of tree fruits based on CNN .The model project can recognize the fruit based on the features like colure and shape. It can help the common people to identify the rare and unknown fruit. It reduces human effort. It reduces the confusion among particular fruit. Experimental results demonstrate that the proposed method is effective and fulfills the fruit classification task.

Future works will investigate the application of the proposed techniques considering other tree fruits. The model can be added as a web application. People can use this project from anytime and anywhere. User will add new type fruit image to train and test.

8 REFERENCES

1. Kamlesh Golhani et al., "A review of neural networks in plant disease detection using hyperspectral data," in Information Processing in Agriculture, vol. 5, pp. 354–371, 2018, doi: 10.1016/j.inpa.2018.05.002.
2. Konstantinos P. Ferentinos, "Deep learning models for plant disease detection and diagnosis," Computers and Electronics in Agriculture, vol. 145, pp. 311–318, 2018. doi: 10.1016/j.compag.2018.01.009.
3. Sukhvir Kaur et al., "Plants Disease Identification and Classification through Leaf Images: A Survey," in Archives of Computational Methods in Engineering, doi: 10.1007/s11831-018-9255-6.
4. R. Gandhi, S. Nimbalkar, N. Yelamanchili and S. Ponkshe, "Plant disease detection using CNNs and GANs as an augmentative approach," in 2018 IEEE International Conference on Innovative Research and Development (ICIRD), Bangkok, 2018, pp. 1-5, doi: 10.1109/ICIRD.2018.8376321.