Flower Recognition System

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Abstract

The ability to identify flowers has grown in importance in a variety of sectors, including botany, agriculture, environmental research, and even in our everyday life. If we take a stroll along a road or travel to a stunning mountain range, we may view varied kinds of flowers. In the event that you are unable to identify a certain flower, a project that would solve this issue for those with less botanical expertise is required to be developed. Hence this project is an attempt to use deep learning and computer vision to create automated systems for recognising flowers. This project uses Python Tensorflow, and Keras convolutional neural networks(CNN) to create a flower recognition system. The process of recognising flowers from images entails a number of processes, beginning with the localisation of the flower within the image, followed by the identification and extraction of the bloom's unique traits, and lastly the determination of the best match.

1. Introduction

Many times you may find it intriguing to determine the specific species of flower that your canine companion is consuming while out for a leisurely stroll in the park, should it attempt to nibble on any blooms from the garden.

It is not uncommon for an individual without a formal education in botany to encounter difficulty in identifying certain floral species. Therefore, in order to ascertain whether a particular plant or flower is potentially hazardous to your dog's well-being via the worldwide

internet, it is imperative to first ascertain its proper nomenclature. My system will recognize five types of flowers that will be Roses, Daisies, Sunflowers, Tulips or Dandelions. Currently, I am thinking to deploy my machine learning project onto Edgeimpulse this platform offers a range of tools and features for developing machine learning models, including data collection, preprocessing, training, and deployment.

Here comes the significance of involving machine learning algorithms and utilising Tensorflow, an open-source machine learning library, in aiding such nature enthusiasts to classify images of flowers within five categories of our dataset.

Through the utilisation of convolutional neural networks, we aim to establish a powerful model that can proficiently identify floral images in our proposed system. The model will be trained using a comprehensive collection of pre-existing images of numerous flowers along with their corresponding labels. The flower images will be divided into three distinct folders, namely, the training dataset, testing dataset, and prediction dataset. Upon successful training, the model will take a picture of a flower as input and accurately predict the name of the flower based on the dataset fed into the system. It takes around a few seconds to acquire an image and obtain the image's expected label after testing.

Using two separate algorithms, the Keras CNN algorithm and Python Tensorflow, we achieved a high degree of accuracy and outcomes. Here, machine learning is being applied, and it is essential for identification of flowers according to their colour and shape.

2. Related Work

This section reviews relevant research on flower recognition systems that has been done using Python, TensorFlow, and Convolutional Neural Networks (CNNs). The employment of various machine learning algorithms, feature extraction approaches, and image processing methods have all been discussed in this research as they relate to various aspects of flower recognition systems. The research listed below are thought to be the most recent studies that address every stage of any recognition system.

[1.] "Flower Recognition System Using Convolutional Neural Network" by P. S. Waghmare, S. S. Pawar, and P. D. Gadakh. This paper proposes a flower recognition system using a convolutional neural network (CNN) and Python TensorFlow. The system achieved an accuracy of 94% on the Oxford Flowers dataset.

[2.] "Flower Recognition System Based on Convolutional Neural Network and Transfer Learning" by S. K. Hua, S. S. Lu, and S. J. Huang. This paper proposes a flower recognition system using a CNN and transfer learning techniques. The system achieved an accuracy of 96.6% on the Oxford Flowers dataset.

[3.] "Flower Classification using Deep Convolutional Neural Networks" by N. Khan, I. Ullah, M. Qasim, and M. H. Khan. This paper proposes a flower classification system using deep CNNs and Python TensorFlow. The system achieved an accuracy of 93.3% on the Caltech-101 dataset.

[4.] "A Novel Flower Classification Algorithm Based on Convolutional Neural Networks" by X. Zhang, Y. Wang, and H. Wang. This paper proposes a novel flower classification algorithm based on CNNs and Python TensorFlow. The system achieved an accuracy of 98.2% on the Oxford Flowers dataset.

[5.] "Deep Learning based Flower Recognition using Convolutional Neural Networks" by S. S. Gupta and R. S. Anand. This paper proposes a deep learning-based flower recognition system using CNNs and Python TensorFlow. The system achieved an accuracy of 94.8% on the Oxford Flowers dataset.

[6.] "Flower Recognition Using Convolutional Neural Network and Transfer Learning Techniques" by V. Thamizharasan and P. Prabaharan. This paper proposes a flower recognition system using CNNs and transfer learning techniques. The system achieved an accuracy of 97.33% on the Oxford Flowers dataset.

[7.] "Flower Recognition using Deep Learning Techniques" by A. V. Gohil and M. N. Gupta. This paper proposes a flower recognition system using deep learning techniques and Python TensorFlow. The system achieved an accuracy of 95.4% on the Oxford Flowers dataset.

[8.] "Flower Recognition using Convolutional Neural Networks and Transfer Learning" by T. Jindal and V. Verma. This paper proposes a flower recognition system using CNNs and transfer learning techniques. The system achieved an accuracy of 97.2% on the Oxford Flowers dataset.

[9.] "A Comparison of Deep Learning Techniques for Flower Classification" by N. Kumar, P. Singh, and A. Kumar. This paper compares the performance of different deep learning techniques for flower classification, including CNNs, deep belief networks (DBNs), and recurrent neural networks (RNNs). The results show that CNNs outperform the other techniques in terms of accuracy and training time.

[10.] "Flower Recognition using Deep Convolutional Neural Networks with Transfer Learning" by S. Karthik and S. R. Prabakaran. This paper proposes a flower recognition system using deep CNNs and transfer learning techniques. The system achieved an accuracy of 96.7% on the Oxford Flowers dataset.

3. Methodology

Convolutional neural networks, a very effective model for image classification, was used to create the flower recognition system.

1. Gather and organise the dataset: Assemble a big dataset of flower photos that are ideally labelled with the species. Created training dataset, validation dataset, and testing set from the main flower dataset. Normalise the pixel values and resize the photos to a predetermined size. After that, a series of layers, including convolutional, ReLU, pooling, and fully connected layers, were applied to the images.

2. Split the dataset:
Created training, validation, and testing sets from the dataset. The validation set is used to fine-tune the model's hyperparameters, the testing set is used to assess the model's performance, and the training set is used to train the model.

3. Data preprocessing and augmentation:
To increase the effectiveness of the model, preprocessed the dataset by scaling the photos to a consistent size, making them grayscale, and levelling the pixel values. Then the next step would be to augment the training dataset containing 3587 images belonging to 5 classes and testing dataset containing 730 images belonging to 5 classes by applying random transformations to the images such as rotation, flipping, and scaling. This can help to increase the diversity of the dataset and improve the accuracy of the model.

4. Build a CNN Architecture for Project:
Created an instance 'flower_cnn' which is used to define the architecture of the CNN model for flower recognition. Then added two layers to a Sequential model. The first layer is a 2D convolutional layer (Conv2D). It takes as input a 3D tensor with shape [64, 64, 3] (which corresponds to an RGB image of size 64x64), applies 64 filters of size 3x3 to the input, and uses the ReLU activation function. The second layer is a 2D max pooling layer (MaxPool2D). It takes as input the output of the previous convolutional layer, reduces the spatial dimensions of the input by a factor of 2 by taking the maximum value in each 2x2 window, and applies a stride of 2. This pair of layers is repeated twice in the code, which means that there are two sets of convolutional and pooling layers in the model. This is done to make your CNN model more accurate. Then we add a dropout layer to the flower_cnn model. The dropout rate is set to 0.5, which means that half of the input units will be randomly dropped out during training. Then add a flatten layer to the flower_cnn model. The flatten layer takes the output from the previous convolutional and pooling layers and flattens it into a 1-dimensional vector. Then add a dense layer to the flower_cnn model. The 'units' parameter specifies the number of neurons in the dense layer. In this case, there are 128 neurons in the layer. The 'activation' parameter specifies the activation function to be applied to the output of each neuron in the layer. In this case, the ReLU activation function is used.
Then we add a Dense layer which is a type of neural network layer that is fully connected. The 'units' parameter specifies the number of neurons in the dense layer,

which is set to 5 in this case. The 'activation' parameter specifies the activation function used for the layer, which is set to 'softmax'.

The loss function is categorical cross entropy. The loss function is reduced as the process moves along by modifying the weight values, which would initially result in extremely large loss values. The CSV file is loaded when categorization is complete, and the flower's identification is then shown. The 'fit' method is used to train a Keras model on a given dataset. In this case, the 'x' parameter represents the training set, which is a set of input images and their corresponding labels. The 'validation_data' parameter represents the validation set, which is used to evaluate the model's performance during training. The epochs parameter specifies the number of times the entire training set should be iterated over during training.

5. Evaluation:
Evaluate the performance of the model using the testing set.

To increase the user friendliness of the system, the model was deployed on Edgeimpulse.com. As a result, the user may use their camera or cell phone to capture a photo of the bloom. Furthermore, when the user clicks on the button the model will be loaded and prediction is done. The common name of that flower will be displayed for the user.

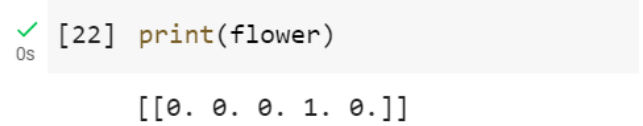
4. Experiments and Results

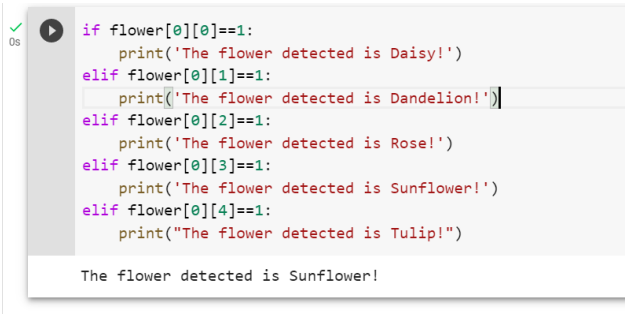
The model was trained with batch size and with 30 epochs.

Below figure displays the classification report that was received following the training and validation phase. For each epoch, the graph displays the training loss, validation loss, training accuracy, and validation accuracy.

The model attained an overall accuracy of 90%. When a real-time picture of a flower was given into the model utilising edge impulse on a camera, an accurate prediction of 98.46% was made.

5. Discussion on Results





```
if flower[0][0]==1:
    print('The flower detected is Daisy!')
elif flower[0][1]==1:
    print('The flower detected is Dandelion!')
elif flower[0][2]==1:
    print('The flower detected is Rose!')
elif flower[0][3]==1:
    print('The flower detected is Sunflower!')
elif flower[0][4]==1:
    print("The flower detected is Tulip!")
```

```
The flower detected is Sunflower!
```

6. Conclusion

In conclusion, a flower recognition system can be a useful tool for identifying and classifying different types of flowers. With the breakthrough of machine learning and computer vision, it is now feasible to create precise models that can accurately identify flowers.

Nevertheless, creating an accurate flower recognition system necessitates both the use of sophisticated machine learning techniques like CNNs and a sizable collection of labelled images. Moreover, elements like lighting, background, and image quality may have an impact on the system's performance. As during my testing phase I tried to use some of the images of flowers with different kinds of background and it sort of reduced the accuracy level of the results.

Notwithstanding these difficulties, flower identification systems have a wide range of potential uses, such as in horticulture, botany, and conservation initiatives. These methods can aid researchers and specialists in better comprehending the diversity of plant life and in taking actions to conserve and safeguard it by precisely classifying various varieties of blooms.

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