JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

Open Source Software Lab (15B17CI575)
(Project Report)

Multiclass Flower Image Classification by Transfer Learning Models (VGG16 & Inception V3)

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Abstract

The aim of this project is to develop a robust flowers species classification system utilising transfer learning with the VGG16 & Inception V3 model. The task involves accurately identifying various Flower species from a diverse set of images. Leveraging the power of transfer learning, we adapt the pre-trained model, known for its proficiency in image-related tasks.

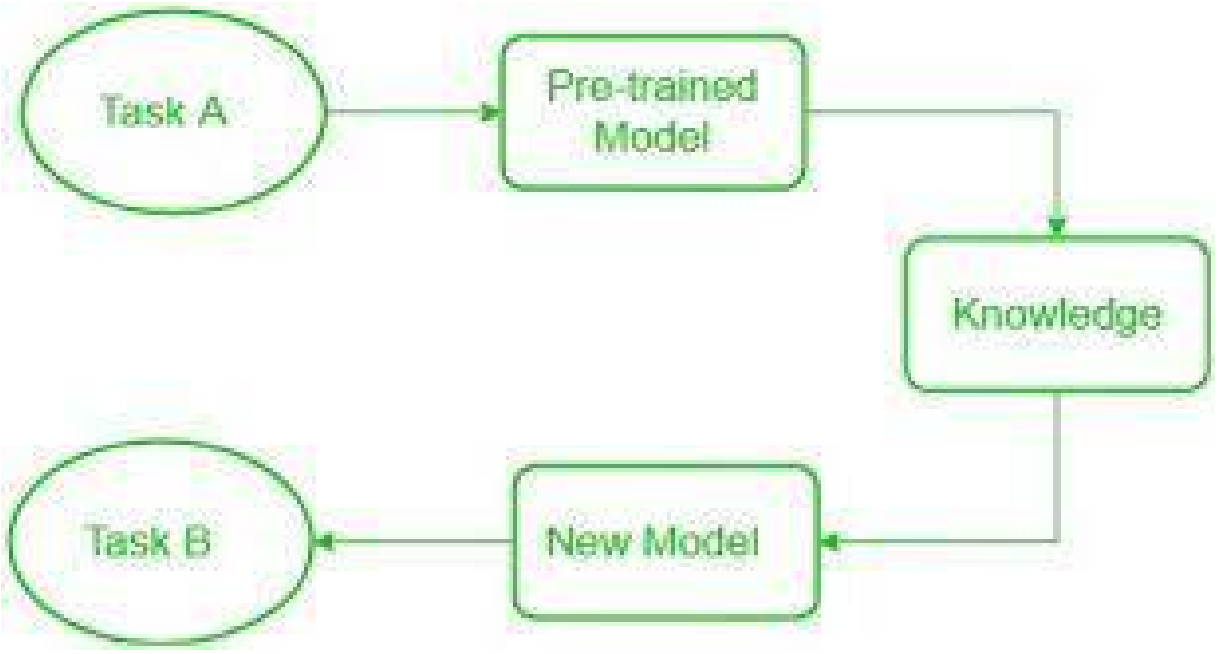
The specific goals of this project includes :

- Curating a comprehensive dataset comprising images of five diverse Plant species.
- Pre-processing the dataset to ensure uniformity and optimal training conditions.
- Applying transfer learning to adapt the pre-trained VGG16 & IV3 model for image classification.
- Evaluating the model's performance and achieving a high level of accuracy.
- Providing insights and recommendations for future improvements or extensions of this work.

Transfer Learning:

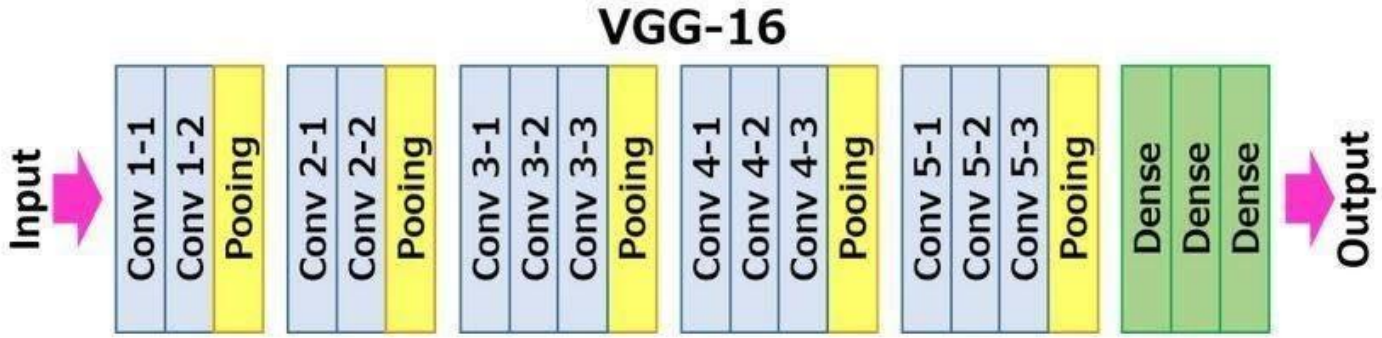
Transfer learning has emerged as a powerful paradigm in deep learning, enabling the transfer of knowledge from pre-trained models to new tasks. In the context of image classification, pre-trained convolutional neural networks (CNNs) have been widely adopted. By leveraging the learned features of a model trained on a large-scale dataset (e.g., ImageNet), transfer learning enables effective training on smaller, specialized datasets.

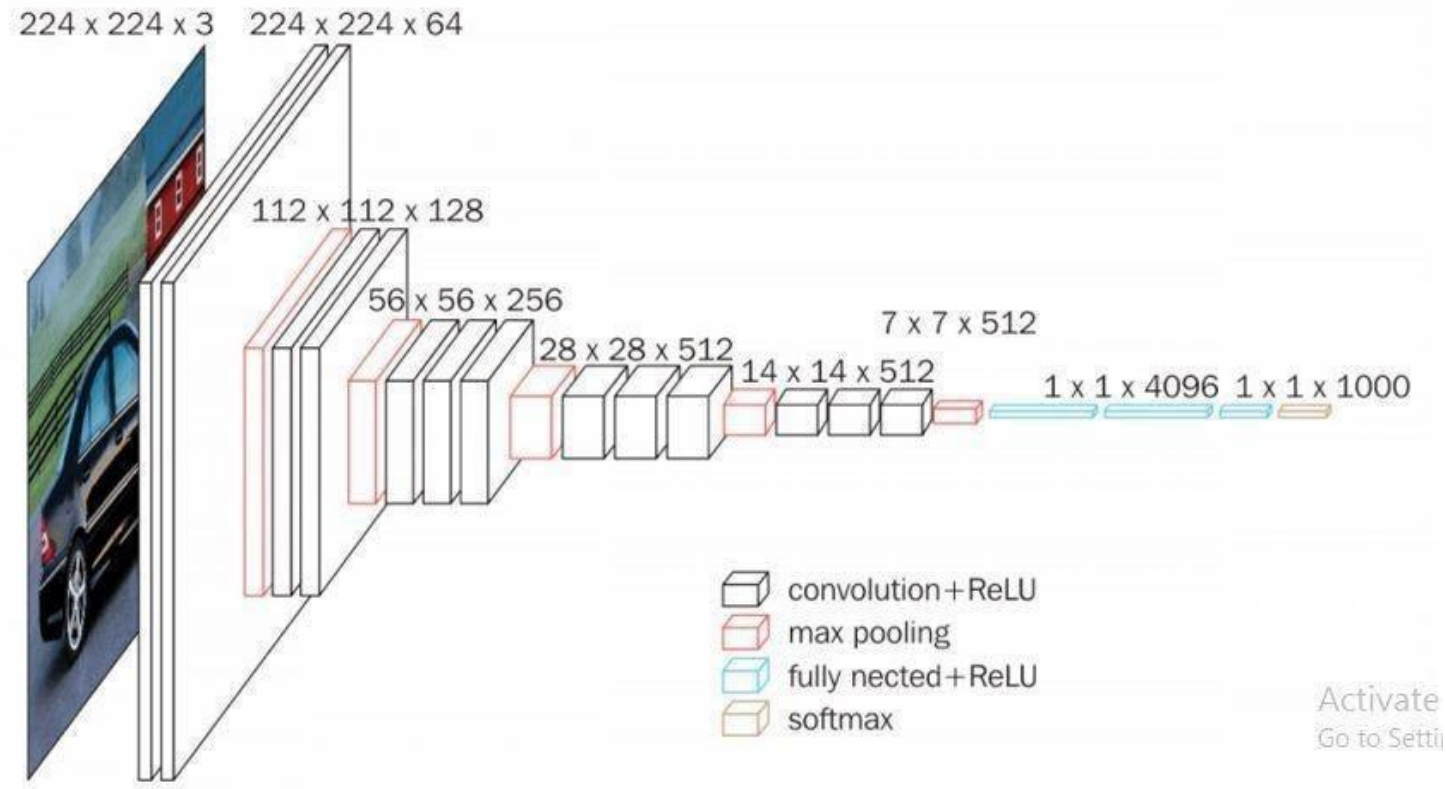
The advantage of transfer learning lies in its ability to accelerate model convergence and improve generalization performance. This is particularly crucial in scenarios where acquiring a large and diverse dataset is challenging, as is often the case in fine-grained classification tasks like plant species identification.



VGG 16 Model:

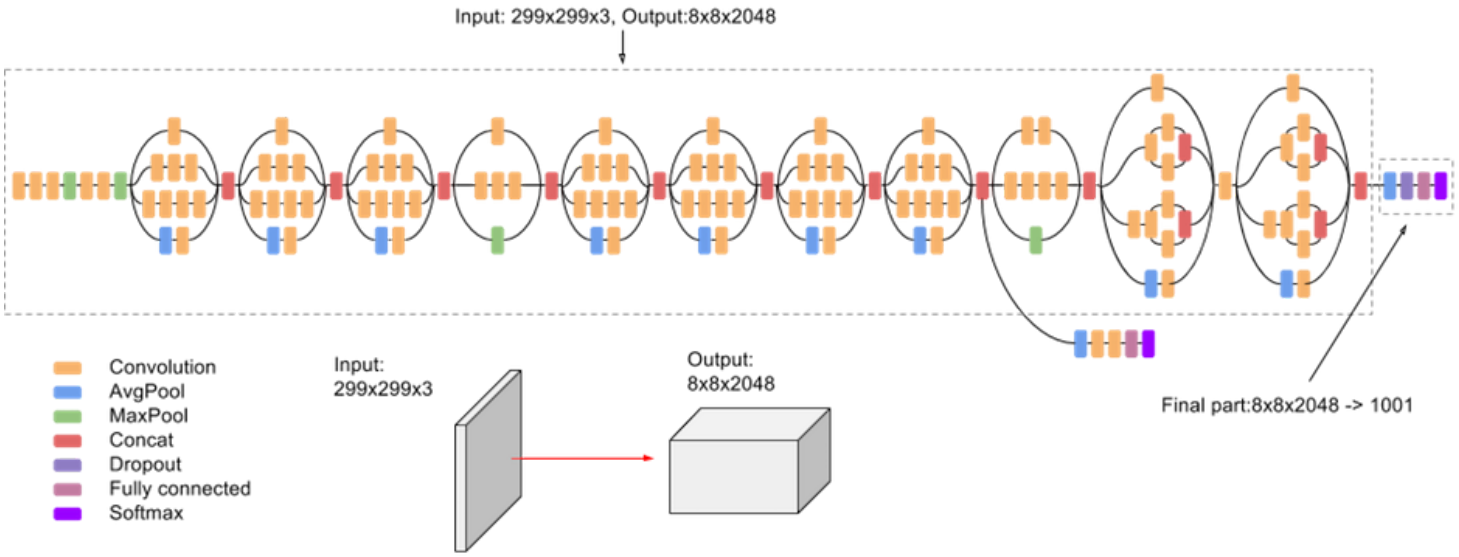
The VGG-16 model, short for the Visual Geometry Group 16-layer model, is a widely recognized deep convolutional neural network architecture in the field of computer vision. It was developed by the Visual-Geometry Group at the University of Oxford. VGG-16 is characterized by its simplicity and depth, consisting of 16 layers of trainable parameters, including 13 convolutional layers and 3 fully connected layers. This architecture is known for its ability to extract rich features from images and has been a crucial component in various image classification and object recognition tasks. While it may not be the most computationally efficient model, VGG-16's straightforward design and impressive performance make it a valuable benchmark and foundation for many subsequent deep learning models.





Inception Model:

The Inception v3 model, part of the Inception architecture series, is a deep convolutional neural network designed for image classification and object recognition tasks. Developed by Google's research team, it is known for its exceptional performance and efficiency. Inception v3 employs a unique inception module that uses a combination of different filter sizes, enabling the network to capture features at various scales and improve accuracy. This architecture is celebrated for its ability to achieve high accuracy on large-scale image datasets while being computationally efficient, making it a popular choice in the field of computer vision and a significant milestone in the development of deep learning models for visual tasks.



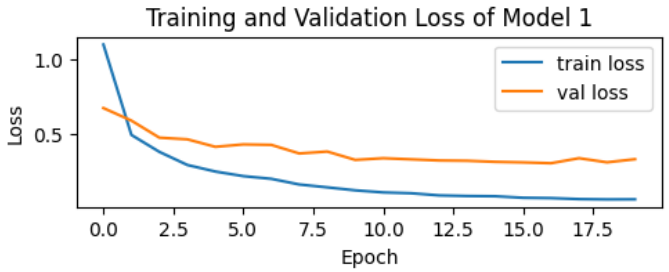
Dataset:

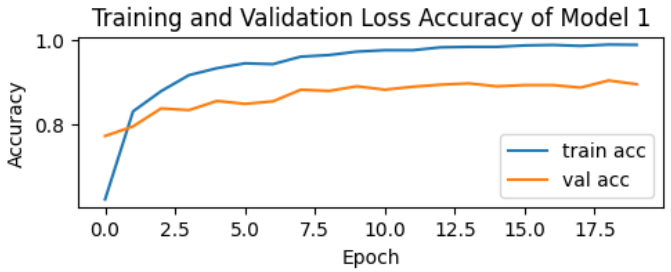
The dataset consists of 5000 images of 5 different species of flowers. They are distributed as Lilly, Lotus, Orchid, Sunflower & Tulip.

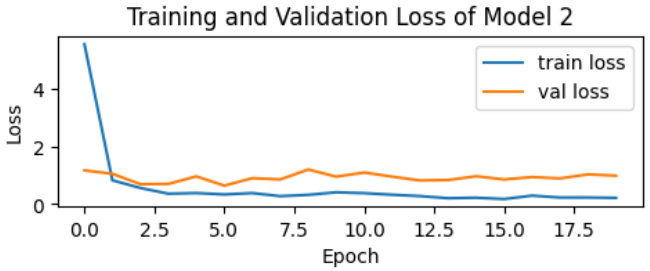
Working:

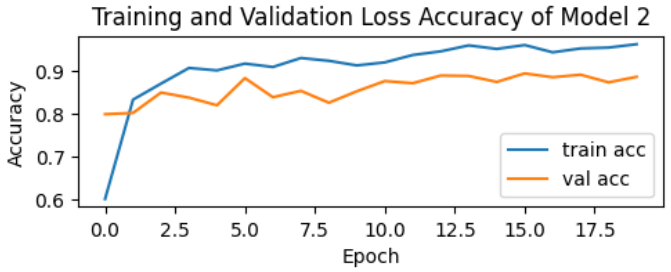
Both models are used to classify the multiclass data, run for 20 epochs & the results are saved. Later these are used for classifying images.

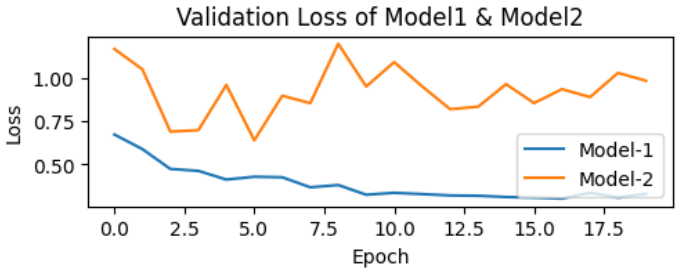
Analysis:

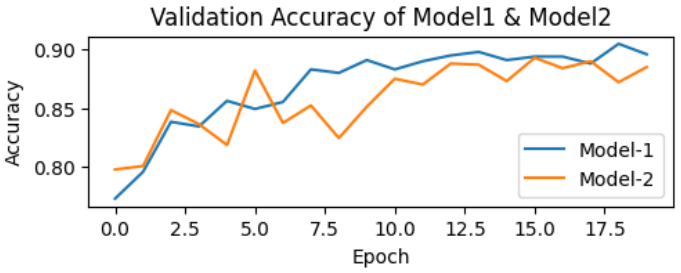












Model 1 – VGG 16
highest accuracy: 90%

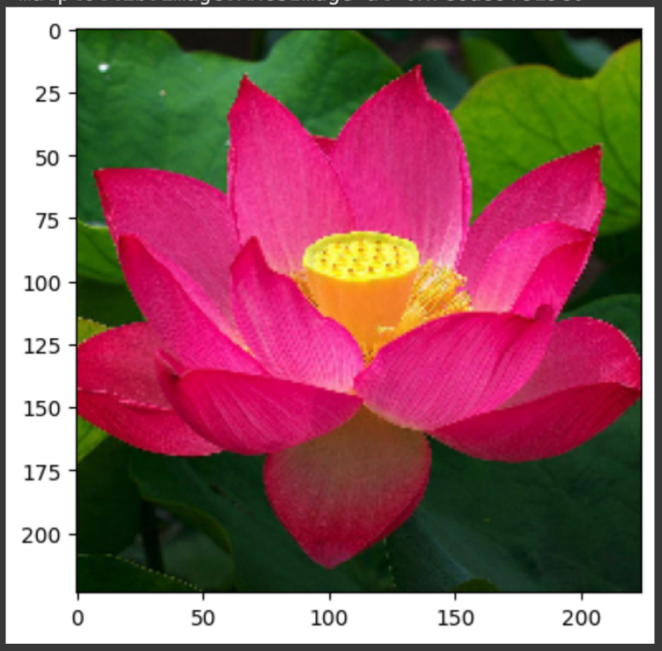
Model 2 – Inception V3
highest accuracy: 89%

Classification Result:

```
[5] deployed_model1 = keras.models.load_model('/content/drive/MyDrive/FlowerClassificationV2_VGG16.h5')
    deployed_model2 = keras.models.load_model('/content/drive/MyDrive/FlowerClassificationV3_VGG16.h5')
```

```
img_path = "/content/drive/MyDrive/flower_images/Lotus/093ed8029f.jpg"
img = cv2.imread(img_path)
img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
img = cv2.resize(img, (224, 224))
plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7e6a89f819c0>
```




```
Labels = ["Lilly" , "Lotus" , "Orchid" ,"Sunflower" , "Tulip"]

max1 = np.argmax(prediction1)
max2 = np.argmax(prediction2)
```

```
1/1 [==============================] - 8s 8s/step
1/1 [==============================] - 0s 133ms/step


 [[4.898764e-35 1.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00]]


 [[4.898764e-35 1.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00]]
```

```
[9] print("\n-----------------------")
    print("\nModel 1 Pridected : ", Labels[max1])
    print("\n-----------------------")
    print("\nModel 2 Pridected : ", Labels[max2])
```

```

-----------------------

Model 1 Pridected :  Lotus

-----------------------

Model 2 Pridected :  Lotus
```

Conclusion :

This project showcases the potential of transfer learning in fine-grained classification tasks, particularly in the domain of bird species identification. The accuracy achieved underscores the suitability of the models for such tasks.

The successful implementation of this project offers a valuable contribution to the field of computer vision and holds promise for applications in ecological studies, conservation efforts, and educational initiatives focused on avian biodiversity.

The classification accuracy indicates the model's proficiency in correctly identifying plant species, underscoring the effectiveness of the transfer learning approach with the VGG16 & Inception V3 model.