**Academic Report: Image Classification using VGG16 Model**

**Higher National Diploma In Software Engineering**

**Machine Learning-Course Work 1**



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Abstract

This report presents the development of a program for image classification using a pre-trained VGG16 model. The goal of the project was to leverage deep learning techniques to classify images and understand the process of loading pre-trained models, image preprocessing, and result interpretation. The implementation utilizes the TensorFlow and Keras libraries in Python.

1. Introduction

1.1 Background

Image classification is a fundamental task in computer vision, finding applications in various domains such as healthcare, autonomous vehicles, and entertainment. Deep learning models, particularly convolutional neural networks (CNNs), have shown exceptional performance in image classification tasks.

1.2 Objectives

- Implement a program for image classification.

- Utilize the pre-trained VGG16 model for efficient feature extraction.

- Understand the process of image preprocessing for deep learning applications.

- Decode and interpret model predictions for human-readable results.

2. Methodology

2.1 Tools and Libraries

- Python: The programming language for implementation.

- TensorFlow: A widely-used open-source machine learning framework.

- Keras: A high-level neural networks API integrated with TensorFlow.

2.2 Model Selection

The VGG16 model was chosen for its simplicity and effectiveness in image classification. The model was pre-trained on the ImageNet dataset, providing a broad range of features for general-purpose image recognition.

3. Implementation

3.1 Loading the VGG16 Model

```python

import tensorflow as tf

from tensorflow.keras.applications import VGG16

model = VGG16(weights='imagenet')

```

3.2 Image Preprocessing

```python

from tensorflow.keras.preprocessing import image

from tensorflow.keras.applications.vgg16 import preprocess\_input

img = image.load\_img(image\_path, target\_size=(224, 224))

x = image.img\_to\_array(img)

x = np.expand\_dims(x, axis=0)

x = preprocess\_input(x)

```

3.3 Making Predictions

Predictions on the preprocessed image are obtained using the `predict` method of the VGG16 model.

```python

predictions = model.predict(x)

```

3.4 Decoding and Display

The predictions are decoded using the `decode\_predictions` function to obtain human-readable labels and confidence scores. The top 5 predictions are then printed.

```python

from tensorflow.keras.applications.vgg16 import decode\_predictions

decoded\_predictions = decode\_predictions(predictions, top=5)

for \_, label, score in decoded\_predictions[0]:

print(f'{label}: {score:.2f}')

```

4. Results

The program successfully classifies images using the pre-trained VGG16 model. Results demonstrate the model's ability to provide accurate predictions and highlight the importance of proper image preprocessing.

5. Conclusion

This project has provided valuable insights into the process of developing an image classification program using a pre-trained VGG16 model. The utilization of the VGG16 architecture, TensorFlow, and Keras showcases the power and accessibility of deep learning tools for image recognition tasks.

6. Future Work

Future work may involve exploring other pre-trained models, optimizing the program for real-time applications, or integrating the image classification system into a larger project.

7. Acknowledgments

I express my sincere gratitude to Mr. C.M.B Herath, a dedicated lecturer in the field of Machine Learning. I have greatly benefited from his profound insights and guidance throughout the project. Mr. Herath's expertise has been instrumental in steering me towards the successful completion of this endeavor. I truly appreciate Mr. Herath's valuable contributions to this project.

8. References

- Simonyan, K., & Zisserman, A. (2014). Very deep convolutional networks for large-scale image recognition. arXiv preprint arXiv:1409.1556.

- Abadi, M., et al. (2016). TensorFlow: A system for large-scale machine learning. In 12th USENIX Symposium on Operating Systems Design and Implementation (OSDI 16) (pp. 265-283).

9.Code of the program

import tensorflow as tf

from tensorflow.keras.applications import VGG16

from tensorflow.keras.preprocessing import image

from tensorflow.keras.applications.vgg16 import preprocess\_input, decode\_predictions

import numpy as np

# Load pre-trained VGG16 model

model = VGG16(weights='imagenet')

# Load an image for classification

image\_path = 'Burmese\_Python\_02.jpg'

img = image.load\_img(image\_path, target\_size=(224, 224))

# Preprocess the image

x = image.img\_to\_array(img)

x = np.expand\_dims(x, axis=0)

x = preprocess\_input(x)

# Make predictions on the image

predictions = model.predict(x)

# Decode and display

decoded\_predictions = decode\_predictions(predictions, top=5)

# Print the result

for \_, label, score in decoded\_predictions[0]:

print(f'{label}: {score:.2f}')