**SWS3009A Deep Learning**

**Assignment Answer Book**

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**IMPORTANT: THIS REPORT IS DUE ON 8 JULY 2025 BUT YOU MUST FINISH EVERYTHING ELSE IN THIS ASSIGNMENT BEFORE YOUR BASELINE EVALUATION!**

Complete this answer book and save to PDF before uploading to Canvas. Deadline is 11.59 pm on 8 July 2025.

1. Fill in the number of images you’ve gotten for each of the species:

Ragdolls: \_\_\_\_\_\_1938\_\_\_\_\_\_\_\_\_\_\_ images

Singapura: \_\_\_\_\_1634\_\_\_\_\_\_\_\_\_\_\_ images

Persians: \_\_\_\_\_\_1873\_\_\_\_\_\_\_\_\_\_\_ images

Sphynx: \_\_\_\_\_\_\_1852\_\_\_\_\_\_\_\_\_\_\_ images

Pallas Cats: \_\_\_\_1625\_\_\_\_\_\_\_\_\_ images

1. Description of our architecture and justification:

**Architecture Selection and Transfer Learning Strategy:**

We selected a Convolutional Neural Network (CNN) architecture and applied transfer learning using EfficientNetB3 as the backbone. This choice was based on EfficientNet's strong performance on image classification benchmarks with relatively fewer parameters and efficient scaling.

**Model Specific Architecture:**

We used the EfficientNetB3 model pretrained on ImageNet as the feature extractor. The original classification head was removed and replaced with a custom classifier tailored for our task. Our architecture includes:

* EfficientNetB3 (pretrained on ImageNet, include\_top=False)
* GlobalAveragePooling2D to reduce spatial dimensions
* Dropout(0.5) to mitigate overfitting
* Dense(NUM\_CLASSES, activation='softmax') output layer for classification into 5 cat breeds

**Transfer Learning Strategy**

The training process was divided into two phases:

1)Train Classifier Head Only:

The base EfficientNetB3 was frozen (base.trainable = False)

We trained only the new classification layers for 10 epochs using Adam optimizer and sparse\_categorical\_crossentropy loss.

2)Fine-Tuning Top Layers:

We unfroze the top 20 layers of the base model (base.trainable = True and freeze all but top 20 layers).

We continued training with a lower learning rate (1e-5) for another 20 epochs, allowing the model to adapt deeper convolutional filters to our cat dataset.

**Justification**

EfficientNetB3 was chosen for its balance between accuracy and computational efficiency. Transfer learning was essential due to the limited size of our dataset, and allowed us to leverage pretrained features while fine-tuning only a subset of the model to avoid overfitting. By dong this, we reduced training time and computational requirements while achieving high classification accuracy on the validation set.

1. Results:

Training Accuracy: \_\_\_\_97.20\_\_\_\_\_\_\_\_ (%)

Validation Accuray: \_\_\_\_96.90\_\_\_\_\_\_\_ (%)

Is there any overfitting? How do you know?

There is minimal overfitting. The training and validation accuracies are very close (within 0.3%), which suggests that the model generalizes well to unseen data.

Is there any underfitting? How do you know?

No clear sign of underfitting. Both accuracies are high, indicating that the model has successfully learned the key patterns in the data.