**Model Optimization and Tuning Phase Template**

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| Date | 12 July 2024 |
| Team ID | SWTID1720067113 |
| Project Title | Dog Breed Identification using Transfer Learning |
| Maximum Marks | 10 Marks |

**Model Optimization and Tuning Phase**

The Model Optimization and Tuning Phase involves refining neural network models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

### Hyperparameter Tuning Documentation (8 Marks):

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| **Model** | **Tuned Hyperparameters** |
| **EfficientNetB7** | 1. Rescale: 1./255    * Normalizes the image pixel values to the range [0, 1]. 2. Shear Range: 0.2    * Randomly applies shearing transformations to the images. 3. Zoom Range: 0.2    * Randomly zooms inside images. 4. Horizontal Flip: True    * Randomly flips half of the images horizontally. 5. Target Size: (224, 224)    * The size to which all images are resized. 6. Batch Size: 32    * The number of images to be used in each batch for training. 7. Optimizer: Adam    * Optimizer used to minimize the loss function. 8. Loss Function: categorical\_crossentropy    * Loss function used for multi-class classification problems. 9. Epochs: 15    * The number of times the entire dataset is passed through the network during training. 10. **Activation**: softmax     * Activation function used in the output layer for multi-class classification. |
| **vgg19** | 1. Learning Rate: Defined by the Adam optimizer with default settings. 2. Batch Size: 32 (used in ImageDataGenerator). 3. Epochs: 15 (defined in the model.fit function). 4. Image Size: 224x224 pixels (used in ImageDataGenerator and load\_img). 5. Pre-trained Model: VGG19 (imported and used as base model). |
| **MobileNet** | 1. Image Size: The target size of the input images used for the VGG19 model. 2. Pre-trained Weights: Specifies that the model uses pre-trained weights from ImageNet. 3. Trainable Layers: Sets all layers of VGG19 to be non-trainable to use the pre-trained features. 4. Output Layer Activation: The activation function used in the final output layer, set to 'softmax' for multi-class classification. |

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### Final Model Selection Justification (2 Marks):

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| **Final Model** | **Reasoning** |
| **EfficientNetB7** | * EfficientNetB7 is known for its superior performance on a variety of image classification benchmarks. It achieves high accuracy with relatively fewer parameters compared to other models. * The EfficientNet architecture scales efficiently in terms of depth, width, and resolution, allowing it to perform well on large datasets while maintaining computational efficiency. * EfficientNetB7 comes pre-trained on ImageNet, providing a strong feature extraction capability which is beneficial for fine-tuning on the dog breed identification dataset. * Despite being a deep model, EfficientNetB7 is optimized for both speed and memory usage, making it practical for real-world applications where computational resources might be limited. * **We chose the model because for specific images nearly every prediction was correct for this model which was not much accurate in other models.** |