**Model Optimization and Tuning Phase**

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| Date | 20 June 2025 |
| Team ID | SWTID1749826875 |
| 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** |
| VGG19 | 1. **Batch Size** = 32 2. **Epochs** = 50 3. **Learning Rate** = 0.0001 4. **Optimizer**: Adam optimizer 5. **Loss Function**: categorical crossentropy 6. **Image Size =** (224 × 224). |
| MobileNetV2 | 1. **Batch Size** = 32 2. **Epochs** = 10 3. **Learning Rate** = 0.0001 4. **Optimizer**: Adam optimizer 5. **Loss Function**: categorical crossentropy 6. **Image Size =** (224 × 224). |
| EfficientNetB0 | 1. **Batch Size** = 32 2. **Epochs** = 10 3. **Learning Rate** = 0.0001 4. **Optimizer**: Adam optimizer 5. **Loss Function**: categorical crossentropy 6. **Image Size =** (224 × 224). |

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

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| **Final Model** | **Reasoning** |
| MobileNetV2 | For this project, MobileNetV2 was chosen as the final model for dog breed classification using transfer learning. This decision was based on a combination of empirical performance and architectural advantages. Among the evaluated models, MobileNetV2 achieved the highest training and testing accuracy, demonstrating strong generalization capabilities even on a relatively small dataset of 1683 images across 20 classes. Its lightweight architecture, which uses depth-wise separable convolutions, allows it to maintain high efficiency while reducing the number of trainable parameters compared to larger models like VGG19. This made it particularly well-suited for our limited data scenario, where larger models tend to overfit. Additionally, MobileNetV2’s pretrained weights on ImageNet allow it to transfer rich feature representations, significantly improving convergence speed and accuracy. The model is also highly compatible with deployment environments due to its low computational footprint, making it an ideal choice for real-time applications on mobile or web platforms. |