Model Optimization and Tuning Phase Report

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Project Title	SynapseScan: AI Driven Classification of Ovarian Cancer Variants
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

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

Hyperparameter Tuning Documentation

Model	Tuned Hyperparameters	Optimal Values
InceptionV3 + Attention	Learning Rate Batch Size Epochs Dropout Rate Dense Layer Size Attention Heads Gaussian Noise Early Stopping Patience	0.0001 32 20 0.25 512 8 0.25 5
InceptionV3 + Attention + Fine-tuning	Fine-tune Learning Rate Fine-tune Epochs Unfreeze Layers Count Early Stopping Patience LR Reduction Factor LR Reduction Patience Minimum Learning Rate	1e-5 25 60 3 0.5 2 1e-7

Performance Metrics Comparison Report

Model	Optimized Metric
InceptionV3 + Attention	**Test Accuracy:** 77.34% **Test Loss:** 0.33% **Precision:** 78.39% **Recall:** 77.31% **F1-Score:** 77.62%
InceptionV3 + Attention + Fine-tuning	**Test Accuracy:** 93.84% **Test Loss:** 0.12% **Precision:** 93.91% **Recall:** 93.84% **F1-Score:** 93.87%

Final Model Selection Justification

Final Model	Reasoning
InceptionV3 + Attention + Fine-tuning	The fine-tuned InceptionV3 with Custom Differential Attention was selected for its superior performance over the base model. The fine-tuning process with selective layer unfreezing (last 60 layers) and reduced learning rate (1e-5) allowed the model to adapt better to the specific dataset characteristics. The incorporation of advanced callbacks including ReduceLROnPlateau and optimized early stopping (patience=3) prevented overfitting while maximizing performance. The custom attention mechanism enhances feature focus, and the fine-tuning approach leverages pre-trained ImageNet weights while adapting to domain-specific patterns, resulting in improved accuracy and generalization capability for loan approval prediction tasks.