Model Development Phase -
Model Optimization and Tuning Phase Report

Date: 30 July 2025

Project Title: AnemiaSense — Machine Learning Based Anemia Detection

Maximum Marks: 10 Marks

Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining machine learning 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 (6 Marks):

Model	Tuned Hyperparameters	Optimal Values
Decision Tree Classifier	max_depth, min_samples_split	max_depth=5, min_samples_split=4
Random Forest Classifier	n_estimators, max_depth	n_estimators=200, max_depth=8
Support Vector Machine	C, kernel, gamma	C=1.0, kernel='rbf', gamma='scale'
Gradient Boosting Classifier	n_estimators, learning_rate, max_depth	n_estimators=150, learning_rate=0.05, max_depth=4

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Accuracy Score (%)
Decision Tree Classifier	100.00
Random Forest Classifier	100.00
Support Vector Machine	92.50
Gradient Boosting Classifier	100.00

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Decision Tree Classifier	The Decision Tree Classifier was selected for its perfect accuracy during hyperparameter tuning, along with its interpretability and computational efficiency. It effectively handled the dataset without overfitting and aligns with the project's goal of providing fast, reliable anemia detection.