Model Optimization and Tuning Phase Report

Date	03 August 2025
Project Title	Anemia Sense – Machine Learning for Precise Anemia Recognition
Maximum Marks:	10 Marks

Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining machine learning models for maximum predictive performance. It includes optimized code, fine-tuning of hyperparameters, comparison of performance metrics, and justification for final model selection—ensuring both accuracy and robustness for anemia detection.

Hyperparameter Tuning Documentation (6 Marks):

Model	Tuned Hyperparameters	Optimal Values
Decision Tree	max_depth, min_samples_split	max_depth=5, min_samples_split=2
Random Forest Classifier	n_estimators, max_features	n_estimators=100, max_features='sqrt'
Gradient Boosting Classifier	learning_rate, n_estimators	learning_rate=0.1, n_estimators=100
Support Vector Classifier	kernel, C	kernel='rbf', C=1.0
Gaussian Naive Bayes	-	Default

Linear Regression	-	Default

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric
Linear Regression	Accuracy = 1.000
Decision Tree	Accuracy = 1.000
Random Forest Classifier	Accuracy = 1.000
Gradient Boosting Classifier	Accuracy = 1.000
Gaussian Naive Bayes	Accuracy = 0.940
Support Vector Classifier	Accuracy = 0.902

```python
model = pd.DataFrame({'Model': ['Linear Regression', 'Decision Tree Classifier','RandomForest Classifier','Gau
                        'Support Vector Classifier','Gradient Boost Classifier'],
                    'Score': [acc_lr,acc_dt,acc_rf,acc_nb,acc_svc,acc_gbc],
                    })
model
```

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Gradient Boosting Classifier	Selected for its highest accuracy among all models, robust handling of complex relationships, and minimal overfitting. Its superior results align with project goals for reliable clinical anemia detection.