Model Optimization and Tuning Phase Report

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Team ID	SWTID1749641473
Project Title	Early Prediction for Chronic Kidney Disease Detection: A Progressive Approach to Health Management
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
| XGBoost | ```python
model = XGBClassifier(objective='binary:logistic',
                      eval_metric='logloss',
                      use_label_encoder=False,
                      random_state=42)
model.fit(X_train, y_train)
``` | ```python
y_pred = model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print(f"Model Accuracy on Test Set (XGBoost): {accuracy:.4f}")
```<br>✅ Final Accuracy Score: 98.75% |

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric (Accuracy)

XGBoost	<pre>--- Classification Report ---
	              precision recall f1-score support
	
	    Not CKD 0.97 1.00 0.98 30
	        CKD 1.00 0.98 0.99 50
	
	   accuracy 0.99 80
	  macro avg 0.98 0.99 0.99 80
	weighted avg 0.99 0.99 0.99 80
	
	✅ Final Accuracy Score: 98.75%</pre>

Final Model Selection Justification (2 Marks):

The **XGBoost** model was selected as the final model due to its exceptional predictive performance, achieving **98.75%** accuracy on the test set. It effectively handles complex relationships in data, offers robust regularization to reduce overfitting, and provides interpretable feature importance scores. These strengths make it highly suitable for medical diagnosis tasks such as chronic kidney disease prediction.