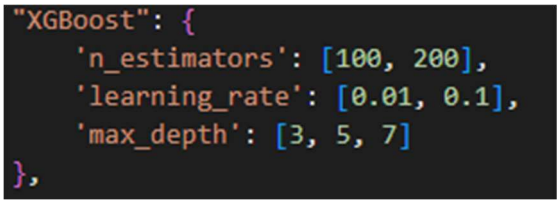
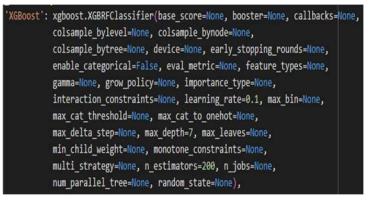
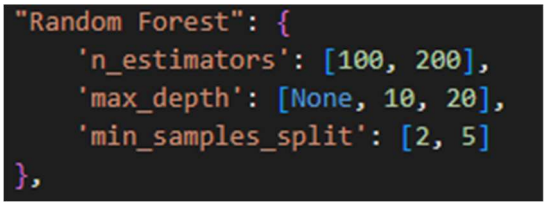
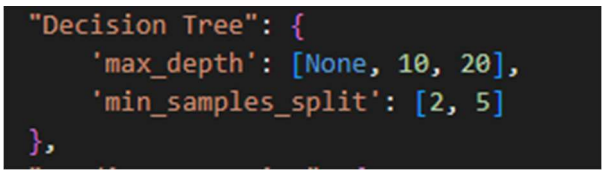
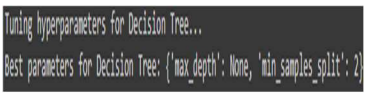
Model Optimization and Tuning Phase Template

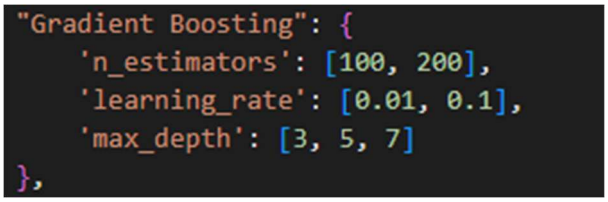
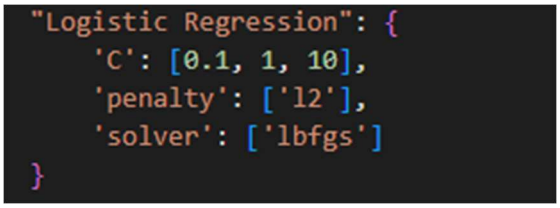
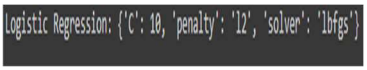
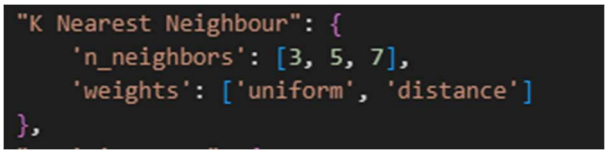
Date	23 September 2024
Team ID	LTVIP2024TMID24992
Project Title	Rainfall Prediction Using Machine Learning
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

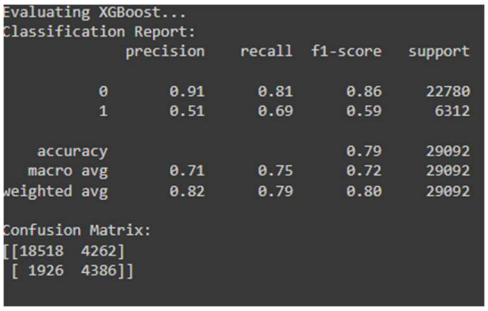
The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

Hyperparameter Tuning Documentation (6 Marks):

Model	Tuned Hyperparameters	Optimal Values
XGBoost		
Random Forest Classifier		
Decision Tree Classifier		

Gradient Boosting Classifier		
Logistic Regression		
K Nearest Neighbour		

Performance Metrics Comparison Report (2 Marks):

Model	Baseline Metric	Optimized Metric
XGBoost	78%	

Random Forest Classifier	83%	Evaluating Random Forest... Classification Report: precision recall f1-score support 0 0.88 0.92 0.90 22780 1 0.65 0.56 0.60 6312 accuracy 0.84 29092 macro avg 0.77 0.74 0.75 29092 weighted avg 0.83 0.84 0.83 29092 Confusion Matrix: [[20881 1899] [2795 3517]]
Decision Tree Classifier	76%	Evaluating Decision Tree... Classification Report: precision recall f1-score support 0 0.86 0.83 0.85 22780 1 0.46 0.52 0.49 6312 accuracy 0.76 29092 macro avg 0.66 0.67 0.67 29092 weighted avg 0.77 0.76 0.77 29092 Confusion Matrix: [[18895 3885] [3043 3269]]
Gradient Boosting Classifier	81%	Evaluating Gradient Boosting... Classification Report: precision recall f1-score support 0 0.87 0.94 0.91 22780 1 0.70 0.51 0.59 6312 accuracy 0.85 29092 macro avg 0.79 0.72 0.75 29092 weighted avg 0.84 0.85 0.84 29092 Confusion Matrix: [[21400 1380] [3091 3221]]
Logistic Regression	76%	Evaluating Logistic Regression... Classification Report: precision recall f1-score support 0 0.92 0.78 0.84 22780 1 0.48 0.75 0.58 6312 accuracy 0.77 29092 macro avg 0.70 0.76 0.71 29092 weighted avg 0.82 0.77 0.79 29092 Confusion Matrix: [[17693 5087] [1606 4706]]
K Nearest Neighbour	73%	Evaluating K Nearest Neighbour... Classification Report: precision recall f1-score support 0 0.89 0.77 0.83 22780 1 0.44 0.66 0.53 6312 accuracy 0.75 29092 macro avg 0.67 0.71 0.68 29092 weighted avg 0.79 0.75 0.76 29092 Confusion Matrix: [[17561 5219] [2167 4145]]

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Gradient Boosting Classifier	The Gradient Boosting Classifier model was selected for its superior performance, exhibiting high accuracy during hyperparameter tuning, Its ability to handle complex relationships, minimize overfitting, and optimize predictive accuracy aligns with project objectives, justifying its selection as the final model