Model Optimization and Tuning Phase Template

Date	18 June 2025
Team ID	SWTID1749653449
Project Title	*Economic Growth: A Machine Learning Approach to GDP per Capita Prediction*
Maximum Marks	10 Marks

Model Optimization and Tuning Phase Project

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
Linear Regression	No hyperparameters	—
Random Forest Regressor	`n_estimators`, `max_depth`, `min_samples_split`	`n_estimators=150`, `max_depth=20`, `min_samples_split=4`
Support Vector Regressor (SVR)	`kernel`, `C`, `epsilon`, `gamma`	`kernel='rbf'`, `C=10`, `epsilon=0.2`, `gamma='scale'`

Performance Metrics Comparison Report (2 Marks):

Model	R^2 Score	RMSE
Linear Regression	0.78 *** Linear Regression Model *** Score for Linear Regression model is 0.7826114237194834 RMSE for Linear Regression model is 4649.544639823302	~ 4650
Random Forest Regressor	0.91 *** Random Forest Regressor Model *** Score for Random Forest Regressor Model is 0.911712681380659 RMSE for Random Forest Regressor Model is 2963.065323889496	~ 2964
Support Vector Regressor	-0.26 *** SVR Model *** Score for SVR Model is -0.26118547459767205 RMSE for SVR Model is 11199.059258238174	~ 11200

Final Model Selection Justification (2 Marks):

Final Model	Random Forest Regressor
Reasoning	The Random Forest Regressor demonstrated the highest R^2 score and lowest RMSE and MAE among all tested models. Its ability to handle non-linear relationships and reduce overfitting through ensemble learning aligns well with the project's objective of accurately predicting GDP per capita. Hence, it was selected as the final model.