Model Optimization and Tuning Phase Report

Date	22 JUNE 2025
Project Title	Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation
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
Shallow CNN	Conv2D filters, Dense units, Dropout rate	16 filters, 64 units, Dropout 0.3
Deep CNN	Conv2D filters, Dense units, Dropout rate	32/64/128 filters, 256 units, Dropout 0.5
CNN + LSTM	Conv2D filters, LSTM units, Dense units, Dropout rate	32/64 filters, 64 LSTM units, 128 units, Dropout 0.5
CNN + GRU + Attention	Conv2D filters, GRU units, Attention, Dense units, Dropout rate	32/64 filters, 64 GRU units, Attention, 128 units, Dropout 0.5

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric (Macro F1 Score %)
Shallow CNN	67%
Deep CNN	91%
CNN + LSTM	80%
CNN + GRU + Attention	60%

Final Model Selection Justification (2 Marks):

Final Model

Deep CNN

Reasoning

The Deep CNN model was selected for its superior performance, exhibiting the highest macro F1 score (91%) during model evaluation. Its ability to extract complex features from 2-D ECG spectral images, minimize misclassification, and optimize predictive accuracy aligns with the project objectives, justifying its selection as the final model