Model Optimization and Tuning Phase Template

Date	7 Feb 2025
Team ID	xxxxxx
Project Title	xxxxxx
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining neural network 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 (8 Marks):

Model	Tuned Hyperparameters				
	Tuned Hyperparameter	**Description**	**Initial Value**	**Final Value**	**Impact on Performance**
Model 1	**Learning Rate**	Controls the step size during model weight updates.	0.001	0.0005	Improved stability, reduced oscillations during training, slightly better validation accuracy.
	Batch Size	Number of images processed in one iteration.	32	64	Faster training, slightly improved accuracy.

	Number of Epochs	Number of complete passes through the training dataset.	100	75	Avoided overfitting; improved validation accuracy.
	Dropout Rate	Fraction of neurons randomly dropped during training to prevent overfitting.	0.3 (various layers)	0.4 (various layers)	Improved generalization, slightly reduced overfitting.

```
# First Conv Block
model.add(Conv2D(32, (3, 3), activation='relu', padding='same', input_shape=input_shape))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.3))
```

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Model 1	The optimized Model 1 was selected as the final model because the hyperparameter tuning resulted in a significant improvement in its performance. Specifically, adjusting the learning rate, batch size,

	number of epochs, and dropout rates led to improved validation accuracy and better generalization, without a significant increase in training time. The final settings represent the best balance between accuracy and training efficiency obtained through experimentation. Further adjustments did not yield substantial improvements.