

Model Optimization and Tuning Phase Report

Date	25 JUNE 2025
Team ID	SWTID1749974387
Project Title	Neural Networks Ahoy: Cutting-Edge Ship Classification For Maritime Mastery
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
VGG16 CNN	<pre> from tensorflow.keras.applications import VGG16 from tensorflow.keras.models import Model from tensorflow.keras.layers import Flatten, Dense, Dropout from tensorflow.keras.optimizers import Adam def build_vgg16_model(input_shape=(224, 224, 3), num_classes=5): base_model = VGG16(include_top=False, weights='imagenet', input_shape=input_shape) for layer in base_model.layers: layer.trainable = False for layer in base_model.layers[-4:]: layer.trainable = True x = Flatten(name='flatten')(base_model.output) x = Dense(4096, activation='relu')(x) x = Dense(1072, activation='relu')(x) x = Dropout(0.2)(x) output = Dense(num_classes, activation='softmax')(x) model = Model(inputs=base_model.input, outputs=output) model.compile(optimizer=Adam(learning_rate=1e-4), loss='categorical_crossentropy', metrics=['accuracy']) return model </pre>	<pre> from keras.callbacks import ReduceLROnPlateau lr_scheduler = ReduceLROnPlateau(monitor='val_loss', patience=3, factor=0.2, verbose=1) </pre>

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric			
VGG16 CNN		precision	recall	f1-score
	1	0.93	0.93	0.93
	2	0.97	0.98	0.97
	3	0.99	0.96	0.98
	4	0.99	0.99	0.99
	5	0.90	0.92	0.91
		support		
		318		
		175		
	accuracy			0.95
	macro avg	0.96	0.96	0.96
	weighted avg	0.95	0.95	0.95
				938

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
VGG16 CNN	The VGG16-based Convolutional Neural Network was selected for its proven effectiveness in image classification tasks. It achieved high validation accuracy during training and generalizes well due to its deep architecture and transfer learning capabilities. Its ability to extract hierarchical features from ship images aligned perfectly with the project's goal of classifying ships into distinct categories with high confidence.

