

Model Optimization and Tuning Phase

Date	15 March 2024
Team ID	739675
Project Title	Cleantech: Transforming Waste Management With Transfer Learning
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
Vgg16_model	<p>Batch Size: Set to 15 for efficient training</p> <pre>[] train_datagen=ImageDataGenerator(rescale=1./255, zoom_range=0.2, shear_range=0.2) test_datagen=ImageDataGenerator(rescale=1./255)</pre> <p>Epochs: Set to 9 epochs for good balance between underfitting and Overfitting</p> <p>Augmentation Parameters: Shear range, zoom range, and horizontal flipping used to improve generalization .</p>

	<pre>layer.trainable = False # Ensure the model is compiled before training vgg16.compile(optimizer=Adam(learning_rate=1e-5), loss='categorical_crossentropy', metrics=['accuracy']) early_stopping = EarlyStopping(monitor='val_loss', patience=3, restore_best_weights=True) # Fit the model using the extracted data history = vgg16.fit(X_train, y_train, validation_data=(X_val, y_val), epochs=50, callbacks=[early_stopping])</pre> <p>Class weights: {0: np.float64(1.0), 1: np.float64(1.0), 2: np.float64(1.0)}</p> <p>Epoch 1/50</p> <p>1/1 13s 13s/step - accuracy: 0.2812 - loss: 1.2703 - val</p>
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Final Model Selection Justification (2 Marks):

Final Model	Reasoning
VGG16 (Transfer Learning)	Selected because it achieves high accuracy with fewer epochs, uses pretrained "ImageNet" features effectively, avoids overfitting (due to augmentation and freezing initial layers), reduces training time compared to building CNN from scratch, and is suitable for waste image classification.