Model Optimization and Tuning Phase Template

Date	14 December 2024
Team ID	740062
Project Title	Plant seedling classification using Deep 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
CNN Base Model (VGG16)	Categorical Crossentropy, Metrics, Optimizer.

```python
# Freeze all layers in the base model
for layer in xception.layers:
    layer.trainable = False

# Add custom layers
X = Flatten()(xception.output)
prediction = Dense(12, activation='softmax')(X)

# Create the final model
model = Model(inputs=xception.input, outputs=prediction)

# Compile the model
model.compile(
    loss='categorical_crossentropy',   # Loss function
    optimizer='adam',                  # Optimizer
    metrics=['accuracy']               # Evaluation metrics
)

# Model summary (optional)
model.summary()
```

Fine Tuning	Unfreezing Layers, Learning Rate, Number of Epochs.

	``python
	# Unfreeze some layers in the base model for fine-tuning
	for layer in xception.layers[-4:]: # Unfreeze the last 4 layers (adjust as needed)
	    layer.trainable = True
	
	# Recompile the model with a lower learning rate for fine-tuning
	from tensorflow.keras.optimizers import Adam
	
	model.compile(
	    loss='categorical_crossentropy',
	    optimizer=Adam(learning_rate=1e-5), # Smaller learning rate for fine-tuning
	    metrics=['accuracy']
	)
	
	# Fine-tuning the model
	r_fine_tune = model.fit(
	    training_set,
	    validation_data=test_dataset,
	    epochs=5, # Fine-tune for fewer epochs
	    steps_per_epoch=steps_per_epoch,
	    validation_steps=validation_steps
	)
	``
	Copy code

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Fine Tuning	We have selected the Fine Tuning model for its accuracy which is greater than other models.