

Model Development Phase Template

Date	14 December 2024
Team ID	739961
Project Title	Plant seedling Classification using Deep Learning
Maximum Marks	10 Marks

Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Initial Model Training Code (5 marks):

```
# Set the number of steps per epoch and validation steps
steps_per_epoch = len(training_set) // 32 # 32 is batch_size
validation_steps = len(test_dataset) // 32 # 32 is batch_size

# Start model training
r = model.fit(
    training_set,
    validation_data=test_dataset,
    epochs=10,
    steps_per_epoch=steps_per_epoch,
    validation_steps=validation_steps
)
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics
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<p>CNN model (Base Model)</p>	<pre># Add custom layers on top of the pre-trained model X = Flatten()(xception.output) # Flatten the feature maps prediction = Dense(12, activation='softmax')(X) # Final dense layer for classification # Create the complete model model = Model(inputs=xception.input, outputs=prediction) # Print the model summary model.summary() # Compile the model model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])</pre>	<pre>Epoch 1/10 ... 4/4 146/step - accuracy: 0.1521 - loss: 9.4402 - val_accuracy: 0.0889 - val_loss: 19.6136 Epoch 2/10 ... 4/4 146/step - accuracy: 0.3125 - loss: 11.3158 - val_accuracy: 0.0819 - val_loss: 17.6900 Epoch 3/10 ... 4/4 146/step - accuracy: 0.3107 - loss: 9.1201 - val_accuracy: 0.0781 - val_loss: 18.3891 Epoch 4/10 ... 4/4 146/step - accuracy: 0.4381 - loss: 7.3388 - val_accuracy: 0.0844 - val_loss: 24.8223 Epoch 5/10 ... 4/4 146/step - accuracy: 0.4896 - loss: 7.5758 - val_accuracy: 0.0819 - val_loss: 25.4674 Epoch 6/10 ... 4/4 146/step - accuracy: 0.3542 - loss: 8.7956 - val_accuracy: 0.0819 - val_loss: 23.7966 Epoch 7/10 ... 4/4 146/step - accuracy: 0.4698 - loss: 6.4703 - val_accuracy: 0.0819 - val_loss: 25.7789 Epoch 8/10 ... 4/4 146/step - accuracy: 0.5508 - loss: 6.3439 - val_accuracy: 0.0830 - val_loss: 29.2279 Epoch 9/10 ... 4/4 146/step - accuracy: 0.5719 - loss: 5.4253 - val_accuracy: 0.0795 - val_loss: 29.1835 Epoch 10/10 ... 4/4 146/step - accuracy: 0.5656 - loss: 6.3408 - val_accuracy: 0.0768 - val_loss: 29.5912</pre>
<p>Fine Tuning</p>	<pre># Unfreeze some layers in the Xception model for fine-tuning for layer in xception.layers[-20:]: # Example: Unfreeze the last 20 layers layer.trainable = True # Recompile the model with a lower learning rate model.compile(loss='categorical_crossentropy', optimizer=tf.keras.optimizers.Adam(learning_rate=1e-5), # Reduced learning rate metrics=['accuracy']) # Fine-tune 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)</pre>	<pre>Epoch 1/5 ... 4/4 219s 19s/step - accuracy: 0.3021 - loss: 11.8456 - val_accuracy: 0.0781 - val_loss: 29.8364 Epoch 2/5 ... 4/4 78s 23s/step - accuracy: 0.2896 - loss: 11.5190 - val_accuracy: 0.0768 - val_loss: 30.0466 Epoch 3/5 ... 4/4 65s 28s/step - accuracy: 0.4115 - loss: 7.9222 - val_accuracy: 0.0756 - val_loss: 30.3446 Epoch 4/5 ... 4/4 59s 17s/step - accuracy: 0.3219 - loss: 8.5186 - val_accuracy: 0.0756 - val_loss: 30.2222 Epoch 5/5 ... 4/4 65s 28s/step - accuracy: 0.4698 - loss: 7.6888 - val_accuracy: 0.0730 - val_loss: 30.5238</pre> <p>+ Code + Text</p>