ARI3129 – Transfer Learning and Fine-Tuning

Note: There was no use of Generative AI whilst carrying out all the below tasks.

Task 1: Varying the learning rate

Comparison of learning rates:

Learning Rate	Initial Training Results	Second Training Results	Final Test Results
0.0001	Accuracy = 91% Loss = 0.216 Validation Set Accuracy = 96.2% Validation Loss = 0.133	Accuracy = 95.55% Loss = 0.109 Validation Set Accuracy = 98.5% Validation Loss = 0.047	Test Accuracy = 99.48% Test Loss = 0.0235
0.001	Accuracy = 95.2% Loss = 0.119 Validation Set Accuracy = 98.5% Validation Loss = 0.051	Accuracy = 98.6% Loss = 0.0286 Validation Set Accuracy = 98.4% Validation Loss = 0.0936	Test Accuracy = 99% Test Loss = 0.043
0.01	Accuracy = 95.2% Loss = 0.148 Validation Set Accuracy = 97.5% Validation Loss = 0.632	Accuracy = 97.4% Loss = 0.111 Validation Set Accuracy = 51.1% Validation Loss = 0.0629	Test Accuracy = 53.3% Test Loss = 0.0663
0.1	Accuracy = 95.9% Loss = 0.954 Validation Set Accuracy = 97.7% Validation Loss = 0.516	Accuracy = 92.8% Loss = 0.1615 Validation Set Accuracy = 49.9% Validation Loss = 110.922	Test Accuracy = 49.4% Test Loss = 112.178

Summary: Increasing the learning rate of the model does not lead to much change in both accuracy and loss before the model is fine-tuned. However, after fine-tuning, the model suffers from a decrease in accuracy and an increase in loss whenever the learning rate decreases. This is especially true when the learning rate is equal to 0.1, causing the model to have just a 49.9% validation accuracy, a 49.4% test accuracy, and both a validation and test loss of over 110. This shows that the learning rate is not sufficient for this model.

Task 2: Fine-Tuning

Optimizer	Initial Training Results	Second Training Results	Final Test Results
RMSprop	Accuracy = 91% Loss = 0.216 Validation Set Accuracy = 96.2% Validation Loss = 0.133	Accuracy = 95.55% Loss = 0.109 Validation Set Accuracy = 98.5% Validation Loss = 0.047	Test Accuracy = 99.48% Test Loss = 0.0235
Adam	Accuracy = 91% Loss = 0.216 Validation Set Accuracy = 96.2% Validation Loss = 0.133	Accuracy = 94.2% Loss = 0.1476 Validation Set Accuracy = 98.4% Validation Loss = 0.0439	Test Accuracy = 97.9% Test Loss = 0.0508

Task 3: Trying a different architecture

Note: Before creating the models using each architecture, care was taken to ensure that the input images were rescaled using the preprocessing method provided by the architecture model.

Architecture	Initial Training Results	Second Training Results	Final Test Results
MobileNetv2	Accuracy = 91% Loss = 0.216 Validation Set Accuracy = 96.2% Validation Loss = 0.133	Accuracy = 95.55% Loss = 0.109 Validation Set Accuracy = 98.5% Validation Loss = 0.047	Test Accuracy = 99.48% Test Loss = 0.0235
Inceptionv3	Accuracy = 90.3% Loss = 0.2433 Validation Set Accuracy = 96.3% Validation Loss = 0.0989	Accuracy = 93.6% Loss = 0.1590 Validation Set Accuracy = 94.7% Validation Loss = 0.1278	Test Accuracy = 93.75% Test Loss = 0.1336
VGG-16	Accuracy = 76% Loss = 1.0020 Validation Set Accuracy = 84.3% Validation Loss = 0.5894	Accuracy = 80.9% Loss = 0.7850 Validation Set Accuracy = 85.6% Validation Loss = 0.5198	Test Accuracy = 79.167% Test Loss = 0.7381
ResNet50	Accuracy = 92.65% Loss = 0.1698 Validation Set Accuracy = 98.27% Validation Loss = 0.0756	Accuracy = 98.84% Loss = 0.0439 Validation Set Accuracy = 98.64% Validation Loss = 0.0405	Test Accuracy = 97.9% Test Loss = 0.0534