**Shape Classification**

Adjust of l2 regulation

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.005  Dropout rate: 0.3  Learning rate 0.001 | accuracy: 0.6360 - loss: 3.6893  Test accuracy: 0.6428571343421936, Test loss: 3.7569339275360107 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.001 | accuracy: 0.6897 - loss: 1.8770  Test accuracy: 0.6964285969734192, Test loss: 1.9395922422409058 |
| Batch size: 8  L2 regulation: 0.003  Dropout rate: 0.3  Learning rate 0.001 | accuracy: 0.6270 - loss: 2.8003  Test accuracy: 0.6071428656578064, Test loss: 2.7177987098693848 |

Adjust of dropout rate

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.001 | accuracy: 0.6897 - loss: 1.8770  Test accuracy: 0.6964285969734192, Test loss: 1.9395922422409058 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.7  Learning rate 0.001 | accuracy: 0.6005 - loss: 2.0586  Test accuracy: 0.6071428656578064, Test loss: 1.9925916194915771 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.2  Learning rate 0.001 | accuracy: 0.6281 - loss: 2.0759  Test accuracy: 0.625, Test loss: 2.0546669960021973 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.5  Learning rate 0.001 | accuracy: 0.6870 - loss: 1.7138  Test accuracy: 0.6428571343421936, Test loss: 1.7309602499008179 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.4  Learning rate 0.001 | accuracy: 0.5551 - loss: 2.5210  Test accuracy: 0.5892857313156128, Test loss: 2.303412914276123 |

Adjust of learning rate

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.001 | accuracy: 0.6897 - loss: 1.8770  Test accuracy: 0.6964285969734192, Test loss: 1.9395922422409058 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005 (reduce) | accuracy: 0.7756 - loss: 1.1220  Test accuracy: 0.6428571343421936, Test loss: 1.462016224861145 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.00025 (reduce) | accuracy: 0.6682 - loss: 2.0922  Test accuracy: 0.625, Test loss: 1.9534236192703247 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.00075 (reduce) | accuracy: 0.6464 - loss: 1.4718  Test accuracy: 0.625, Test loss: 1.6591202020645142 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.005 (reduce) | accuracy: 0.6124 - loss: 1.9673  Test accuracy: 0.5714285969734192, Test loss: 2.2867908477783203 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0025 (reduce) | accuracy: 0.6718 - loss: 1.5955  Test accuracy: 0.6964285969734192, Test loss: 1.6571543216705322 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0075 (reduce) | accuracy: 0.6698 - loss: 3.0198  Test accuracy: 0.6428571343421936, Test loss: 3.4581120014190674 |

Adjust Fine tune Unfreeze layer

|  |  |
| --- | --- |
| Unfreeze layer: -5  Learning rate 0.0001 | accuracy: 0.5715 - loss: 3.1844  Test accuracy: 0.5535714030265808, Test loss: 3.6702802181243896 |
| Unfreeze layer: -10  Learning rate 0.0001 | accuracy: 0.7240 - loss: 2.2268  Test accuracy: 0.6607142686843872, Test loss: 2.5474307537078857 |
| Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.7421 - loss: 2.1252  Test accuracy: 0.6964285969734192, Test loss: 2.5142531394958496 |
| Unfreeze layer: -20  Learning rate 0.0001 | accuracy: 0.7282 - loss: 1.9450  Test accuracy: 0.6607142686843872, Test loss: 2.4129436016082764 |
| Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.6420 - loss: 2.8159  Test accuracy: 0.6785714030265808, Test loss: 2.5063116550445557 |
| Unfreeze layer: -30  Learning rate 0.0001 | accuracy: 0.6433 - loss: 3.0652  Test accuracy: 0.6428571343421936, Test loss: 2.5807926654815674 |
| Unfreeze layer: -35  Learning rate 0.0001 | accuracy: 0.6138 - loss: 2.9689  Test accuracy: 0.6428571343421936, Test loss: 2.549015760421753 |
| Unfreeze layer: -40  Learning rate 0.0001 | accuracy: 0.6303 - loss: 2.2853  Test accuracy: 0.6785714030265808, Test loss: 2.413963794708252 |

Fine tune with learning rate

|  |  |
| --- | --- |
| Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.7421 - loss: 2.1252  Test accuracy: 0.6964285969734192, Test loss: 2.5142531394958496 |
| Unfreeze layer: -15  Learning rate 0.00025 | accuracy: 0.6605 - loss: 2.1640  Test accuracy: 0.6607142686843872, Test loss: 2.4123594760894775 |
| Unfreeze layer: -15  Learning rate 0.00005 | accuracy: 0.7342 - loss: 2.1474  Test accuracy: 0.6785714030265808, Test loss: 2.5051000118255615 |
| Unfreeze layer: -15  Learning rate 0.00001 | accuracy: 0.6341 - loss: 2.4676  Test accuracy: 0.625, Test loss: 2.552347421646118 |

Sequence Fine Tune

|  |  |
| --- | --- |
| Fine tune #1  Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.7421 - loss: 2.1252  Test accuracy: 0.6964285969734192, Test loss: 2.5142531394958496 |
| Fine tune #2  Unfreeze layer: -15  Learning rate 0.0075 | accuracy: 0.7374 - loss: 1.7350  Test accuracy: 0.6964285969734192, Test loss: 2.0548479557037354 |
| Fine tune #3  Unfreeze layer: -15  Learning rate 0.0075 | accuracy: 0.7240 - loss: 1.8184  Test accuracy: 0.75, Test loss: 1.5395348072052002 |
| Fine tune #4  Unfreeze layer: -15  Learning rate 0.0075 | accuracy: 0.6831 - loss: 1.5744  Test accuracy: 0.75, Test loss: 1.57294762134552 |
| Fine tune #5  Unfreeze layer: -15  Learning rate 0.0075 | accuracy: 0.7688 - loss: 1.3638  Test accuracy: 0.75, Test loss: 1.6643908023834229 |

If your goal is to improve test performance, continuing to fine-tune may not necessarily yield better results than Fine-tuning #3, as the improvements have plateaued or even degraded.

Use #3 fine tune model, adjust learning rate to bet better performance and accuracy

………………………….

Colour Classification

Base Model Adjustment

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| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005  With early stop | accuracy: 0.5851 - loss: 1.8258  Test accuracy: 0.6071428656578064, Test loss: 1.799311876296997 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005  Run 100 epoch | accuracy: 0.9333 - loss: 1.3953  Test accuracy: 0.875, Test loss: 1.503572702407837 |

Learning rate > dropout rate > l2 regularization

Adjust L2 regulation

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005 | accuracy: 0.9333 - loss: 1.3953  Test accuracy: 0.875, Test loss: 1.503572702407837 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.00025 | accuracy: 0.8388 - loss: 1.4047  Test accuracy: 0.8571428656578064, Test loss: 1.4137003421783447 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.00075 | accuracy: 0.8795 - loss: 1.2253  Test accuracy: 0.8928571343421936, Test loss: 1.2786672115325928 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.005 | accuracy: 0.8531 - loss: 1.6785  Test accuracy: 0.8571428656578064, Test loss: 1.6617695093154907  In [325]: |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0025 | accuracy: 0.8971 - loss: 1.1076  Test accuracy: 0.875, Test loss: 1.2354921102523804 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0075 | accuracy: 0.8891 - loss: 1.8889  Test accuracy: 0.8928571343421936, Test loss: 1.8578846454620361 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.001 | accuracy: 0.9519 - loss: 1.1263  Test accuracy: 0.9285714030265808, Test loss: 1.2053778171539307 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0001 | accuracy: 0.9140 - loss: 1.4307  Test accuracy: 0.8571428656578064, Test loss: 1.5752546787261963 |

Adjust on dropout rate

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.001 | accuracy: 0.8795 - loss: 1.2268  Test accuracy: 0.8928571343421936, Test loss: 1.291562795639038 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.1  Learning rate 0.001 | accuracy: 0.9378 - loss: 1.1806  Test accuracy: 0.8928571343421936, Test loss: 1.3406225442886353 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.2  Learning rate 0.001 | accuracy: 0.7249 - loss: 1.4506  Test accuracy: 0.8035714030265808, Test loss: 1.4601972103118896 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.4  Learning rate 0.001 | accuracy: 0.8722 - loss: 1.2949  Test accuracy: 0.8928571343421936, Test loss: 1.3081169128417969 |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.5  Learning rate 0.001 | accuracy: 0.9428 - loss: 0.9688  Test accuracy: 0.9107142686843872, Test loss: 1.1928136348724365 |

Adjust on l2 regularization

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.5  Learning rate 0.001 | accuracy: 0.9428 - loss: 0.9688  Test accuracy: 0.9107142686843872, Test loss: 1.1928136348724365 |
| Batch size: 8  L2 regulation: 0.0001  Dropout rate: 0.5  Learning rate 0.001 | accuracy: 0.8435 - loss: 0.6361  Test accuracy: 0.8571428656578064, Test loss: 0.5937434434890747 |
| Batch size: 8  L2 regulation: 0.005  Dropout rate: 0.5  Learning rate 0.001 | accuracy: 0.8893 - loss: 3.0728  Test accuracy: 0.875, Test loss: 3.1792900562286377 |

Fine tune unfreeze layer

|  |  |
| --- | --- |
| Unfreeze layer: -5  Learning rate 0.0001 | accuracy: 0.9201 - loss: 0.9921  Test accuracy: 0.9107142686843872, Test loss: 1.015599250793457 |
| Unfreeze layer: -10  Learning rate 0.0001 | accuracy: 0.9352 - loss: 0.9744  Test accuracy: 0.9107142686843872, Test loss: 0.9437541961669922 |
| Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.8923 - loss: 0.9493  Test accuracy: 0.9107142686843872, Test loss: 0.8712202906608582 |
| Unfreeze layer: -20  Learning rate 0.0001 | accuracy: 0.9123 - loss: 1.0680  Test accuracy: 0.9107142686843872, Test loss: 0.8313925862312317 |
| Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.9499 - loss: 0.7772  Test accuracy: 0.9285714030265808, Test loss: 0.8119930624961853 |
| Unfreeze layer: -30  Learning rate 0.0001 | accuracy: 0.9413 - loss: 0.5831  Test accuracy: 0.9285714030265808, Test loss: 0.8138152360916138 |
| Unfreeze layer: -35  Learning rate 0.0001 | accuracy: 0.9305 - loss: 0.6398  Test accuracy: 0.9107142686843872, Test loss: 0.8027634024620056 |
| Unfreeze layer: -40  Learning rate 0.0001 | accuracy: 0.9298 - loss: 0.6187  Test accuracy: 0.9107142686843872, Test loss: 0.7933946251869202 |

Fine tune learning rate

|  |  |
| --- | --- |
| Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.9499 - loss: 0.7772  Test accuracy: 0.9285714030265808, Test loss: 0.8119930624961853 |
| Unfreeze layer: -25  Learning rate 0.0075 |  |
| Unfreeze layer: -25  Learning rate 0.00025 |  |

Fine tuning

|  |  |
| --- | --- |
| Fine tune #1  Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.9036 - loss: 0.9628  Test accuracy: 0.875, Test loss: 1.0610872507095337 |
| Fine tune #2  Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.8911 - loss: 1.2090  Test accuracy: 0.875, Test loss: 1.0412023067474365 |
| Fine tune #3  Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.8943 - loss: 1.0307  Test accuracy: 0.9107142686843872, Test loss: 0.991912841796875 |
| Fine tune #4  Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.9123 - loss: 0.6946  Test accuracy: 0.9107142686843872, Test loss: 0.9706792235374451 |
| Fine tune #5  Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.9415 - loss: 0.6715  Test accuracy: 0.9285714030265808, Test loss: 0.8965980410575867 |

Fine tune #5 have chosen, further fine tune can be done on #5

Colour Classification

Base Model Adjustment

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005  With early stop |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0001  Run 100 epoch | accuracy: 0.7688 - loss: 1.3638  Test accuracy: 0.75, Test loss: 1.6643908023834229 |

Learning rate > dropout rate > l2 regularization

Adjust L2 regulation

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate 0.0005 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.00025 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.00075 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.005 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0025 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0075 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.001 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.0001 |  |

Adjust on dropout rate

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.3  Learning rate: 0.001 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.1  Learning rate 0.001 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.2  Learning rate 0.001 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.4  Learning rate 0.001 |  |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.5  Learning rate 0.001 |  |

Adjust on l2 regularization

|  |  |
| --- | --- |
| Batch size: 8  L2 regulation: 0.001  Dropout rate: 0.5  Learning rate 0.001 |  |
| Batch size: 8  L2 regulation: 0.0001  Dropout rate: 0.5  Learning rate 0.001 |  |
| Batch size: 8  L2 regulation: 0.005  Dropout rate: 0.5  Learning rate 0.001 |  |

Fine tune unfreeze layer

|  |  |
| --- | --- |
| Unfreeze layer: -5  Learning rate 0.0001 | accuracy: 0.8665 - loss: 1.0185  Test accuracy: 0.875, Test loss: 0.9952677488327026 |
| Unfreeze layer: -10  Learning rate 0.0001 | accuracy: 0.7397 - loss: 2.4557  Test accuracy: 0.875, Test loss: 1.473283052444458 |
| Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.8421 - loss: 2.0730  Test accuracy: 0.9375, Test loss: 0.9769739508628845 |
| Unfreeze layer: -20  Learning rate 0.0001 | accuracy: 0.9017 - loss: 1.0640  Test accuracy: 0.875, Test loss: 1.2698898315429688 |
| Unfreeze layer: -25  Learning rate 0.0001 | accuracy: 0.6419 - loss: 1.5721  Test accuracy: 0.8125, Test loss: 0.7563219666481018 |
| Unfreeze layer: -30  Learning rate 0.0001 | accuracy: 0.8415 - loss: 1.2048  Test accuracy: 0.875, Test loss: 0.8206470608711243 |
| Unfreeze layer: -35  Learning rate 0.0001 | accuracy: 0.9439 - loss: 0.6608  Test accuracy: 0.875, Test loss: 0.973038375377655 |
| Unfreeze layer: -40  Learning rate 0.0001 | accuracy: 0.7577 - loss: 2.0937  Test accuracy: 0.8125, Test loss: 1.043323040008545 |

Fine tuning

|  |  |
| --- | --- |
| Fine tune #1  Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.7849 - loss: 1.0083  Test accuracy: 0.75, Test loss: 1.0891468524932861 |
| Fine tune #2  Unfreeze layer: -15  Learning rate 0.0001 | accuracy: 0.9267 - loss: 0.9110  Test accuracy: 0.875, Test loss: 1.2443432807922363 |
| Fine tune #3  Unfreeze layer: -15  Learning rate 0.0001 |  |
| Fine tune #4  Unfreeze layer: -15  Learning rate 0.0001 |  |
| Fine tune #5  Unfreeze layer: -15  Learning rate 0.0001 |  |

Fine tune #5 have chosen, further fine tune can be done on #5