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MNIST

Keras

Nombre	Acierto medio (train)	Acierto medio (valoración)
1_mlp_basic.py	1	0.9833
2_mlp_batchnorm.py	0.999	0.9857
3_mlp_BN_GN.py	0.985	0.9882
4_mlp_BN_GN_LRA.py	0.991	0.9888
5_mlp_BN_GN_LRA_DA.py	0.9675	0.9899
6_mlp_BN_GN_LRA_DA+_ RLROP_Adam.py	0.9703	0.9933

1_mlp_basic.py: Red neuronal de densa de tres capas ocultas
2_mlp_batchnorm.py: se añade batch normalization
3_mlp_BN_GN.py: se añade el uso de ruido gausiano
4_mlp_BN_GN_LRA.py: se aplica el learnin rate annealing, sin data aumentation
5_mlp_BN_GN_LRA_DA.py: se aplica el learnin rate annealing con data augmentation de movimiento de la imagen
6_mlp_BN_GN_LRA_DA+_RROP_Adam.py: se aplica lo anterior, se mejora el data augmentation con zoom, rotación y deformación de la imagen, se reduce LR on plateau y se usa Adam. (valores por cada de epoch en Anexo)

CIFAR

Pytorch

Nombre	Acierto medio (train)	Acierto medio (valoración)
1_cifar_conv.py	0.9863	0.8259
2_cifar_LRA_DA.py	0.8673	0.8402
3_cifar_LRA_DA2.py	0.9850	0.8947
4_cifar_LRA_DA2_ResNet.py	0.9795	0.9255

1_cifar_conv.py: Red convulucional de 5 bloques
2_cifar_LRA_DA.py: Se aplica data augmentation de movimiento de la imagen y learning rate annealing
3_cifar_LRA_DA2.py: Se mejora el data augmentation con rotación, giro horizontal y escalado
4_cifar_LRA_DA2_ResNet.py: Se cambia ligeramente el data augmentation añadiendo deformación de la imagen y se usan 8 bloques de red neuronal residual (ResNet) (valores por cada de epoch en Anexo)

ANEXO

MNIST (6_mlp_BN_GN_LRA_DA+_RLROP_Adam.py):

Epoch 1/85
600/600 [==============================] - 13s 20ms/step - loss: 1.1412 - accuracy: 0.7010 - val_loss: 0.2481 - val_accuracy: 0.9282 - lr: 0.1000
Epoch 2/85
600/600 [==============================] - 12s 20ms/step - loss: 0.4927 - accuracy: 0.8476 - val_loss: 0.1783 - val_accuracy: 0.9471 - lr: 0.1000
Epoch 3/85
600/600 [==============================] - 13s 22ms/step - loss: 0.4216 - accuracy: 0.8737 - val_loss: 0.1012 - val_accuracy: 0.9682 - lr: 0.1000
Epoch 4/85
600/600 [==============================] - 13s 21ms/step - loss: 0.3802 - accuracy: 0.8853 - val_loss: 0.0924 - val_accuracy: 0.9730 - lr: 0.1000
Epoch 5/85
600/600 [==============================] - 12s 20ms/step - loss: 0.3573 - accuracy: 0.8927 - val_loss: 0.0938 - val_accuracy: 0.9721 - lr: 0.1000
Epoch 6/85
600/600 [==============================] - 12s 20ms/step - loss: 0.3373 - accuracy: 0.8979 - val_loss: 0.2470 - val_accuracy: 0.9409 - lr: 0.1000
Epoch 7/85
600/600 [==============================] - 12s 20ms/step - loss: 0.3269 - accuracy: 0.9033 - val_loss: 0.0864 - val_accuracy: 0.9722 - lr: 0.1000
Epoch 8/85
600/600 [==============================] - 12s 20ms/step - loss: 0.3123 - accuracy: 0.9082 - val_loss: 0.1036 - val_accuracy: 0.9701 - lr: 0.1000
Epoch 9/85
600/600 [==============================] - 12s 20ms/step - loss: 0.3012 - accuracy: 0.9096 - val_loss: 0.1227 - val_accuracy: 0.9623 - lr: 0.1000
Epoch 10/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2953 - accuracy: 0.9134 - val_loss: 0.0781 - val_accuracy: 0.9782 - lr: 0.1000
Epoch 11/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2864 - accuracy: 0.9161 - val_loss: 0.0762 - val_accuracy: 0.9783 - lr: 0.1000
Epoch 12/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2762 - accuracy: 0.9207 - val_loss: 0.0665 - val_accuracy: 0.9823 - lr: 0.1000
Epoch 13/85
600/600 [==============================] - 12s 21ms/step - loss: 0.2632 - accuracy: 0.9224 - val_loss: 0.0689 - val_accuracy: 0.9803 - lr: 0.1000
Epoch 14/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2566 - accuracy: 0.9247 - val_loss: 0.0581 - val_accuracy: 0.9826 - lr: 0.1000
Epoch 15/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2523 - accuracy: 0.9253 - val_loss: 0.1635 - val_accuracy: 0.9587 - lr: 0.1000
Epoch 16/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2568 - accuracy: 0.9255 - val_loss: 0.8163 - val_accuracy: 0.9080 - lr: 0.1000
Epoch 17/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2402 - accuracy:

0.9301 - val_loss: 0.0513 - val_accuracy: 0.9842 - lr: 0.1000
Epoch 18/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2406 - accuracy:
0.9300 - val_loss: 0.3581 - val_accuracy: 0.9215 - lr: 0.1000
Epoch 19/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2341 - accuracy:
0.9316 - val_loss: 0.0634 - val_accuracy: 0.9807 - lr: 0.1000
Epoch 20/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2355 - accuracy:
0.9333 - val_loss: 0.0528 - val_accuracy: 0.9847 - lr: 0.1000
Epoch 21/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2232 - accuracy:
0.9353 - val_loss: 4.0020 - val_accuracy: 0.8248 - lr: 0.1000
Epoch 22/85
600/600 [==============================] - 12s 20ms/step - loss: 0.2218 - accuracy:
0.9364 - val_loss: 0.2361 - val_accuracy: 0.9554 - lr: 0.1000
Epoch 23/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1787 - accuracy:
0.9460 - val_loss: 0.0362 - val_accuracy: 0.9885 - lr: 0.0500
Epoch 24/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1652 - accuracy:
0.9500 - val_loss: 0.0337 - val_accuracy: 0.9905 - lr: 0.0500
Epoch 25/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1707 - accuracy:
0.9491 - val_loss: 0.0359 - val_accuracy: 0.9872 - lr: 0.0500
Epoch 26/85
600/600 [==============================] - 13s 21ms/step - loss: 0.1642 - accuracy:
0.9507 - val_loss: 0.0352 - val_accuracy: 0.9887 - lr: 0.0500
Epoch 27/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1601 - accuracy:
0.9529 - val_loss: 0.0308 - val_accuracy: 0.9905 - lr: 0.0500
Epoch 28/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1602 - accuracy:
0.9525 - val_loss: 0.0419 - val_accuracy: 0.9884 - lr: 0.0500
Epoch 29/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1544 - accuracy:
0.9528 - val_loss: 0.0351 - val_accuracy: 0.9901 - lr: 0.0500
Epoch 30/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1524 - accuracy:
0.9544 - val_loss: 0.0345 - val_accuracy: 0.9886 - lr: 0.0500
Epoch 31/85
600/600 [==============================] - 16s 27ms/step - loss: 0.1544 - accuracy:
0.9535 - val_loss: 0.0330 - val_accuracy: 0.9892 - lr: 0.0500
Epoch 32/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1483 - accuracy:
0.9552 - val_loss: 0.0293 - val_accuracy: 0.9904 - lr: 0.0500
Epoch 33/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1542 - accuracy:
0.9542 - val_loss: 0.0361 - val_accuracy: 0.9902 - lr: 0.0500
Epoch 34/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1500 - accuracy:
0.9548 - val_loss: 0.0300 - val_accuracy: 0.9903 - lr: 0.0500
Epoch 35/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1439 - accuracy:
0.9560 - val_loss: 0.0315 - val_accuracy: 0.9899 - lr: 0.0500

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Epoch 36/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1446 - accuracy:
0.9567 - val_loss: 0.0310 - val_accuracy: 0.9905 - lr: 0.0500
Epoch 37/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1461 - accuracy:
0.9558 - val_loss: 0.0296 - val_accuracy: 0.9908 - lr: 0.0500
Epoch 38/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1235 - accuracy:
0.9623 - val_loss: 0.0266 - val_accuracy: 0.9916 - lr: 0.0250
Epoch 39/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1191 - accuracy:
0.9629 - val_loss: 0.0271 - val_accuracy: 0.9910 - lr: 0.0250
Epoch 40/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1184 - accuracy:
0.9634 - val_loss: 0.0244 - val_accuracy: 0.9916 - lr: 0.0250
Epoch 41/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1183 - accuracy:
0.9635 - val_loss: 0.0274 - val_accuracy: 0.9914 - lr: 0.0250
Epoch 42/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1166 - accuracy:
0.9642 - val_loss: 0.0264 - val_accuracy: 0.9914 - lr: 0.0250
Epoch 43/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1158 - accuracy:
0.9646 - val_loss: 0.0239 - val_accuracy: 0.9924 - lr: 0.0250
Epoch 44/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1158 - accuracy:
0.9646 - val_loss: 0.0280 - val_accuracy: 0.9906 - lr: 0.0250
Epoch 45/85
600/600 [==============================] - 13s 21ms/step - loss: 0.1140 - accuracy:
0.9654 - val_loss: 0.0237 - val_accuracy: 0.9919 - lr: 0.0250
Epoch 46/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1145 - accuracy:
0.9652 - val_loss: 0.0236 - val_accuracy: 0.9920 - lr: 0.0250
Epoch 47/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1096 - accuracy:
0.9662 - val_loss: 0.0239 - val_accuracy: 0.9925 - lr: 0.0250
Epoch 48/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1153 - accuracy:
0.9650 - val_loss: 0.0236 - val_accuracy: 0.9921 - lr: 0.0250
Epoch 49/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1104 - accuracy:
0.9663 - val_loss: 0.0246 - val_accuracy: 0.9916 - lr: 0.0250
Epoch 50/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1094 - accuracy:
0.9659 - val_loss: 0.0249 - val_accuracy: 0.9926 - lr: 0.0250
Epoch 51/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1107 - accuracy:
0.9662 - val_loss: 0.0229 - val_accuracy: 0.9927 - lr: 0.0250
Epoch 52/85
600/600 [==============================] - 16s 26ms/step - loss: 0.1076 - accuracy:
0.9665 - val_loss: 0.0263 - val_accuracy: 0.9924 - lr: 0.0250
Epoch 53/85
600/600 [==============================] - 12s 21ms/step - loss: 0.1083 - accuracy:
0.9669 - val_loss: 0.0228 - val_accuracy: 0.9924 - lr: 0.0250
Epoch 54/85
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600/600 [==============================] - 12s 20ms/step - loss: 0.1044 - accuracy: 0.9669 - val_loss: 0.0241 - val_accuracy: 0.9927 - lr: 0.0250
Epoch 55/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1052 - accuracy: 0.9678 - val_loss: 0.0231 - val_accuracy: 0.9925 - lr: 0.0250
Epoch 56/85
600/600 [==============================] - 12s 20ms/step - loss: 0.1053 - accuracy: 0.9676 - val_loss: 0.0236 - val_accuracy: 0.9921 - lr: 0.0250
Epoch 57/85
600/600 [==============================] - 13s 21ms/step - loss: 0.1000 - accuracy: 0.9686 - val_loss: 0.0199 - val_accuracy: 0.9929 - lr: 0.0125
Epoch 58/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0960 - accuracy: 0.9697 - val_loss: 0.0225 - val_accuracy: 0.9926 - lr: 0.0125
Epoch 59/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0983 - accuracy: 0.9694 - val_loss: 0.0197 - val_accuracy: 0.9933 - lr: 0.0125
Epoch 60/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0935 - accuracy: 0.9711 - val_loss: 0.0212 - val_accuracy: 0.9931 - lr: 0.0125
Epoch 61/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0964 - accuracy: 0.9702 - val_loss: 0.0229 - val_accuracy: 0.9926 - lr: 0.0125
Epoch 62/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0917 - accuracy: 0.9720 - val_loss: 0.0204 - val_accuracy: 0.9934 - lr: 0.0125
Epoch 63/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0958 - accuracy: 0.9700 - val_loss: 0.0231 - val_accuracy: 0.9926 - lr: 0.0125
Epoch 64/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0929 - accuracy: 0.9709 - val_loss: 0.0229 - val_accuracy: 0.9929 - lr: 0.0125
Epoch 65/85
600/600 [==============================] - 16s 27ms/step - loss: 0.0902 - accuracy: 0.9712 - val_loss: 0.0196 - val_accuracy: 0.9927 - lr: 0.0063
Epoch 66/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0909 - accuracy: 0.9716 - val_loss: 0.0187 - val_accuracy: 0.9933 - lr: 0.0063
Epoch 67/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0879 - accuracy: 0.9722 - val_loss: 0.0202 - val_accuracy: 0.9933 - lr: 0.0063
Epoch 68/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0878 - accuracy: 0.9723 - val_loss: 0.0190 - val_accuracy: 0.9939 - lr: 0.0063
Epoch 69/85
600/600 [==============================] - 13s 21ms/step - loss: 0.0855 - accuracy: 0.9724 - val_loss: 0.0193 - val_accuracy: 0.9933 - lr: 0.0063
Epoch 70/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0870 - accuracy: 0.9725 - val_loss: 0.0193 - val_accuracy: 0.9934 - lr: 0.0063
Epoch 71/85
600/600 [==============================] - 12s 20ms/step - loss: 0.0877 - accuracy: 0.9727 - val_loss: 0.0187 - val_accuracy: 0.9934 - lr: 0.0063
Epoch 72/85
600/600 [==============================] - 13s 21ms/step - loss: 0.0863 - accuracy:

0.9729 - val_loss: 0.0185 - val_accuracy: 0.9935 - lr: 0.0031
Epoch 73/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0843 - accuracy: 0.9733 - val_loss: 0.0192 - val_accuracy: 0.9933 - lr: 0.0031
Epoch 74/85
600/600 [==============================] - 14s 24ms/step - loss: 0.0843 - accuracy: 0.9736 - val_loss: 0.0194 - val_accuracy: 0.9936 - lr: 0.0031
Epoch 75/85
600/600 [==============================] - 15s 25ms/step - loss: 0.0815 - accuracy: 0.9745 - val_loss: 0.0188 - val_accuracy: 0.9939 - lr: 0.0031
Epoch 76/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0846 - accuracy: 0.9732 - val_loss: 0.0191 - val_accuracy: 0.9933 - lr: 0.0031
Epoch 77/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0866 - accuracy: 0.9721 - val_loss: 0.0184 - val_accuracy: 0.9939 - lr: 0.0031
Epoch 78/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0830 - accuracy: 0.9735 - val_loss: 0.0188 - val_accuracy: 0.9933 - lr: 0.0016
Epoch 79/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0795 - accuracy: 0.9750 - val_loss: 0.0182 - val_accuracy: 0.9940 - lr: 0.0016
Epoch 80/85
600/600 [==============================] - 13s 21ms/step - loss: 0.0820 - accuracy: 0.9746 - val_loss: 0.0184 - val_accuracy: 0.9940 - lr: 0.0016
Epoch 81/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0813 - accuracy: 0.9740 - val_loss: 0.0181 - val_accuracy: 0.9937 - lr: 0.0016
Epoch 82/85
600/600 [==============================] - 16s 27ms/step - loss: 0.0833 - accuracy: 0.9731 - val_loss: 0.0175 - val_accuracy: 0.9941 - lr: 0.0016
Epoch 83/85
600/600 [==============================] - 14s 23ms/step - loss: 0.0815 - accuracy: 0.9736 - val_loss: 0.0180 - val_accuracy: 0.9939 - lr: 0.0016
Epoch 84/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0781 - accuracy: 0.9750 - val_loss: 0.0181 - val_accuracy: 0.9934 - lr: 0.0016
Epoch 85/85
600/600 [==============================] - 13s 22ms/step - loss: 0.0833 - accuracy: 0.9735 - val_loss: 0.0178 - val_accuracy: 0.9938 - lr: 0.0016

CIFAR (4_cifar_LRA_DA2_ResNet.py):

[Epoch 1] LR: 0.100 - Train Loss: 0.01736 - Test Loss: 0.01430 - Train Accuracy: 36.53% - Test Accuracy: 47.83%
[Epoch 2] LR: 0.100 - Train Loss: 0.01309 - Test Loss: 0.01136 - Train Accuracy: 52.48% - Test Accuracy: 59.17%
[Epoch 3] LR: 0.100 - Train Loss: 0.01097 - Test Loss: 0.00982 - Train Accuracy: 61.00% - Test Accuracy: 65.55%
[Epoch 4] LR: 0.100 - Train Loss: 0.00956 - Test Loss: 0.00885 - Train Accuracy: 66.42% - Test Accuracy: 68.85%
[Epoch 5] LR: 0.100 - Train Loss: 0.00846 - Test Loss: 0.00733 - Train Accuracy: 70.05% - Test Accuracy: 74.62%
[Epoch 6] LR: 0.100 - Train Loss: 0.00763 - Test Loss: 0.00712 - Train Accuracy: 73.42% -

Test Accuracy: 75.34%
[Epoch 7] LR: 0.100 - Train Loss: 0.00704 - Test Loss: 0.00671 - Train Accuracy: 75.28% - Test Accuracy: 77.30%
[Epoch 8] LR: 0.100 - Train Loss: 0.00657 - Test Loss: 0.00608 - Train Accuracy: 77.07% - Test Accuracy: 79.04%
[Epoch 9] LR: 0.100 - Train Loss: 0.00617 - Test Loss: 0.00591 - Train Accuracy: 78.38% - Test Accuracy: 79.55%
[Epoch 10] LR: 0.100 - Train Loss: 0.00579 - Test Loss: 0.00514 - Train Accuracy: 80.00% - Test Accuracy: 82.11%
[Epoch 11] LR: 0.100 - Train Loss: 0.00546 - Test Loss: 0.00581 - Train Accuracy: 80.93% - Test Accuracy: 81.13%
[Epoch 12] LR: 0.100 - Train Loss: 0.00521 - Test Loss: 0.00523 - Train Accuracy: 82.01% - Test Accuracy: 81.98%
[Epoch 13] LR: 0.100 - Train Loss: 0.00495 - Test Loss: 0.00535 - Train Accuracy: 82.72% - Test Accuracy: 82.13%
[Epoch 14] LR: 0.100 - Train Loss: 0.00472 - Test Loss: 0.00456 - Train Accuracy: 83.59% - Test Accuracy: 84.92%
[Epoch 15] LR: 0.100 - Train Loss: 0.00454 - Test Loss: 0.00474 - Train Accuracy: 84.10% - Test Accuracy: 84.27%
[Epoch 16] LR: 0.100 - Train Loss: 0.00436 - Test Loss: 0.00488 - Train Accuracy: 84.80% - Test Accuracy: 84.16%
[Epoch 17] LR: 0.100 - Train Loss: 0.00417 - Test Loss: 0.00516 - Train Accuracy: 85.27% - Test Accuracy: 83.44%
[Epoch 18] LR: 0.100 - Train Loss: 0.00400 - Test Loss: 0.00468 - Train Accuracy: 86.02% - Test Accuracy: 84.32%
[Epoch 19] LR: 0.100 - Train Loss: 0.00389 - Test Loss: 0.00435 - Train Accuracy: 86.38% - Test Accuracy: 85.74%
[Epoch 20] LR: 0.100 - Train Loss: 0.00375 - Test Loss: 0.00453 - Train Accuracy: 86.93% - Test Accuracy: 85.74%
[Epoch 21] LR: 0.100 - Train Loss: 0.00365 - Test Loss: 0.00460 - Train Accuracy: 87.09% - Test Accuracy: 85.48%
[Epoch 22] LR: 0.100 - Train Loss: 0.00354 - Test Loss: 0.00429 - Train Accuracy: 87.43% - Test Accuracy: 86.39%
[Epoch 23] LR: 0.100 - Train Loss: 0.00335 - Test Loss: 0.00384 - Train Accuracy: 88.20% - Test Accuracy: 87.85%
[Epoch 24] LR: 0.100 - Train Loss: 0.00332 - Test Loss: 0.00374 - Train Accuracy: 88.20% - Test Accuracy: 87.81%
[Epoch 25] LR: 0.100 - Train Loss: 0.00318 - Test Loss: 0.00389 - Train Accuracy: 88.81% - Test Accuracy: 87.39%
[Epoch 26] LR: 0.100 - Train Loss: 0.00307 - Test Loss: 0.00365 - Train Accuracy: 89.21% - Test Accuracy: 87.85%
[Epoch 27] LR: 0.100 - Train Loss: 0.00301 - Test Loss: 0.00372 - Train Accuracy: 89.39% - Test Accuracy: 88.14%
[Epoch 28] LR: 0.100 - Train Loss: 0.00288 - Test Loss: 0.00364 - Train Accuracy: 89.73% - Test Accuracy: 88.35%
[Epoch 29] LR: 0.100 - Train Loss: 0.00285 - Test Loss: 0.00368 - Train Accuracy: 89.94% - Test Accuracy: 88.56%
[Epoch 30] LR: 0.100 - Train Loss: 0.00275 - Test Loss: 0.00361 - Train Accuracy: 90.40% - Test Accuracy: 89.03%
[Epoch 31] LR: 0.100 - Train Loss: 0.00268 - Test Loss: 0.00385 - Train Accuracy: 90.67% - Test Accuracy: 88.54%
[Epoch 32] LR: 0.100 - Train Loss: 0.00256 - Test Loss: 0.00380 - Train Accuracy: 91.00% - Test Accuracy: 88.75%
[Epoch 33] LR: 0.100 - Train Loss: 0.00252 - Test Loss: 0.00354 - Train Accuracy: 91.08% - Test Accuracy: 89.20%

[Epoch 34] LR: 0.100 - Train Loss: 0.00243 - Test Loss: 0.00352 - Train Accuracy: 91.48% - Test Accuracy: 89.25%
[Epoch 35] LR: 0.100 - Train Loss: 0.00241 - Test Loss: 0.00364 - Train Accuracy: 91.48% - Test Accuracy: 88.98%
[Epoch 36] LR: 0.100 - Train Loss: 0.00237 - Test Loss: 0.00365 - Train Accuracy: 91.56% - Test Accuracy: 89.42%
[Epoch 37] LR: 0.100 - Train Loss: 0.00230 - Test Loss: 0.00454 - Train Accuracy: 91.89% - Test Accuracy: 87.96%
[Epoch 38] LR: 0.100 - Train Loss: 0.00222 - Test Loss: 0.00312 - Train Accuracy: 92.25% - Test Accuracy: 90.50%
[Epoch 39] LR: 0.100 - Train Loss: 0.00213 - Test Loss: 0.00359 - Train Accuracy: 92.43% - Test Accuracy: 89.44%
[Epoch 40] LR: 0.100 - Train Loss: 0.00210 - Test Loss: 0.00383 - Train Accuracy: 92.64% - Test Accuracy: 88.91%
[Epoch 41] LR: 0.100 - Train Loss: 0.00205 - Test Loss: 0.00337 - Train Accuracy: 92.67% - Test Accuracy: 89.90%
[Epoch 42] LR: 0.100 - Train Loss: 0.00197 - Test Loss: 0.00354 - Train Accuracy: 92.98% - Test Accuracy: 89.73%
[Epoch 43] LR: 0.100 - Train Loss: 0.00191 - Test Loss: 0.00325 - Train Accuracy: 93.14% - Test Accuracy: 90.71%
[Epoch 44] LR: 0.100 - Train Loss: 0.00185 - Test Loss: 0.00356 - Train Accuracy: 93.37% - Test Accuracy: 90.18%
[Epoch 45] LR: 0.100 - Train Loss: 0.00184 - Test Loss: 0.00353 - Train Accuracy: 93.38% - Test Accuracy: 89.31%
[Epoch 46] LR: 0.100 - Train Loss: 0.00183 - Test Loss: 0.00385 - Train Accuracy: 93.51% - Test Accuracy: 89.62%
[Epoch 47] LR: 0.100 - Train Loss: 0.00175 - Test Loss: 0.00345 - Train Accuracy: 93.71% - Test Accuracy: 90.46%
[Epoch 48] LR: 0.100 - Train Loss: 0.00170 - Test Loss: 0.00374 - Train Accuracy: 93.90% - Test Accuracy: 89.62%
[Epoch 49] LR: 0.100 - Train Loss: 0.00167 - Test Loss: 0.00401 - Train Accuracy: 94.12% - Test Accuracy: 89.03%
[Epoch 50] LR: 0.100 - Train Loss: 0.00164 - Test Loss: 0.00350 - Train Accuracy: 94.17% - Test Accuracy: 90.34%
[Epoch 51] LR: 0.010 - Train Loss: 0.00122 - Test Loss: 0.00282 - Train Accuracy: 95.79% - Test Accuracy: 92.41%
[Epoch 52] LR: 0.010 - Train Loss: 0.00102 - Test Loss: 0.00281 - Train Accuracy: 96.52% - Test Accuracy: 92.41%
[Epoch 53] LR: 0.010 - Train Loss: 0.00097 - Test Loss: 0.00278 - Train Accuracy: 96.59% - Test Accuracy: 92.53%
[Epoch 54] LR: 0.010 - Train Loss: 0.00092 - Test Loss: 0.00283 - Train Accuracy: 96.88% - Test Accuracy: 92.42%
[Epoch 55] LR: 0.010 - Train Loss: 0.00088 - Test Loss: 0.00282 - Train Accuracy: 96.94% - Test Accuracy: 92.63%
[Epoch 56] LR: 0.010 - Train Loss: 0.00087 - Test Loss: 0.00283 - Train Accuracy: 96.97% - Test Accuracy: 92.59%
[Epoch 57] LR: 0.010 - Train Loss: 0.00082 - Test Loss: 0.00286 - Train Accuracy: 97.15% - Test Accuracy: 92.53%
[Epoch 58] LR: 0.010 - Train Loss: 0.00079 - Test Loss: 0.00287 - Train Accuracy: 97.28% - Test Accuracy: 92.60%
[Epoch 59] LR: 0.010 - Train Loss: 0.00080 - Test Loss: 0.00288 - Train Accuracy: 97.14% - Test Accuracy: 92.41%
[Epoch 60] LR: 0.010 - Train Loss: 0.00079 - Test Loss: 0.00289 - Train Accuracy: 97.24% - Test Accuracy: 92.40%
[Epoch 61] LR: 0.010 - Train Loss: 0.00076 - Test Loss: 0.00290 - Train Accuracy: 97.35% -

Test Accuracy: 92.31%
[Epoch 62] LR: 0.010 - Train Loss: 0.00074 - Test Loss: 0.00294 - Train Accuracy: 97.41% - Test Accuracy: 92.49%
[Epoch 63] LR: 0.010 - Train Loss: 0.00073 - Test Loss: 0.00297 - Train Accuracy: 97.42% - Test Accuracy: 92.28%
[Epoch 64] LR: 0.010 - Train Loss: 0.00070 - Test Loss: 0.00298 - Train Accuracy: 97.48% - Test Accuracy: 92.35%
[Epoch 65] LR: 0.010 - Train Loss: 0.00073 - Test Loss: 0.00295 - Train Accuracy: 97.45% - Test Accuracy: 92.40%
[Epoch 66] LR: 0.010 - Train Loss: 0.00070 - Test Loss: 0.00302 - Train Accuracy: 97.54% - Test Accuracy: 92.36%
[Epoch 67] LR: 0.010 - Train Loss: 0.00070 - Test Loss: 0.00305 - Train Accuracy: 97.54% - Test Accuracy: 92.47%
[Epoch 68] LR: 0.010 - Train Loss: 0.00069 - Test Loss: 0.00305 - Train Accuracy: 97.64% - Test Accuracy: 92.29%
[Epoch 69] LR: 0.010 - Train Loss: 0.00069 - Test Loss: 0.00305 - Train Accuracy: 97.56% - Test Accuracy: 92.49%
[Epoch 70] LR: 0.010 - Train Loss: 0.00067 - Test Loss: 0.00303 - Train Accuracy: 97.70% - Test Accuracy: 92.58%
[Epoch 71] LR: 0.001 - Train Loss: 0.00063 - Test Loss: 0.00300 - Train Accuracy: 97.78% - Test Accuracy: 92.57%
[Epoch 72] LR: 0.001 - Train Loss: 0.00062 - Test Loss: 0.00301 - Train Accuracy: 97.86% - Test Accuracy: 92.56%
[Epoch 73] LR: 0.001 - Train Loss: 0.00062 - Test Loss: 0.00301 - Train Accuracy: 97.80% - Test Accuracy: 92.54%
[Epoch 74] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00300 - Train Accuracy: 97.92% - Test Accuracy: 92.48%
[Epoch 75] LR: 0.001 - Train Loss: 0.00063 - Test Loss: 0.00301 - Train Accuracy: 97.81% - Test Accuracy: 92.56%
[Epoch 76] LR: 0.001 - Train Loss: 0.00064 - Test Loss: 0.00300 - Train Accuracy: 97.76% - Test Accuracy: 92.62%
[Epoch 77] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00297 - Train Accuracy: 97.86% - Test Accuracy: 92.62%
[Epoch 78] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00301 - Train Accuracy: 97.88% - Test Accuracy: 92.62%
[Epoch 79] LR: 0.001 - Train Loss: 0.00062 - Test Loss: 0.00300 - Train Accuracy: 97.82% - Test Accuracy: 92.56%
[Epoch 80] LR: 0.001 - Train Loss: 0.00060 - Test Loss: 0.00298 - Train Accuracy: 97.95% - Test Accuracy: 92.61%
[Epoch 81] LR: 0.001 - Train Loss: 0.00062 - Test Loss: 0.00299 - Train Accuracy: 97.84% - Test Accuracy: 92.60%
[Epoch 82] LR: 0.001 - Train Loss: 0.00059 - Test Loss: 0.00302 - Train Accuracy: 98.03% - Test Accuracy: 92.51%
[Epoch 83] LR: 0.001 - Train Loss: 0.00059 - Test Loss: 0.00302 - Train Accuracy: 97.93% - Test Accuracy: 92.55%
[Epoch 84] LR: 0.001 - Train Loss: 0.00059 - Test Loss: 0.00303 - Train Accuracy: 97.94% - Test Accuracy: 92.54%
[Epoch 85] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00303 - Train Accuracy: 97.84% - Test Accuracy: 92.58%
[Epoch 86] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00301 - Train Accuracy: 97.95% - Test Accuracy: 92.55%
[Epoch 87] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00302 - Train Accuracy: 97.85% - Test Accuracy: 92.49%
[Epoch 88] LR: 0.001 - Train Loss: 0.00060 - Test Loss: 0.00303 - Train Accuracy: 97.92% - Test Accuracy: 92.52%

[Epoch 89] LR: 0.001 - Train Loss: 0.00059 - Test Loss: 0.00303 - Train Accuracy: 97.83% - Test Accuracy: 92.59%
[Epoch 90] LR: 0.001 - Train Loss: 0.00060 - Test Loss: 0.00303 - Train Accuracy: 97.98% - Test Accuracy: 92.54%
[Epoch 91] LR: 0.001 - Train Loss: 0.00057 - Test Loss: 0.00303 - Train Accuracy: 98.04% - Test Accuracy: 92.53%
[Epoch 92] LR: 0.001 - Train Loss: 0.00058 - Test Loss: 0.00301 - Train Accuracy: 98.02% - Test Accuracy: 92.63%
[Epoch 93] LR: 0.001 - Train Loss: 0.00058 - Test Loss: 0.00301 - Train Accuracy: 97.96% - Test Accuracy: 92.57%
[Epoch 94] LR: 0.001 - Train Loss: 0.00058 - Test Loss: 0.00300 - Train Accuracy: 98.02% - Test Accuracy: 92.56%
[Epoch 95] LR: 0.001 - Train Loss: 0.00057 - Test Loss: 0.00301 - Train Accuracy: 98.03% - Test Accuracy: 92.67%
[Epoch 96] LR: 0.001 - Train Loss: 0.00058 - Test Loss: 0.00301 - Train Accuracy: 97.99% - Test Accuracy: 92.61%
[Epoch 97] LR: 0.001 - Train Loss: 0.00057 - Test Loss: 0.00301 - Train Accuracy: 97.99% - Test Accuracy: 92.55%
[Epoch 98] LR: 0.001 - Train Loss: 0.00060 - Test Loss: 0.00302 - Train Accuracy: 98.00% - Test Accuracy: 92.54%
[Epoch 99] LR: 0.001 - Train Loss: 0.00061 - Test Loss: 0.00303 - Train Accuracy: 97.90% - Test Accuracy: 92.52%
[Epoch 100] LR: 0.001 - Train Loss: 0.00058 - Test Loss: 0.00302 - Train Accuracy: 97.97% - Test Accuracy: 92.55%