###########################################################################################################################################################################################################################

# Activation functions

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# A\_01\_relu

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Epoch 1/30

1563/1563 [==============================] - 11s 6ms/step - loss: 1.7444 - accuracy: 0.3540 - val\_loss: 1.3138 - val\_accuracy: 0.5296

Epoch 2/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1783 - accuracy: 0.5823 - val\_loss: 1.0630 - val\_accuracy: 0.6251

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0016 - accuracy: 0.6453 - val\_loss: 0.9434 - val\_accuracy: 0.6740

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8740 - accuracy: 0.6945 - val\_loss: 0.9624 - val\_accuracy: 0.6612

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8069 - accuracy: 0.7170 - val\_loss: 0.8745 - val\_accuracy: 0.6941

Epoch 6/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7259 - accuracy: 0.7444 - val\_loss: 0.8600 - val\_accuracy: 0.7031

Epoch 7/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6778 - accuracy: 0.7617 - val\_loss: 0.8389 - val\_accuracy: 0.7153

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6339 - accuracy: 0.7797 - val\_loss: 0.8696 - val\_accuracy: 0.7036

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5986 - accuracy: 0.7886 - val\_loss: 0.8668 - val\_accuracy: 0.7078

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5552 - accuracy: 0.8041 - val\_loss: 0.8791 - val\_accuracy: 0.7072

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5252 - accuracy: 0.8123 - val\_loss: 0.9189 - val\_accuracy: 0.7152

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4821 - accuracy: 0.8318 - val\_loss: 0.9552 - val\_accuracy: 0.6970

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4466 - accuracy: 0.8392 - val\_loss: 0.9149 - val\_accuracy: 0.7221

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4118 - accuracy: 0.8521 - val\_loss: 0.9748 - val\_accuracy: 0.7134

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3820 - accuracy: 0.8653 - val\_loss: 1.0138 - val\_accuracy: 0.7107

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3566 - accuracy: 0.8697 - val\_loss: 1.0802 - val\_accuracy: 0.7000

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3370 - accuracy: 0.8799 - val\_loss: 1.1417 - val\_accuracy: 0.7079

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3094 - accuracy: 0.8884 - val\_loss: 1.1724 - val\_accuracy: 0.7010

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2990 - accuracy: 0.8916 - val\_loss: 1.1809 - val\_accuracy: 0.7054

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2594 - accuracy: 0.9065 - val\_loss: 1.2495 - val\_accuracy: 0.7030

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2536 - accuracy: 0.9088 - val\_loss: 1.3073 - val\_accuracy: 0.7057

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2334 - accuracy: 0.9180 - val\_loss: 1.5219 - val\_accuracy: 0.6761

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2154 - accuracy: 0.9237 - val\_loss: 1.4408 - val\_accuracy: 0.6977

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2085 - accuracy: 0.9227 - val\_loss: 1.4540 - val\_accuracy: 0.6989

Epoch 25/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1897 - accuracy: 0.9318 - val\_loss: 1.5333 - val\_accuracy: 0.6962

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1718 - accuracy: 0.9382 - val\_loss: 1.6079 - val\_accuracy: 0.6958

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1711 - accuracy: 0.9384 - val\_loss: 1.6894 - val\_accuracy: 0.6845

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1629 - accuracy: 0.9405 - val\_loss: 1.7325 - val\_accuracy: 0.6875

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1501 - accuracy: 0.9446 - val\_loss: 1.7962 - val\_accuracy: 0.6922

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1553 - accuracy: 0.9445 - val\_loss: 1.8775 - val\_accuracy: 0.6904

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# A\_01\_elu

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Epoch 1/30

1563/1563 [==============================] - 11s 6ms/step - loss: 1.6037 - accuracy: 0.4270 - val\_loss: 1.1704 - val\_accuracy: 0.5861

Epoch 2/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1272 - accuracy: 0.6029 - val\_loss: 1.0199 - val\_accuracy: 0.6452

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9478 - accuracy: 0.6658 - val\_loss: 0.9608 - val\_accuracy: 0.6643

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8460 - accuracy: 0.7046 - val\_loss: 0.9680 - val\_accuracy: 0.6653

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7584 - accuracy: 0.7343 - val\_loss: 0.9006 - val\_accuracy: 0.6911

Epoch 6/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6908 - accuracy: 0.7586 - val\_loss: 0.9249 - val\_accuracy: 0.6887

Epoch 7/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6213 - accuracy: 0.7815 - val\_loss: 0.9187 - val\_accuracy: 0.6990

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5586 - accuracy: 0.8043 - val\_loss: 0.8990 - val\_accuracy: 0.7039

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4999 - accuracy: 0.8227 - val\_loss: 0.9738 - val\_accuracy: 0.6989

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4548 - accuracy: 0.8383 - val\_loss: 0.9427 - val\_accuracy: 0.7141

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3974 - accuracy: 0.8597 - val\_loss: 1.0015 - val\_accuracy: 0.7069

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3567 - accuracy: 0.8730 - val\_loss: 1.1166 - val\_accuracy: 0.6959

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3157 - accuracy: 0.8882 - val\_loss: 1.1893 - val\_accuracy: 0.7060

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2797 - accuracy: 0.9016 - val\_loss: 1.2567 - val\_accuracy: 0.6965

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2562 - accuracy: 0.9069 - val\_loss: 1.3553 - val\_accuracy: 0.6875

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2250 - accuracy: 0.9199 - val\_loss: 1.3937 - val\_accuracy: 0.6940

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2048 - accuracy: 0.9269 - val\_loss: 1.5403 - val\_accuracy: 0.6840

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1888 - accuracy: 0.9331 - val\_loss: 1.5612 - val\_accuracy: 0.6990

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1686 - accuracy: 0.9391 - val\_loss: 1.6317 - val\_accuracy: 0.6969

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1593 - accuracy: 0.9420 - val\_loss: 1.7151 - val\_accuracy: 0.6891

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1523 - accuracy: 0.9431 - val\_loss: 1.7993 - val\_accuracy: 0.6956

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1340 - accuracy: 0.9514 - val\_loss: 1.8929 - val\_accuracy: 0.6910

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1363 - accuracy: 0.9514 - val\_loss: 1.9537 - val\_accuracy: 0.6944

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1220 - accuracy: 0.9573 - val\_loss: 2.0340 - val\_accuracy: 0.6841

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1319 - accuracy: 0.9532 - val\_loss: 2.1735 - val\_accuracy: 0.6946

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1242 - accuracy: 0.9561 - val\_loss: 2.1873 - val\_accuracy: 0.6855

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1141 - accuracy: 0.9594 - val\_loss: 2.1710 - val\_accuracy: 0.6974

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1126 - accuracy: 0.9602 - val\_loss: 2.1900 - val\_accuracy: 0.6843

Epoch 29/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1178 - accuracy: 0.9586 - val\_loss: 2.2557 - val\_accuracy: 0.6923

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.0978 - accuracy: 0.9668 - val\_loss: 2.5048 - val\_accuracy: 0.6819

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# A\_01\_exponential

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Epoch 1/30

1563/1563 [==============================] - 9s 6ms/step - loss: nan - accuracy: 0.0997 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 2/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1003 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 3/30

1563/1563 [==============================] - 9s 6ms/step - loss: nan - accuracy: 0.1012 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0996 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0992 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 6/30

1563/1563 [==============================] - 9s 6ms/step - loss: nan - accuracy: 0.0995 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 7/30

1563/1563 [==============================] - 9s 5ms/step - loss: nan - accuracy: 0.1010 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0996 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0991 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1001 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0978 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1000 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1001 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1020 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1011 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1000 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0981 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1003 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1006 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1028 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1016 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1012 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0997 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1014 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1010 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1007 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0984 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0980 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.0971 - val\_loss: nan - val\_accuracy: 0.1000

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: nan - accuracy: 0.1008 - val\_loss: nan - val\_accuracy: 0.1000

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# A\_01\_gelu

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Epoch 1/30

1563/1563 [==============================] - 11s 7ms/step - loss: 1.6708 - accuracy: 0.3942 - val\_loss: 1.1764 - val\_accuracy: 0.5916

Epoch 2/30

1563/1563 [==============================] - 10s 6ms/step - loss: 1.0950 - accuracy: 0.6098 - val\_loss: 0.9831 - val\_accuracy: 0.6575

Epoch 3/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.8895 - accuracy: 0.6888 - val\_loss: 0.9210 - val\_accuracy: 0.6782

Epoch 4/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.7659 - accuracy: 0.7292 - val\_loss: 0.8668 - val\_accuracy: 0.7024

Epoch 5/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.6656 - accuracy: 0.7679 - val\_loss: 0.8728 - val\_accuracy: 0.7043

Epoch 6/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.5764 - accuracy: 0.7976 - val\_loss: 0.8709 - val\_accuracy: 0.7119

Epoch 7/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.5059 - accuracy: 0.8229 - val\_loss: 0.8799 - val\_accuracy: 0.7097

Epoch 8/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.4315 - accuracy: 0.8490 - val\_loss: 0.9592 - val\_accuracy: 0.7076

Epoch 9/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.3897 - accuracy: 0.8649 - val\_loss: 1.0085 - val\_accuracy: 0.7068

Epoch 10/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.3356 - accuracy: 0.8815 - val\_loss: 1.0149 - val\_accuracy: 0.7165

Epoch 11/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.2806 - accuracy: 0.9031 - val\_loss: 1.1122 - val\_accuracy: 0.7000

Epoch 12/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.2440 - accuracy: 0.9147 - val\_loss: 1.2280 - val\_accuracy: 0.7009

Epoch 13/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.2197 - accuracy: 0.9254 - val\_loss: 1.2713 - val\_accuracy: 0.7074

Epoch 14/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1945 - accuracy: 0.9323 - val\_loss: 1.3652 - val\_accuracy: 0.7010

Epoch 15/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1726 - accuracy: 0.9393 - val\_loss: 1.4375 - val\_accuracy: 0.6940

Epoch 16/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1574 - accuracy: 0.9456 - val\_loss: 1.4570 - val\_accuracy: 0.6947

Epoch 17/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1436 - accuracy: 0.9493 - val\_loss: 1.5668 - val\_accuracy: 0.6910

Epoch 18/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1294 - accuracy: 0.9558 - val\_loss: 1.6488 - val\_accuracy: 0.6871

Epoch 19/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1198 - accuracy: 0.9587 - val\_loss: 1.7625 - val\_accuracy: 0.6800

Epoch 20/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1188 - accuracy: 0.9586 - val\_loss: 1.7470 - val\_accuracy: 0.6913

Epoch 21/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.1081 - accuracy: 0.9619 - val\_loss: 1.8152 - val\_accuracy: 0.6934

Epoch 22/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0952 - accuracy: 0.9665 - val\_loss: 1.8757 - val\_accuracy: 0.6901

Epoch 23/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0918 - accuracy: 0.9681 - val\_loss: 1.9649 - val\_accuracy: 0.6874

Epoch 24/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0956 - accuracy: 0.9665 - val\_loss: 1.9622 - val\_accuracy: 0.6974

Epoch 25/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0829 - accuracy: 0.9713 - val\_loss: 2.0304 - val\_accuracy: 0.6854

Epoch 26/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0861 - accuracy: 0.9707 - val\_loss: 2.2264 - val\_accuracy: 0.6719

Epoch 27/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0943 - accuracy: 0.9676 - val\_loss: 2.2016 - val\_accuracy: 0.6797

Epoch 28/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0870 - accuracy: 0.9696 - val\_loss: 2.1798 - val\_accuracy: 0.6834

Epoch 29/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0829 - accuracy: 0.9705 - val\_loss: 2.2137 - val\_accuracy: 0.6931

Epoch 30/30

1563/1563 [==============================] - 10s 6ms/step - loss: 0.0802 - accuracy: 0.9714 - val\_loss: 2.3839 - val\_accuracy: 0.6827

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# A\_01\_hard\_sigmoid

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Epoch 1/30

1563/1563 [==============================] - 10s 6ms/step - loss: 2.1616 - accuracy: 0.1882 - val\_loss: 1.7080 - val\_accuracy: 0.3818

Epoch 2/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.6523 - accuracy: 0.4009 - val\_loss: 1.5139 - val\_accuracy: 0.4539

Epoch 3/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.4725 - accuracy: 0.4683 - val\_loss: 1.4098 - val\_accuracy: 0.4908

Epoch 4/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.3879 - accuracy: 0.5032 - val\_loss: 1.3589 - val\_accuracy: 0.5099

Epoch 5/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.3103 - accuracy: 0.5332 - val\_loss: 1.3205 - val\_accuracy: 0.5205

Epoch 6/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.2536 - accuracy: 0.5518 - val\_loss: 1.2827 - val\_accuracy: 0.5378

Epoch 7/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.2187 - accuracy: 0.5652 - val\_loss: 1.2421 - val\_accuracy: 0.5550

Epoch 8/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.1708 - accuracy: 0.5844 - val\_loss: 1.2049 - val\_accuracy: 0.5722

Epoch 9/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.1260 - accuracy: 0.6031 - val\_loss: 1.2079 - val\_accuracy: 0.5674

Epoch 10/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.0977 - accuracy: 0.6089 - val\_loss: 1.1591 - val\_accuracy: 0.5891

Epoch 11/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.0548 - accuracy: 0.6250 - val\_loss: 1.1538 - val\_accuracy: 0.5914

Epoch 12/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.0286 - accuracy: 0.6379 - val\_loss: 1.1358 - val\_accuracy: 0.6000

Epoch 13/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.9903 - accuracy: 0.6547 - val\_loss: 1.1325 - val\_accuracy: 0.6048

Epoch 14/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.9537 - accuracy: 0.6637 - val\_loss: 1.1270 - val\_accuracy: 0.6097

Epoch 15/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.9298 - accuracy: 0.6773 - val\_loss: 1.0961 - val\_accuracy: 0.6163

Epoch 16/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8973 - accuracy: 0.6895 - val\_loss: 1.1003 - val\_accuracy: 0.6150

Epoch 17/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8691 - accuracy: 0.6939 - val\_loss: 1.0984 - val\_accuracy: 0.6130

Epoch 18/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8351 - accuracy: 0.7097 - val\_loss: 1.0863 - val\_accuracy: 0.6238

Epoch 19/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8165 - accuracy: 0.7147 - val\_loss: 1.0761 - val\_accuracy: 0.6279

Epoch 20/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7897 - accuracy: 0.7247 - val\_loss: 1.0815 - val\_accuracy: 0.6287

Epoch 21/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7728 - accuracy: 0.7300 - val\_loss: 1.0679 - val\_accuracy: 0.6355

Epoch 22/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7521 - accuracy: 0.7350 - val\_loss: 1.0778 - val\_accuracy: 0.6308

Epoch 23/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7185 - accuracy: 0.7503 - val\_loss: 1.0807 - val\_accuracy: 0.6292

Epoch 24/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7008 - accuracy: 0.7591 - val\_loss: 1.0913 - val\_accuracy: 0.6313

Epoch 25/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6753 - accuracy: 0.7663 - val\_loss: 1.1028 - val\_accuracy: 0.6273

Epoch 26/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6424 - accuracy: 0.7759 - val\_loss: 1.1200 - val\_accuracy: 0.6249

Epoch 27/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6343 - accuracy: 0.7759 - val\_loss: 1.1080 - val\_accuracy: 0.6353

Epoch 28/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6160 - accuracy: 0.7855 - val\_loss: 1.1239 - val\_accuracy: 0.6380

Epoch 29/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.5921 - accuracy: 0.7933 - val\_loss: 1.1633 - val\_accuracy: 0.6290

Epoch 30/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.5743 - accuracy: 0.8015 - val\_loss: 1.1275 - val\_accuracy: 0.6378

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# A\_01\_linear

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Epoch 1/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.6296 - accuracy: 0.4193 - val\_loss: 1.2926 - val\_accuracy: 0.5557

Epoch 2/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.2020 - accuracy: 0.5825 - val\_loss: 1.1723 - val\_accuracy: 0.5984

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1090 - accuracy: 0.6204 - val\_loss: 1.1078 - val\_accuracy: 0.6216

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0474 - accuracy: 0.6418 - val\_loss: 1.1066 - val\_accuracy: 0.6280

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9882 - accuracy: 0.6616 - val\_loss: 1.0886 - val\_accuracy: 0.6286

Epoch 6/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9682 - accuracy: 0.6695 - val\_loss: 1.0658 - val\_accuracy: 0.6435

Epoch 7/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9259 - accuracy: 0.6809 - val\_loss: 1.1068 - val\_accuracy: 0.6297

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9051 - accuracy: 0.6887 - val\_loss: 1.0514 - val\_accuracy: 0.6478

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8599 - accuracy: 0.7069 - val\_loss: 1.0521 - val\_accuracy: 0.6494

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8475 - accuracy: 0.7075 - val\_loss: 1.0638 - val\_accuracy: 0.6472

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8276 - accuracy: 0.7168 - val\_loss: 1.0665 - val\_accuracy: 0.6525

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8015 - accuracy: 0.7255 - val\_loss: 1.1198 - val\_accuracy: 0.6340

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7805 - accuracy: 0.7331 - val\_loss: 1.1476 - val\_accuracy: 0.6274

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7648 - accuracy: 0.7346 - val\_loss: 1.1063 - val\_accuracy: 0.6382

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7505 - accuracy: 0.7438 - val\_loss: 1.1158 - val\_accuracy: 0.6445

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7355 - accuracy: 0.7462 - val\_loss: 1.1080 - val\_accuracy: 0.6430

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7095 - accuracy: 0.7569 - val\_loss: 1.1158 - val\_accuracy: 0.6487

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7083 - accuracy: 0.7588 - val\_loss: 1.1103 - val\_accuracy: 0.6425

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6863 - accuracy: 0.7651 - val\_loss: 1.1516 - val\_accuracy: 0.6296

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6731 - accuracy: 0.7685 - val\_loss: 1.1496 - val\_accuracy: 0.6394

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6698 - accuracy: 0.7678 - val\_loss: 1.1754 - val\_accuracy: 0.6327

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6639 - accuracy: 0.7693 - val\_loss: 1.2029 - val\_accuracy: 0.6428

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6458 - accuracy: 0.7756 - val\_loss: 1.1543 - val\_accuracy: 0.6428

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6335 - accuracy: 0.7802 - val\_loss: 1.1765 - val\_accuracy: 0.6422

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6314 - accuracy: 0.7807 - val\_loss: 1.2147 - val\_accuracy: 0.6388

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6216 - accuracy: 0.7859 - val\_loss: 1.2480 - val\_accuracy: 0.6359

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6197 - accuracy: 0.7826 - val\_loss: 1.2686 - val\_accuracy: 0.6343

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6110 - accuracy: 0.7875 - val\_loss: 1.2283 - val\_accuracy: 0.6411

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5949 - accuracy: 0.7919 - val\_loss: 1.2512 - val\_accuracy: 0.6313

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5872 - accuracy: 0.7955 - val\_loss: 1.2836 - val\_accuracy: 0.6290

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# A\_01\_selu

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Epoch 1/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.6103 - accuracy: 0.4261 - val\_loss: 1.2198 - val\_accuracy: 0.5674

Epoch 2/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1861 - accuracy: 0.5835 - val\_loss: 1.1152 - val\_accuracy: 0.6142

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0343 - accuracy: 0.6359 - val\_loss: 1.0316 - val\_accuracy: 0.6464

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9272 - accuracy: 0.6758 - val\_loss: 0.9840 - val\_accuracy: 0.6690

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8517 - accuracy: 0.7020 - val\_loss: 0.9975 - val\_accuracy: 0.6601

Epoch 6/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7912 - accuracy: 0.7222 - val\_loss: 0.9750 - val\_accuracy: 0.6711

Epoch 7/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7340 - accuracy: 0.7415 - val\_loss: 1.0009 - val\_accuracy: 0.6678

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6840 - accuracy: 0.7615 - val\_loss: 1.0078 - val\_accuracy: 0.6771

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6397 - accuracy: 0.7756 - val\_loss: 1.0351 - val\_accuracy: 0.6750

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5823 - accuracy: 0.7913 - val\_loss: 1.0157 - val\_accuracy: 0.6814

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5376 - accuracy: 0.8110 - val\_loss: 1.0792 - val\_accuracy: 0.6731

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5101 - accuracy: 0.8186 - val\_loss: 1.1117 - val\_accuracy: 0.6625

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4654 - accuracy: 0.8335 - val\_loss: 1.1539 - val\_accuracy: 0.6711

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4206 - accuracy: 0.8491 - val\_loss: 1.2252 - val\_accuracy: 0.6640

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4002 - accuracy: 0.8565 - val\_loss: 1.2698 - val\_accuracy: 0.6732

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3734 - accuracy: 0.8652 - val\_loss: 1.3273 - val\_accuracy: 0.6554

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3307 - accuracy: 0.8821 - val\_loss: 1.3333 - val\_accuracy: 0.6614

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3141 - accuracy: 0.8859 - val\_loss: 1.4293 - val\_accuracy: 0.6509

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2937 - accuracy: 0.8940 - val\_loss: 1.5283 - val\_accuracy: 0.6603

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2694 - accuracy: 0.9018 - val\_loss: 1.5183 - val\_accuracy: 0.6567

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2558 - accuracy: 0.9074 - val\_loss: 1.6473 - val\_accuracy: 0.6504

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2357 - accuracy: 0.9152 - val\_loss: 1.7292 - val\_accuracy: 0.6610

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2298 - accuracy: 0.9168 - val\_loss: 1.8089 - val\_accuracy: 0.6647

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2166 - accuracy: 0.9227 - val\_loss: 1.8308 - val\_accuracy: 0.6502

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1955 - accuracy: 0.9304 - val\_loss: 1.8417 - val\_accuracy: 0.6457

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2126 - accuracy: 0.9253 - val\_loss: 1.9925 - val\_accuracy: 0.6512

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1853 - accuracy: 0.9331 - val\_loss: 2.0439 - val\_accuracy: 0.6540

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1834 - accuracy: 0.9354 - val\_loss: 2.1382 - val\_accuracy: 0.6369

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1740 - accuracy: 0.9388 - val\_loss: 2.2126 - val\_accuracy: 0.6473

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1828 - accuracy: 0.9347 - val\_loss: 2.2388 - val\_accuracy: 0.6464

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# A\_01\_sigmoid

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Epoch 1/30

1563/1563 [==============================] - 10s 6ms/step - loss: 2.1778 - accuracy: 0.1752 - val\_loss: 1.8696 - val\_accuracy: 0.3150

Epoch 2/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.8175 - accuracy: 0.3371 - val\_loss: 1.6154 - val\_accuracy: 0.4204

Epoch 3/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.5864 - accuracy: 0.4328 - val\_loss: 1.5251 - val\_accuracy: 0.4460

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.4827 - accuracy: 0.4698 - val\_loss: 1.4087 - val\_accuracy: 0.4977

Epoch 5/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.3856 - accuracy: 0.5035 - val\_loss: 1.3722 - val\_accuracy: 0.5038

Epoch 6/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.3361 - accuracy: 0.5232 - val\_loss: 1.3375 - val\_accuracy: 0.5185

Epoch 7/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.2898 - accuracy: 0.5407 - val\_loss: 1.2878 - val\_accuracy: 0.5395

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.2302 - accuracy: 0.5634 - val\_loss: 1.2632 - val\_accuracy: 0.5473

Epoch 9/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1891 - accuracy: 0.5789 - val\_loss: 1.2395 - val\_accuracy: 0.5604

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1396 - accuracy: 0.5972 - val\_loss: 1.2224 - val\_accuracy: 0.5678

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1116 - accuracy: 0.6080 - val\_loss: 1.1916 - val\_accuracy: 0.5764

Epoch 12/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0617 - accuracy: 0.6242 - val\_loss: 1.1696 - val\_accuracy: 0.5894

Epoch 13/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0285 - accuracy: 0.6394 - val\_loss: 1.1625 - val\_accuracy: 0.5902

Epoch 14/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9983 - accuracy: 0.6511 - val\_loss: 1.1757 - val\_accuracy: 0.5900

Epoch 15/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9635 - accuracy: 0.6649 - val\_loss: 1.1486 - val\_accuracy: 0.6030

Epoch 16/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9417 - accuracy: 0.6690 - val\_loss: 1.1276 - val\_accuracy: 0.6107

Epoch 17/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9031 - accuracy: 0.6818 - val\_loss: 1.1667 - val\_accuracy: 0.5975

Epoch 18/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8751 - accuracy: 0.6929 - val\_loss: 1.1181 - val\_accuracy: 0.6130

Epoch 19/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8482 - accuracy: 0.7029 - val\_loss: 1.1289 - val\_accuracy: 0.6152

Epoch 20/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.8078 - accuracy: 0.7178 - val\_loss: 1.1136 - val\_accuracy: 0.6186

Epoch 21/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7960 - accuracy: 0.7234 - val\_loss: 1.1470 - val\_accuracy: 0.6072

Epoch 22/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7683 - accuracy: 0.7292 - val\_loss: 1.1215 - val\_accuracy: 0.6180

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7510 - accuracy: 0.7382 - val\_loss: 1.1243 - val\_accuracy: 0.6201

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7244 - accuracy: 0.7469 - val\_loss: 1.1823 - val\_accuracy: 0.6095

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6921 - accuracy: 0.7600 - val\_loss: 1.1353 - val\_accuracy: 0.6219

Epoch 26/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6770 - accuracy: 0.7656 - val\_loss: 1.1453 - val\_accuracy: 0.6277

Epoch 27/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6524 - accuracy: 0.7755 - val\_loss: 1.1581 - val\_accuracy: 0.6173

Epoch 28/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6331 - accuracy: 0.7843 - val\_loss: 1.1807 - val\_accuracy: 0.6158

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.6062 - accuracy: 0.7907 - val\_loss: 1.1951 - val\_accuracy: 0.6234

Epoch 30/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5866 - accuracy: 0.7985 - val\_loss: 1.1996 - val\_accuracy: 0.6195

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# A\_01\_softplus

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Epoch 1/30

1563/1563 [==============================] - 9s 6ms/step - loss: 2.1355 - accuracy: 0.2026 - val\_loss: 1.6026 - val\_accuracy: 0.4297

Epoch 2/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.5952 - accuracy: 0.4331 - val\_loss: 1.5160 - val\_accuracy: 0.4530

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.4500 - accuracy: 0.4809 - val\_loss: 1.3712 - val\_accuracy: 0.5131

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.3515 - accuracy: 0.5164 - val\_loss: 1.3645 - val\_accuracy: 0.5171

Epoch 5/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.2668 - accuracy: 0.5457 - val\_loss: 1.2700 - val\_accuracy: 0.5573

Epoch 6/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.1923 - accuracy: 0.5765 - val\_loss: 1.2525 - val\_accuracy: 0.5645

Epoch 7/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.1356 - accuracy: 0.5938 - val\_loss: 1.2262 - val\_accuracy: 0.5722

Epoch 8/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.0637 - accuracy: 0.6254 - val\_loss: 1.1992 - val\_accuracy: 0.5816

Epoch 9/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.0159 - accuracy: 0.6371 - val\_loss: 1.2281 - val\_accuracy: 0.5809

Epoch 10/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9512 - accuracy: 0.6611 - val\_loss: 1.1975 - val\_accuracy: 0.5881

Epoch 11/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9054 - accuracy: 0.6795 - val\_loss: 1.2465 - val\_accuracy: 0.5805

Epoch 12/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8548 - accuracy: 0.6936 - val\_loss: 1.2474 - val\_accuracy: 0.5861

Epoch 13/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8165 - accuracy: 0.7098 - val\_loss: 1.2671 - val\_accuracy: 0.5862

Epoch 14/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7653 - accuracy: 0.7251 - val\_loss: 1.3037 - val\_accuracy: 0.5864

Epoch 15/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.7141 - accuracy: 0.7430 - val\_loss: 1.3789 - val\_accuracy: 0.5886

Epoch 16/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.6871 - accuracy: 0.7566 - val\_loss: 1.3950 - val\_accuracy: 0.5822

Epoch 17/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6597 - accuracy: 0.7636 - val\_loss: 1.4372 - val\_accuracy: 0.5874

Epoch 18/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6132 - accuracy: 0.7812 - val\_loss: 1.4752 - val\_accuracy: 0.5802

Epoch 19/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5816 - accuracy: 0.7928 - val\_loss: 1.5331 - val\_accuracy: 0.5809

Epoch 20/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5508 - accuracy: 0.7999 - val\_loss: 1.5857 - val\_accuracy: 0.5815

Epoch 21/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.5157 - accuracy: 0.8148 - val\_loss: 1.6085 - val\_accuracy: 0.5814

Epoch 22/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.5011 - accuracy: 0.8193 - val\_loss: 1.8001 - val\_accuracy: 0.5798

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4715 - accuracy: 0.8278 - val\_loss: 1.8177 - val\_accuracy: 0.5740

Epoch 24/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.4358 - accuracy: 0.8437 - val\_loss: 1.8916 - val\_accuracy: 0.5725

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4152 - accuracy: 0.8496 - val\_loss: 1.8822 - val\_accuracy: 0.5712

Epoch 26/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.3927 - accuracy: 0.8571 - val\_loss: 2.0598 - val\_accuracy: 0.5696

Epoch 27/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.3753 - accuracy: 0.8655 - val\_loss: 2.1173 - val\_accuracy: 0.5603

Epoch 28/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.3515 - accuracy: 0.8698 - val\_loss: 2.1506 - val\_accuracy: 0.5654

Epoch 29/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.3381 - accuracy: 0.8780 - val\_loss: 2.2733 - val\_accuracy: 0.5650

Epoch 30/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.3262 - accuracy: 0.8826 - val\_loss: 2.3170 - val\_accuracy: 0.5697

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# A\_01\_softsign

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Epoch 1/30

1563/1563 [==============================] - 10s 6ms/step - loss: 1.6244 - accuracy: 0.4131 - val\_loss: 1.1877 - val\_accuracy: 0.5854

Epoch 2/30

1563/1563 [==============================] - 9s 6ms/step - loss: 1.1475 - accuracy: 0.5952 - val\_loss: 1.0837 - val\_accuracy: 0.6156

Epoch 3/30

1563/1563 [==============================] - 9s 5ms/step - loss: 1.0092 - accuracy: 0.6466 - val\_loss: 0.9894 - val\_accuracy: 0.6553

Epoch 4/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.9318 - accuracy: 0.6757 - val\_loss: 1.0134 - val\_accuracy: 0.6456

Epoch 5/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.8684 - accuracy: 0.6979 - val\_loss: 0.9481 - val\_accuracy: 0.6757

Epoch 6/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.8073 - accuracy: 0.7198 - val\_loss: 0.9559 - val\_accuracy: 0.6669

Epoch 7/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.7612 - accuracy: 0.7375 - val\_loss: 0.9346 - val\_accuracy: 0.6791

Epoch 8/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.7257 - accuracy: 0.7494 - val\_loss: 0.9292 - val\_accuracy: 0.6877

Epoch 9/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6779 - accuracy: 0.7615 - val\_loss: 0.9273 - val\_accuracy: 0.6863

Epoch 10/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6399 - accuracy: 0.7760 - val\_loss: 0.9240 - val\_accuracy: 0.6880

Epoch 11/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6007 - accuracy: 0.7907 - val\_loss: 0.9316 - val\_accuracy: 0.6925

Epoch 12/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.5668 - accuracy: 0.8044 - val\_loss: 0.9431 - val\_accuracy: 0.6872

Epoch 13/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.5397 - accuracy: 0.8138 - val\_loss: 0.9551 - val\_accuracy: 0.6913

Epoch 14/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.5038 - accuracy: 0.8250 - val\_loss: 0.9447 - val\_accuracy: 0.6950

Epoch 15/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.4742 - accuracy: 0.8376 - val\_loss: 0.9731 - val\_accuracy: 0.6915

Epoch 16/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.4536 - accuracy: 0.8453 - val\_loss: 0.9901 - val\_accuracy: 0.6933

Epoch 17/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.4183 - accuracy: 0.8559 - val\_loss: 1.0148 - val\_accuracy: 0.6871

Epoch 18/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.3912 - accuracy: 0.8644 - val\_loss: 1.0420 - val\_accuracy: 0.6859

Epoch 19/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.3740 - accuracy: 0.8727 - val\_loss: 1.0759 - val\_accuracy: 0.6852

Epoch 20/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.3465 - accuracy: 0.8817 - val\_loss: 1.1096 - val\_accuracy: 0.6808

Epoch 21/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.3187 - accuracy: 0.8910 - val\_loss: 1.1164 - val\_accuracy: 0.6839

Epoch 22/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3082 - accuracy: 0.8938 - val\_loss: 1.1491 - val\_accuracy: 0.6901

Epoch 23/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2866 - accuracy: 0.9009 - val\_loss: 1.1760 - val\_accuracy: 0.6793

Epoch 24/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2711 - accuracy: 0.9070 - val\_loss: 1.2240 - val\_accuracy: 0.6800

Epoch 25/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2513 - accuracy: 0.9150 - val\_loss: 1.2290 - val\_accuracy: 0.6752

Epoch 26/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.2454 - accuracy: 0.9164 - val\_loss: 1.2468 - val\_accuracy: 0.6859

Epoch 27/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.2269 - accuracy: 0.9231 - val\_loss: 1.2925 - val\_accuracy: 0.6764

Epoch 28/30

1563/1563 [==============================] - 9s 5ms/step - loss: 0.2167 - accuracy: 0.9271 - val\_loss: 1.3420 - val\_accuracy: 0.6726

Epoch 29/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.2044 - accuracy: 0.9308 - val\_loss: 1.3591 - val\_accuracy: 0.6789

Epoch 30/30

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1955 - accuracy: 0.9342 - val\_loss: 1.3849 - val\_accuracy: 0.6747

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# A\_01\_swish

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Epoch 1/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.7059 - accuracy: 0.3773 - val\_loss: 1.2194 - val\_accuracy: 0.5707

Epoch 2/30

1563/1563 [==============================] - 7s 5ms/step - loss: 1.1596 - accuracy: 0.5891 - val\_loss: 1.0314 - val\_accuracy: 0.6406

Epoch 3/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.9585 - accuracy: 0.6596 - val\_loss: 0.9708 - val\_accuracy: 0.6631

Epoch 4/30

1563/1563 [==============================] - 8s 5ms/step - loss: 0.8361 - accuracy: 0.7031 - val\_loss: 0.9494 - val\_accuracy: 0.6749

Epoch 5/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7315 - accuracy: 0.7394 - val\_loss: 0.9368 - val\_accuracy: 0.6837

Epoch 6/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6355 - accuracy: 0.7744 - val\_loss: 0.9456 - val\_accuracy: 0.6894

Epoch 7/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5648 - accuracy: 0.8001 - val\_loss: 0.9251 - val\_accuracy: 0.6962

Epoch 8/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5071 - accuracy: 0.8210 - val\_loss: 0.9217 - val\_accuracy: 0.7056

Epoch 9/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.4490 - accuracy: 0.8429 - val\_loss: 0.9727 - val\_accuracy: 0.7065

Epoch 10/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3910 - accuracy: 0.8633 - val\_loss: 1.0143 - val\_accuracy: 0.6983

Epoch 11/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3380 - accuracy: 0.8791 - val\_loss: 1.0445 - val\_accuracy: 0.7052

Epoch 12/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3010 - accuracy: 0.8965 - val\_loss: 1.1591 - val\_accuracy: 0.6964

Epoch 13/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.2595 - accuracy: 0.9083 - val\_loss: 1.2053 - val\_accuracy: 0.7041

Epoch 14/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.2265 - accuracy: 0.9208 - val\_loss: 1.3051 - val\_accuracy: 0.6901

Epoch 15/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.2037 - accuracy: 0.9279 - val\_loss: 1.4015 - val\_accuracy: 0.6889

Epoch 16/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1874 - accuracy: 0.9344 - val\_loss: 1.4878 - val\_accuracy: 0.6882

Epoch 17/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.1632 - accuracy: 0.9424 - val\_loss: 1.5904 - val\_accuracy: 0.6861

Epoch 18/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1502 - accuracy: 0.9463 - val\_loss: 1.5934 - val\_accuracy: 0.6911

Epoch 19/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1408 - accuracy: 0.9492 - val\_loss: 1.6674 - val\_accuracy: 0.6899

Epoch 20/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1217 - accuracy: 0.9574 - val\_loss: 1.7927 - val\_accuracy: 0.6808

Epoch 21/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1098 - accuracy: 0.9617 - val\_loss: 1.8655 - val\_accuracy: 0.6780

Epoch 22/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.1129 - accuracy: 0.9605 - val\_loss: 1.9603 - val\_accuracy: 0.6881

Epoch 23/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.1009 - accuracy: 0.9647 - val\_loss: 1.9694 - val\_accuracy: 0.6877

Epoch 24/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.0918 - accuracy: 0.9685 - val\_loss: 2.0540 - val\_accuracy: 0.6795

Epoch 25/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1009 - accuracy: 0.9634 - val\_loss: 2.0837 - val\_accuracy: 0.6862

Epoch 26/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.0862 - accuracy: 0.9705 - val\_loss: 2.2320 - val\_accuracy: 0.6768

Epoch 27/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.1036 - accuracy: 0.9640 - val\_loss: 2.2717 - val\_accuracy: 0.6746

Epoch 28/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.0885 - accuracy: 0.9688 - val\_loss: 2.3336 - val\_accuracy: 0.6766

Epoch 29/30

1563/1563 [==============================] - 7s 5ms/step - loss: 0.0924 - accuracy: 0.9673 - val\_loss: 2.3224 - val\_accuracy: 0.6813

Epoch 30/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.0847 - accuracy: 0.9714 - val\_loss: 2.3344 - val\_accuracy: 0.6782

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# A\_01\_tanh

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Epoch 1/30

1563/1563 [==============================] - 8s 5ms/step - loss: 1.5955 - accuracy: 0.4252 - val\_loss: 1.2545 - val\_accuracy: 0.5505

Epoch 2/30

1563/1563 [==============================] - 7s 4ms/step - loss: 1.1581 - accuracy: 0.5953 - val\_loss: 1.0866 - val\_accuracy: 0.6243

Epoch 3/30

1563/1563 [==============================] - 7s 4ms/step - loss: 1.0372 - accuracy: 0.6404 - val\_loss: 1.0709 - val\_accuracy: 0.6261

Epoch 4/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.9728 - accuracy: 0.6605 - val\_loss: 1.0009 - val\_accuracy: 0.6511

Epoch 5/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.9005 - accuracy: 0.6880 - val\_loss: 1.0258 - val\_accuracy: 0.6446

Epoch 6/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8553 - accuracy: 0.7053 - val\_loss: 0.9968 - val\_accuracy: 0.6599

Epoch 7/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8098 - accuracy: 0.7202 - val\_loss: 0.9745 - val\_accuracy: 0.6625

Epoch 8/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7668 - accuracy: 0.7365 - val\_loss: 0.9813 - val\_accuracy: 0.6654

Epoch 9/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7180 - accuracy: 0.7532 - val\_loss: 0.9852 - val\_accuracy: 0.6698

Epoch 10/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6815 - accuracy: 0.7648 - val\_loss: 0.9874 - val\_accuracy: 0.6691

Epoch 11/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6610 - accuracy: 0.7711 - val\_loss: 0.9780 - val\_accuracy: 0.6760

Epoch 12/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.6283 - accuracy: 0.7845 - val\_loss: 1.0070 - val\_accuracy: 0.6690

Epoch 13/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5870 - accuracy: 0.7983 - val\_loss: 1.0357 - val\_accuracy: 0.6683

Epoch 14/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5577 - accuracy: 0.8062 - val\_loss: 1.0149 - val\_accuracy: 0.6706

Epoch 15/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5278 - accuracy: 0.8157 - val\_loss: 1.0560 - val\_accuracy: 0.6674

Epoch 16/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5082 - accuracy: 0.8229 - val\_loss: 1.0566 - val\_accuracy: 0.6716

Epoch 17/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.4832 - accuracy: 0.8338 - val\_loss: 1.1047 - val\_accuracy: 0.6623

Epoch 18/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4497 - accuracy: 0.8433 - val\_loss: 1.2021 - val\_accuracy: 0.6442

Epoch 19/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4430 - accuracy: 0.8470 - val\_loss: 1.1236 - val\_accuracy: 0.6636

Epoch 20/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4167 - accuracy: 0.8560 - val\_loss: 1.1201 - val\_accuracy: 0.6718

Epoch 21/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.4024 - accuracy: 0.8594 - val\_loss: 1.1773 - val\_accuracy: 0.6548

Epoch 22/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.3906 - accuracy: 0.8651 - val\_loss: 1.1705 - val\_accuracy: 0.6647

Epoch 23/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3706 - accuracy: 0.8711 - val\_loss: 1.2520 - val\_accuracy: 0.6527

Epoch 24/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3682 - accuracy: 0.8713 - val\_loss: 1.2094 - val\_accuracy: 0.6611

Epoch 25/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3429 - accuracy: 0.8837 - val\_loss: 1.2522 - val\_accuracy: 0.6591

Epoch 26/30

1563/1563 [==============================] - 6s 4ms/step - loss: 0.3361 - accuracy: 0.8826 - val\_loss: 1.2548 - val\_accuracy: 0.6572

Epoch 27/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3177 - accuracy: 0.8914 - val\_loss: 1.2685 - val\_accuracy: 0.6581

Epoch 28/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3009 - accuracy: 0.8951 - val\_loss: 1.2942 - val\_accuracy: 0.6598

Epoch 29/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3096 - accuracy: 0.8947 - val\_loss: 1.3301 - val\_accuracy: 0.6546

Epoch 30/30

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3001 - accuracy: 0.8919 - val\_loss: 1.3069 - val\_accuracy: 0.6597

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# Batch sizes

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# A\_01 b=1

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Epoch 1/20

50000/50000 [==============================] - 170s 3ms/step - loss: 2.3041 - accuracy: 0.0991 - val\_loss: 2.3038 - val\_accuracy: 0.1000

Epoch 2/20

50000/50000 [==============================] - 168s 3ms/step - loss: 2.3036 - accuracy: 0.0976 - val\_loss: 2.3031 - val\_accuracy: 0.1000

Epoch 3/20

50000/50000 [==============================] - 168s 3ms/step - loss: 2.3033 - accuracy: 0.1008 - val\_loss: 2.3032 - val\_accuracy: 0.1000

Epoch 4/20

50000/50000 [==============================] - 169s 3ms/step - loss: 2.3033 - accuracy: 0.0996 - val\_loss: 2.3031 - val\_accuracy: 0.1000

Epoch 5/20

50000/50000 [==============================] - 168s 3ms/step - loss: 2.3034 - accuracy: 0.1004 - val\_loss: 2.3030 - val\_accuracy: 0.1000

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# A\_01 b=2

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Epoch 1/20

25000/25000 [==============================] - 81s 3ms/step - loss: 1.7232 - accuracy: 0.3652 - val\_loss: 1.2650 - val\_accuracy: 0.5515

Epoch 2/20

25000/25000 [==============================] - 78s 3ms/step - loss: 1.2282 - accuracy: 0.5671 - val\_loss: 1.2310 - val\_accuracy: 0.5672

Epoch 3/20

25000/25000 [==============================] - 78s 3ms/step - loss: 1.0997 - accuracy: 0.6145 - val\_loss: 1.1042 - val\_accuracy: 0.6174

Epoch 4/20

25000/25000 [==============================] - 78s 3ms/step - loss: 1.0259 - accuracy: 0.6396 - val\_loss: 1.1430 - val\_accuracy: 0.6063

Epoch 5/20

25000/25000 [==============================] - 79s 3ms/step - loss: 0.9761 - accuracy: 0.6589 - val\_loss: 1.0858 - val\_accuracy: 0.6315

Epoch 6/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.9390 - accuracy: 0.6714 - val\_loss: 1.0674 - val\_accuracy: 0.6367

Epoch 7/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.9101 - accuracy: 0.6845 - val\_loss: 1.0864 - val\_accuracy: 0.6355

Epoch 8/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8759 - accuracy: 0.6981 - val\_loss: 1.1239 - val\_accuracy: 0.6248

Epoch 9/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8580 - accuracy: 0.6988 - val\_loss: 1.1498 - val\_accuracy: 0.6153

Epoch 10/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8686 - accuracy: 0.7001 - val\_loss: 1.1659 - val\_accuracy: 0.6412

Epoch 11/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8298 - accuracy: 0.7145 - val\_loss: 1.2419 - val\_accuracy: 0.6201

Epoch 12/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8394 - accuracy: 0.7097 - val\_loss: 1.1966 - val\_accuracy: 0.6216

Epoch 13/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8180 - accuracy: 0.7166 - val\_loss: 1.2125 - val\_accuracy: 0.6277

Epoch 14/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8054 - accuracy: 0.7218 - val\_loss: 1.1741 - val\_accuracy: 0.6293

Epoch 15/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8031 - accuracy: 0.7209 - val\_loss: 1.2048 - val\_accuracy: 0.6232

Epoch 16/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.8020 - accuracy: 0.7243 - val\_loss: 1.2656 - val\_accuracy: 0.6232

Epoch 17/20

25000/25000 [==============================] - 82s 3ms/step - loss: 0.7964 - accuracy: 0.7273 - val\_loss: 1.2514 - val\_accuracy: 0.6192

Epoch 18/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.7877 - accuracy: 0.7305 - val\_loss: 1.1879 - val\_accuracy: 0.6463

Epoch 19/20

25000/25000 [==============================] - 79s 3ms/step - loss: 0.7770 - accuracy: 0.7355 - val\_loss: 1.1964 - val\_accuracy: 0.6450

Epoch 20/20

25000/25000 [==============================] - 78s 3ms/step - loss: 0.7903 - accuracy: 0.7263 - val\_loss: 1.1960 - val\_accuracy: 0.6266

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# A\_01 b=0

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Epoch 1/20

16667/16667 [==============================] - 61s 4ms/step - loss: 1.6490 - accuracy: 0.3915 - val\_loss: 1.3794 - val\_accuracy: 0.5134

Epoch 2/20

16667/16667 [==============================] - 60s 4ms/step - loss: 1.1167 - accuracy: 0.6082 - val\_loss: 1.0814 - val\_accuracy: 0.6295

Epoch 3/20

16667/16667 [==============================] - 60s 4ms/step - loss: 0.9696 - accuracy: 0.6613 - val\_loss: 1.0432 - val\_accuracy: 0.6392

Epoch 4/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.8984 - accuracy: 0.6889 - val\_loss: 1.0102 - val\_accuracy: 0.6454

Epoch 5/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.8414 - accuracy: 0.7064 - val\_loss: 0.9907 - val\_accuracy: 0.6699

Epoch 6/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.8004 - accuracy: 0.7225 - val\_loss: 1.0312 - val\_accuracy: 0.6655

Epoch 7/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.7394 - accuracy: 0.7425 - val\_loss: 1.0718 - val\_accuracy: 0.6517

Epoch 8/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.7177 - accuracy: 0.7493 - val\_loss: 1.0332 - val\_accuracy: 0.6703

Epoch 9/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.6721 - accuracy: 0.7641 - val\_loss: 1.1108 - val\_accuracy: 0.6570

Epoch 10/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.6342 - accuracy: 0.7784 - val\_loss: 1.0815 - val\_accuracy: 0.6605

Epoch 11/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.6169 - accuracy: 0.7856 - val\_loss: 1.0921 - val\_accuracy: 0.6659

Epoch 12/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5990 - accuracy: 0.7940 - val\_loss: 1.2148 - val\_accuracy: 0.6578

Epoch 13/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5771 - accuracy: 0.7985 - val\_loss: 1.1688 - val\_accuracy: 0.6716

Epoch 14/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5552 - accuracy: 0.8062 - val\_loss: 1.1914 - val\_accuracy: 0.6610

Epoch 15/20

16667/16667 [==============================] - 60s 4ms/step - loss: 0.5335 - accuracy: 0.8151 - val\_loss: 1.2275 - val\_accuracy: 0.6545

Epoch 16/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5265 - accuracy: 0.8153 - val\_loss: 1.2708 - val\_accuracy: 0.6592

Epoch 17/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5125 - accuracy: 0.8247 - val\_loss: 1.2868 - val\_accuracy: 0.6535

Epoch 18/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.5057 - accuracy: 0.8253 - val\_loss: 1.2906 - val\_accuracy: 0.6607

Epoch 19/20

16667/16667 [==============================] - 61s 4ms/step - loss: 0.4939 - accuracy: 0.8294 - val\_loss: 1.4133 - val\_accuracy: 0.6313

Epoch 20/20

16667/16667 [==============================] - 63s 4ms/step - loss: 0.4906 - accuracy: 0.8315 - val\_loss: 1.4356 - val\_accuracy: 0.6483

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# A\_01 b=4

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Epoch 1/20

12500/12500 [==============================] - 46s 4ms/step - loss: 1.7154 - accuracy: 0.3652 - val\_loss: 1.2042 - val\_accuracy: 0.5706

Epoch 2/20

12500/12500 [==============================] - 45s 4ms/step - loss: 1.1766 - accuracy: 0.5828 - val\_loss: 1.0736 - val\_accuracy: 0.6251

Epoch 3/20

12500/12500 [==============================] - 45s 4ms/step - loss: 1.0141 - accuracy: 0.6431 - val\_loss: 1.0339 - val\_accuracy: 0.6411

Epoch 4/20

12500/12500 [==============================] - 45s 4ms/step - loss: 0.9139 - accuracy: 0.6788 - val\_loss: 0.9680 - val\_accuracy: 0.6630

Epoch 5/20

12500/12500 [==============================] - 42s 3ms/step - loss: 0.8546 - accuracy: 0.6997 - val\_loss: 0.9688 - val\_accuracy: 0.6672

Epoch 6/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.7804 - accuracy: 0.7268 - val\_loss: 0.9912 - val\_accuracy: 0.6701

Epoch 7/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.7453 - accuracy: 0.7350 - val\_loss: 1.0168 - val\_accuracy: 0.6607

Epoch 8/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.7019 - accuracy: 0.7539 - val\_loss: 1.0040 - val\_accuracy: 0.6745

Epoch 9/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.6560 - accuracy: 0.7695 - val\_loss: 1.0412 - val\_accuracy: 0.6705

Epoch 10/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.6370 - accuracy: 0.7747 - val\_loss: 1.0383 - val\_accuracy: 0.6751

Epoch 11/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.6106 - accuracy: 0.7821 - val\_loss: 1.1020 - val\_accuracy: 0.6635

Epoch 12/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.5910 - accuracy: 0.7889 - val\_loss: 1.1408 - val\_accuracy: 0.6716

Epoch 13/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.5595 - accuracy: 0.8038 - val\_loss: 1.1150 - val\_accuracy: 0.6733

Epoch 14/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.5319 - accuracy: 0.8116 - val\_loss: 1.1822 - val\_accuracy: 0.6736

Epoch 15/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.5254 - accuracy: 0.8138 - val\_loss: 1.1516 - val\_accuracy: 0.6650

Epoch 16/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.5040 - accuracy: 0.8231 - val\_loss: 1.2207 - val\_accuracy: 0.6624

Epoch 17/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.4977 - accuracy: 0.8256 - val\_loss: 1.2593 - val\_accuracy: 0.6710

Epoch 18/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.4737 - accuracy: 0.8318 - val\_loss: 1.2308 - val\_accuracy: 0.6645

Epoch 19/20

12500/12500 [==============================] - 40s 3ms/step - loss: 0.4528 - accuracy: 0.8413 - val\_loss: 1.3455 - val\_accuracy: 0.6504

Epoch 20/20

12500/12500 [==============================] - 41s 3ms/step - loss: 0.4424 - accuracy: 0.8438 - val\_loss: 1.3655 - val\_accuracy: 0.6645

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# A\_01 b=5

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Epoch 1/20

10000/10000 [==============================] - 33s 3ms/step - loss: 1.6604 - accuracy: 0.3870 - val\_loss: 1.2274 - val\_accuracy: 0.5557

Epoch 2/20

10000/10000 [==============================] - 32s 3ms/step - loss: 1.1361 - accuracy: 0.6012 - val\_loss: 1.0475 - val\_accuracy: 0.6317

Epoch 3/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.9858 - accuracy: 0.6542 - val\_loss: 1.0206 - val\_accuracy: 0.6411

Epoch 4/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.9017 - accuracy: 0.6850 - val\_loss: 0.9695 - val\_accuracy: 0.6619

Epoch 5/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.8271 - accuracy: 0.7107 - val\_loss: 0.9829 - val\_accuracy: 0.6676

Epoch 6/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.7626 - accuracy: 0.7312 - val\_loss: 1.0109 - val\_accuracy: 0.6581

Epoch 7/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.7247 - accuracy: 0.7421 - val\_loss: 1.0002 - val\_accuracy: 0.6689

Epoch 8/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.6938 - accuracy: 0.7575 - val\_loss: 0.9859 - val\_accuracy: 0.6756

Epoch 9/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.6529 - accuracy: 0.7696 - val\_loss: 1.0551 - val\_accuracy: 0.6604

Epoch 10/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.6227 - accuracy: 0.7795 - val\_loss: 1.0286 - val\_accuracy: 0.6706

Epoch 11/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.5888 - accuracy: 0.7920 - val\_loss: 1.1422 - val\_accuracy: 0.6531

Epoch 12/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.5557 - accuracy: 0.8053 - val\_loss: 1.1033 - val\_accuracy: 0.6698

Epoch 13/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.5430 - accuracy: 0.8061 - val\_loss: 1.1534 - val\_accuracy: 0.6702

Epoch 14/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.5154 - accuracy: 0.8173 - val\_loss: 1.1891 - val\_accuracy: 0.6634

Epoch 15/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.5001 - accuracy: 0.8229 - val\_loss: 1.2510 - val\_accuracy: 0.6514

Epoch 16/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.4835 - accuracy: 0.8274 - val\_loss: 1.2352 - val\_accuracy: 0.6592

Epoch 17/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.4650 - accuracy: 0.8347 - val\_loss: 1.2413 - val\_accuracy: 0.6657

Epoch 18/20

10000/10000 [==============================] - 32s 3ms/step - loss: 0.4523 - accuracy: 0.8406 - val\_loss: 1.2457 - val\_accuracy: 0.6713

Epoch 19/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.4383 - accuracy: 0.8455 - val\_loss: 1.3055 - val\_accuracy: 0.6662

Epoch 20/20

10000/10000 [==============================] - 33s 3ms/step - loss: 0.4112 - accuracy: 0.8566 - val\_loss: 1.3597 - val\_accuracy: 0.6623

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# A\_01 b=6

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Epoch 1/20

8334/8334 [==============================] - 31s 4ms/step - loss: 1.7139 - accuracy: 0.3623 - val\_loss: 1.2011 - val\_accuracy: 0.5748

Epoch 2/20

8334/8334 [==============================] - 30s 4ms/step - loss: 1.1408 - accuracy: 0.5928 - val\_loss: 1.0601 - val\_accuracy: 0.6277

Epoch 3/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.9709 - accuracy: 0.6560 - val\_loss: 0.9952 - val\_accuracy: 0.6598

Epoch 4/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.8735 - accuracy: 0.6915 - val\_loss: 0.9751 - val\_accuracy: 0.6615

Epoch 5/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.8073 - accuracy: 0.7147 - val\_loss: 0.9168 - val\_accuracy: 0.6819

Epoch 6/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.7504 - accuracy: 0.7362 - val\_loss: 0.9264 - val\_accuracy: 0.6889

Epoch 7/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.7044 - accuracy: 0.7523 - val\_loss: 1.0075 - val\_accuracy: 0.6624

Epoch 8/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.6738 - accuracy: 0.7651 - val\_loss: 0.9565 - val\_accuracy: 0.6828

Epoch 9/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.6375 - accuracy: 0.7778 - val\_loss: 0.9714 - val\_accuracy: 0.6873

Epoch 10/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.6077 - accuracy: 0.7857 - val\_loss: 1.0072 - val\_accuracy: 0.6786

Epoch 11/20

8334/8334 [==============================] - 30s 4ms/step - loss: 0.5700 - accuracy: 0.7972 - val\_loss: 0.9706 - val\_accuracy: 0.6949

Epoch 12/20

8334/8334 [==============================] - 30s 4ms/step - loss: 0.5504 - accuracy: 0.8037 - val\_loss: 1.0604 - val\_accuracy: 0.6867

Epoch 13/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.5227 - accuracy: 0.8160 - val\_loss: 1.0611 - val\_accuracy: 0.6811

Epoch 14/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.4869 - accuracy: 0.8281 - val\_loss: 1.0826 - val\_accuracy: 0.6857

Epoch 15/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.4671 - accuracy: 0.8345 - val\_loss: 1.1602 - val\_accuracy: 0.6754

Epoch 16/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.4492 - accuracy: 0.8411 - val\_loss: 1.1373 - val\_accuracy: 0.6849

Epoch 17/20

8334/8334 [==============================] - 30s 4ms/step - loss: 0.4325 - accuracy: 0.8480 - val\_loss: 1.2132 - val\_accuracy: 0.6807

Epoch 18/20

8334/8334 [==============================] - 30s 4ms/step - loss: 0.4138 - accuracy: 0.8525 - val\_loss: 1.2447 - val\_accuracy: 0.6710

Epoch 19/20

8334/8334 [==============================] - 30s 4ms/step - loss: 0.3938 - accuracy: 0.8615 - val\_loss: 1.2543 - val\_accuracy: 0.6784

Epoch 20/20

8334/8334 [==============================] - 31s 4ms/step - loss: 0.3833 - accuracy: 0.8642 - val\_loss: 1.3083 - val\_accuracy: 0.6748

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# A\_01 b=7

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Epoch 1/20

7143/7143 [==============================] - 31s 4ms/step - loss: 1.6851 - accuracy: 0.3758 - val\_loss: 1.2028 - val\_accuracy: 0.5774

Epoch 2/20

7143/7143 [==============================] - 29s 4ms/step - loss: 1.1409 - accuracy: 0.5940 - val\_loss: 1.0284 - val\_accuracy: 0.6383

Epoch 3/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.9813 - accuracy: 0.6529 - val\_loss: 0.9835 - val\_accuracy: 0.6595

Epoch 4/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.8811 - accuracy: 0.6938 - val\_loss: 0.9319 - val\_accuracy: 0.6798

Epoch 5/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.8125 - accuracy: 0.7151 - val\_loss: 0.9542 - val\_accuracy: 0.6730

Epoch 6/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.7571 - accuracy: 0.7355 - val\_loss: 0.9466 - val\_accuracy: 0.6762

Epoch 7/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.7092 - accuracy: 0.7513 - val\_loss: 0.9811 - val\_accuracy: 0.6736

Epoch 8/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.6614 - accuracy: 0.7664 - val\_loss: 0.9919 - val\_accuracy: 0.6764

Epoch 9/20

7143/7143 [==============================] - 37s 5ms/step - loss: 0.6233 - accuracy: 0.7819 - val\_loss: 0.9913 - val\_accuracy: 0.6779

Epoch 10/20

7143/7143 [==============================] - 30s 4ms/step - loss: 0.5823 - accuracy: 0.7949 - val\_loss: 1.0277 - val\_accuracy: 0.6772

Epoch 11/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.5507 - accuracy: 0.8046 - val\_loss: 1.0503 - val\_accuracy: 0.6823

Epoch 12/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.5327 - accuracy: 0.8103 - val\_loss: 1.0192 - val\_accuracy: 0.6920

Epoch 13/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.4895 - accuracy: 0.8259 - val\_loss: 1.0389 - val\_accuracy: 0.6940

Epoch 14/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.4663 - accuracy: 0.8328 - val\_loss: 1.0969 - val\_accuracy: 0.6795

Epoch 15/20

7143/7143 [==============================] - 28s 4ms/step - loss: 0.4501 - accuracy: 0.8385 - val\_loss: 1.1181 - val\_accuracy: 0.6888

Epoch 16/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.4356 - accuracy: 0.8448 - val\_loss: 1.2064 - val\_accuracy: 0.6797

Epoch 17/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.4088 - accuracy: 0.8543 - val\_loss: 1.2305 - val\_accuracy: 0.6743

Epoch 18/20

7143/7143 [==============================] - 29s 4ms/step - loss: 0.3916 - accuracy: 0.8601 - val\_loss: 1.2458 - val\_accuracy: 0.6819

Epoch 19/20

7143/7143 [==============================] - 37s 5ms/step - loss: 0.3694 - accuracy: 0.8676 - val\_loss: 1.3031 - val\_accuracy: 0.6818

Epoch 20/20

7143/7143 [==============================] - 30s 4ms/step - loss: 0.3617 - accuracy: 0.8728 - val\_loss: 1.4008 - val\_accuracy: 0.6717

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# A\_01 b=8

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Epoch 1/20

6250/6250 [==============================] - 23s 4ms/step - loss: 1.7352 - accuracy: 0.3552 - val\_loss: 1.2528 - val\_accuracy: 0.5539

Epoch 2/20

6250/6250 [==============================] - 22s 4ms/step - loss: 1.1590 - accuracy: 0.5857 - val\_loss: 1.0648 - val\_accuracy: 0.6269

Epoch 3/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.9903 - accuracy: 0.6497 - val\_loss: 1.0229 - val\_accuracy: 0.6449

Epoch 4/20

6250/6250 [==============================] - 29s 5ms/step - loss: 0.8944 - accuracy: 0.6857 - val\_loss: 0.9433 - val\_accuracy: 0.6760

Epoch 5/20

6250/6250 [==============================] - 25s 4ms/step - loss: 0.8305 - accuracy: 0.7074 - val\_loss: 0.9426 - val\_accuracy: 0.6776

Epoch 6/20

6250/6250 [==============================] - 23s 4ms/step - loss: 0.7671 - accuracy: 0.7321 - val\_loss: 0.9241 - val\_accuracy: 0.6875

Epoch 7/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.7169 - accuracy: 0.7483 - val\_loss: 0.9205 - val\_accuracy: 0.6924

Epoch 8/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.6747 - accuracy: 0.7630 - val\_loss: 1.0093 - val\_accuracy: 0.6703

Epoch 9/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.6299 - accuracy: 0.7785 - val\_loss: 0.9413 - val\_accuracy: 0.6906

Epoch 10/20

6250/6250 [==============================] - 23s 4ms/step - loss: 0.5869 - accuracy: 0.7916 - val\_loss: 1.0137 - val\_accuracy: 0.6799

Epoch 11/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.5595 - accuracy: 0.8026 - val\_loss: 1.0140 - val\_accuracy: 0.6806

Epoch 12/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.5213 - accuracy: 0.8189 - val\_loss: 1.0291 - val\_accuracy: 0.6810

Epoch 13/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.5012 - accuracy: 0.8212 - val\_loss: 1.0570 - val\_accuracy: 0.6854

Epoch 14/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.4815 - accuracy: 0.8286 - val\_loss: 1.1358 - val\_accuracy: 0.6764

Epoch 15/20

6250/6250 [==============================] - 23s 4ms/step - loss: 0.4517 - accuracy: 0.8392 - val\_loss: 1.1123 - val\_accuracy: 0.6856

Epoch 16/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.4276 - accuracy: 0.8459 - val\_loss: 1.1596 - val\_accuracy: 0.6731

Epoch 17/20

6250/6250 [==============================] - 29s 5ms/step - loss: 0.4088 - accuracy: 0.8561 - val\_loss: 1.2167 - val\_accuracy: 0.6856

Epoch 18/20

6250/6250 [==============================] - 25s 4ms/step - loss: 0.3919 - accuracy: 0.8605 - val\_loss: 1.2433 - val\_accuracy: 0.6742

Epoch 19/20

6250/6250 [==============================] - 23s 4ms/step - loss: 0.3759 - accuracy: 0.8660 - val\_loss: 1.2820 - val\_accuracy: 0.6754

Epoch 20/20

6250/6250 [==============================] - 22s 4ms/step - loss: 0.3615 - accuracy: 0.8694 - val\_loss: 1.3763 - val\_accuracy: 0.6674

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# A\_01 b=9

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Epoch 1/20

5556/5556 [==============================] - 23s 4ms/step - loss: 1.7131 - accuracy: 0.3595 - val\_loss: 1.1922 - val\_accuracy: 0.5680

Epoch 2/20

5556/5556 [==============================] - 22s 4ms/step - loss: 1.1188 - accuracy: 0.6016 - val\_loss: 1.0817 - val\_accuracy: 0.6197

Epoch 3/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.9496 - accuracy: 0.6649 - val\_loss: 0.9823 - val\_accuracy: 0.6553

Epoch 4/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.8543 - accuracy: 0.6992 - val\_loss: 0.9535 - val\_accuracy: 0.6726

Epoch 5/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.7824 - accuracy: 0.7253 - val\_loss: 0.9006 - val\_accuracy: 0.6889

Epoch 6/20

5556/5556 [==============================] - 25s 4ms/step - loss: 0.7202 - accuracy: 0.7476 - val\_loss: 0.8919 - val\_accuracy: 0.6986

Epoch 7/20

5556/5556 [==============================] - 29s 5ms/step - loss: 0.6730 - accuracy: 0.7626 - val\_loss: 0.8850 - val\_accuracy: 0.7018

Epoch 8/20

5556/5556 [==============================] - 23s 4ms/step - loss: 0.6355 - accuracy: 0.7783 - val\_loss: 0.9184 - val\_accuracy: 0.7038

Epoch 9/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.5866 - accuracy: 0.7920 - val\_loss: 0.9203 - val\_accuracy: 0.7058

Epoch 10/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.5547 - accuracy: 0.8053 - val\_loss: 0.9293 - val\_accuracy: 0.7110

Epoch 11/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.5230 - accuracy: 0.8131 - val\_loss: 0.9533 - val\_accuracy: 0.7053

Epoch 12/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.4854 - accuracy: 0.8272 - val\_loss: 1.0184 - val\_accuracy: 0.6968

Epoch 13/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.4573 - accuracy: 0.8389 - val\_loss: 1.0262 - val\_accuracy: 0.7023

Epoch 14/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.4271 - accuracy: 0.8471 - val\_loss: 1.1644 - val\_accuracy: 0.6803

Epoch 15/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.4183 - accuracy: 0.8507 - val\_loss: 1.1066 - val\_accuracy: 0.6922

Epoch 16/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.3923 - accuracy: 0.8592 - val\_loss: 1.1583 - val\_accuracy: 0.6904

Epoch 17/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.3705 - accuracy: 0.8691 - val\_loss: 1.1725 - val\_accuracy: 0.6922

Epoch 18/20

5556/5556 [==============================] - 22s 4ms/step - loss: 0.3522 - accuracy: 0.8737 - val\_loss: 1.2289 - val\_accuracy: 0.6838

Epoch 19/20

5556/5556 [==============================] - 23s 4ms/step - loss: 0.3420 - accuracy: 0.8767 - val\_loss: 1.3179 - val\_accuracy: 0.6780

Epoch 20/20

5556/5556 [==============================] - 30s 5ms/step - loss: 0.3224 - accuracy: 0.8863 - val\_loss: 1.3356 - val\_accuracy: 0.6823

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# A\_01 b=10

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Epoch 1/20

5000/5000 [==============================] - 17s 3ms/step - loss: 1.7428 - accuracy: 0.3528 - val\_loss: 1.1907 - val\_accuracy: 0.5717

Epoch 2/20

5000/5000 [==============================] - 17s 3ms/step - loss: 1.1483 - accuracy: 0.5918 - val\_loss: 1.0757 - val\_accuracy: 0.6198

Epoch 3/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.9744 - accuracy: 0.6574 - val\_loss: 0.9755 - val\_accuracy: 0.6608

Epoch 4/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.8684 - accuracy: 0.6931 - val\_loss: 0.9420 - val\_accuracy: 0.6770

Epoch 5/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.8033 - accuracy: 0.7204 - val\_loss: 0.9033 - val\_accuracy: 0.6906

Epoch 6/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.7399 - accuracy: 0.7411 - val\_loss: 0.9259 - val\_accuracy: 0.6874

Epoch 7/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.6806 - accuracy: 0.7601 - val\_loss: 0.9237 - val\_accuracy: 0.6815

Epoch 8/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.6253 - accuracy: 0.7821 - val\_loss: 0.9736 - val\_accuracy: 0.6750

Epoch 9/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.5773 - accuracy: 0.7970 - val\_loss: 0.9382 - val\_accuracy: 0.6905

Epoch 10/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.5475 - accuracy: 0.8070 - val\_loss: 1.0121 - val\_accuracy: 0.6766

Epoch 11/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.5132 - accuracy: 0.8158 - val\_loss: 1.0552 - val\_accuracy: 0.6732

Epoch 12/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.4853 - accuracy: 0.8304 - val\_loss: 1.1454 - val\_accuracy: 0.6743

Epoch 13/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.4467 - accuracy: 0.8408 - val\_loss: 1.0968 - val\_accuracy: 0.6845

Epoch 14/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.4164 - accuracy: 0.8514 - val\_loss: 1.1529 - val\_accuracy: 0.6747

Epoch 15/20

5000/5000 [==============================] - 16s 3ms/step - loss: 0.3810 - accuracy: 0.8631 - val\_loss: 1.2226 - val\_accuracy: 0.6687

Epoch 16/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.3671 - accuracy: 0.8701 - val\_loss: 1.2822 - val\_accuracy: 0.6701

Epoch 17/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.3483 - accuracy: 0.8772 - val\_loss: 1.3410 - val\_accuracy: 0.6692

Epoch 18/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.3309 - accuracy: 0.8832 - val\_loss: 1.3646 - val\_accuracy: 0.6635

Epoch 19/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.3110 - accuracy: 0.8894 - val\_loss: 1.4547 - val\_accuracy: 0.6697

Epoch 20/20

5000/5000 [==============================] - 17s 3ms/step - loss: 0.2893 - accuracy: 0.8964 - val\_loss: 1.4940 - val\_accuracy: 0.6587

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# A\_01 b=12

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Epoch 1/20

4167/4167 [==============================] - 17s 4ms/step - loss: 1.7220 - accuracy: 0.3641 - val\_loss: 1.2250 - val\_accuracy: 0.5608

Epoch 2/20

4167/4167 [==============================] - 15s 4ms/step - loss: 1.1523 - accuracy: 0.5897 - val\_loss: 1.2412 - val\_accuracy: 0.5575

Epoch 3/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.9901 - accuracy: 0.6524 - val\_loss: 0.9689 - val\_accuracy: 0.6609

Epoch 4/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.8793 - accuracy: 0.6889 - val\_loss: 0.9399 - val\_accuracy: 0.6694

Epoch 5/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.7957 - accuracy: 0.7204 - val\_loss: 0.8808 - val\_accuracy: 0.6923

Epoch 6/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.7382 - accuracy: 0.7397 - val\_loss: 0.9039 - val\_accuracy: 0.6924

Epoch 7/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.6779 - accuracy: 0.7589 - val\_loss: 0.9036 - val\_accuracy: 0.6922

Epoch 8/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.6403 - accuracy: 0.7732 - val\_loss: 0.9185 - val\_accuracy: 0.6924

Epoch 9/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.5942 - accuracy: 0.7912 - val\_loss: 0.9658 - val\_accuracy: 0.6842

Epoch 10/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.5482 - accuracy: 0.8057 - val\_loss: 0.9252 - val\_accuracy: 0.6966

Epoch 11/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.5162 - accuracy: 0.8161 - val\_loss: 0.9602 - val\_accuracy: 0.6995

Epoch 12/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.4787 - accuracy: 0.8278 - val\_loss: 1.0045 - val\_accuracy: 0.6923

Epoch 13/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.4517 - accuracy: 0.8373 - val\_loss: 1.0493 - val\_accuracy: 0.6904

Epoch 14/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.4189 - accuracy: 0.8515 - val\_loss: 1.1423 - val\_accuracy: 0.6785

Epoch 15/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.3918 - accuracy: 0.8595 - val\_loss: 1.1708 - val\_accuracy: 0.6855

Epoch 16/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.3746 - accuracy: 0.8663 - val\_loss: 1.1945 - val\_accuracy: 0.6858

Epoch 17/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.3519 - accuracy: 0.8730 - val\_loss: 1.2539 - val\_accuracy: 0.6865

Epoch 18/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.3286 - accuracy: 0.8823 - val\_loss: 1.3506 - val\_accuracy: 0.6794

Epoch 19/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.3174 - accuracy: 0.8864 - val\_loss: 1.3889 - val\_accuracy: 0.6764

Epoch 20/20

4167/4167 [==============================] - 15s 4ms/step - loss: 0.2923 - accuracy: 0.8944 - val\_loss: 1.4278 - val\_accuracy: 0.6718

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# A\_01 b=15

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Epoch 1/20

3334/3334 [==============================] - 15s 4ms/step - loss: 1.7470 - accuracy: 0.3543 - val\_loss: 1.2331 - val\_accuracy: 0.5554

Epoch 2/20

3334/3334 [==============================] - 13s 4ms/step - loss: 1.1979 - accuracy: 0.5741 - val\_loss: 1.0857 - val\_accuracy: 0.6120

Epoch 3/20

3334/3334 [==============================] - 12s 4ms/step - loss: 1.0179 - accuracy: 0.6393 - val\_loss: 0.9768 - val\_accuracy: 0.6572

Epoch 4/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.9140 - accuracy: 0.6787 - val\_loss: 1.0480 - val\_accuracy: 0.6435

Epoch 5/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.8249 - accuracy: 0.7103 - val\_loss: 1.0446 - val\_accuracy: 0.6435

Epoch 6/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.7743 - accuracy: 0.7279 - val\_loss: 0.9087 - val\_accuracy: 0.6907

Epoch 7/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.7146 - accuracy: 0.7461 - val\_loss: 0.8939 - val\_accuracy: 0.6938

Epoch 8/20

3334/3334 [==============================] - 13s 4ms/step - loss: 0.6793 - accuracy: 0.7625 - val\_loss: 0.9370 - val\_accuracy: 0.6900

Epoch 9/20

3334/3334 [==============================] - 13s 4ms/step - loss: 0.6295 - accuracy: 0.7778 - val\_loss: 0.9442 - val\_accuracy: 0.6980

Epoch 10/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.5945 - accuracy: 0.7904 - val\_loss: 0.9255 - val\_accuracy: 0.6965

Epoch 11/20

3334/3334 [==============================] - 12s 4ms/step - loss: 0.5572 - accuracy: 0.8016 - val\_loss: 0.9398 - val\_accuracy: 0.7060

Epoch 12/20

3334/3334 [==============================] - 13s 4ms/step - loss: 0.5352 - accuracy: 0.8109 - val\_loss: 0.9655 - val\_accuracy: 0.6948

Epoch 13/20

3334/3334 [==============================] - 15s 4ms/step - loss: 0.5025 - accuracy: 0.8207 - val\_loss: 0.9695 - val\_accuracy: 0.7029

Epoch 14/20

3334/3334 [==============================] - 13s 4ms/step - loss: 0.4770 - accuracy: 0.8311 - val\_loss: 0.9930 - val\_accuracy: 0.6947

Epoch 15/20

3334/3334 [==============================] - 15s 5ms/step - loss: 0.4442 - accuracy: 0.8426 - val\_loss: 1.0441 - val\_accuracy: 0.6932

Epoch 16/20

3334/3334 [==============================] - 16s 5ms/step - loss: 0.4255 - accuracy: 0.8489 - val\_loss: 1.1025 - val\_accuracy: 0.6842

Epoch 17/20

3334/3334 [==============================] - 16s 5ms/step - loss: 0.3952 - accuracy: 0.8583 - val\_loss: 1.1257 - val\_accuracy: 0.6964

Epoch 18/20

3334/3334 [==============================] - 15s 5ms/step - loss: 0.3788 - accuracy: 0.8643 - val\_loss: 1.1430 - val\_accuracy: 0.6913

Epoch 19/20

3334/3334 [==============================] - 16s 5ms/step - loss: 0.3691 - accuracy: 0.8665 - val\_loss: 1.2533 - val\_accuracy: 0.6777

Epoch 20/20

3334/3334 [==============================] - 15s 4ms/step - loss: 0.3444 - accuracy: 0.8758 - val\_loss: 1.2534 - val\_accuracy: 0.6759

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# A\_01 b=20

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Epoch 1/20

2500/2500 [==============================] - 13s 4ms/step - loss: 1.7466 - accuracy: 0.3558 - val\_loss: 1.3128 - val\_accuracy: 0.5320

Epoch 2/20

2500/2500 [==============================] - 10s 4ms/step - loss: 1.1850 - accuracy: 0.5809 - val\_loss: 1.0815 - val\_accuracy: 0.6180

Epoch 3/20

2500/2500 [==============================] - 10s 4ms/step - loss: 1.0089 - accuracy: 0.6483 - val\_loss: 0.9823 - val\_accuracy: 0.6533

Epoch 4/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.8957 - accuracy: 0.6876 - val\_loss: 1.0147 - val\_accuracy: 0.6521

Epoch 5/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.8208 - accuracy: 0.7133 - val\_loss: 0.9227 - val\_accuracy: 0.6809

Epoch 6/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.7664 - accuracy: 0.7328 - val\_loss: 0.9102 - val\_accuracy: 0.6880

Epoch 7/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.7016 - accuracy: 0.7534 - val\_loss: 0.8978 - val\_accuracy: 0.6936

Epoch 8/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.6562 - accuracy: 0.7711 - val\_loss: 0.9303 - val\_accuracy: 0.6892

Epoch 9/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.6194 - accuracy: 0.7823 - val\_loss: 0.9290 - val\_accuracy: 0.6957

Epoch 10/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.5791 - accuracy: 0.7948 - val\_loss: 0.9312 - val\_accuracy: 0.6988

Epoch 11/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.5391 - accuracy: 0.8095 - val\_loss: 0.9297 - val\_accuracy: 0.6987

Epoch 12/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.5161 - accuracy: 0.8188 - val\_loss: 0.9634 - val\_accuracy: 0.6968

Epoch 13/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.4810 - accuracy: 0.8301 - val\_loss: 0.9540 - val\_accuracy: 0.7082

Epoch 14/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.4454 - accuracy: 0.8426 - val\_loss: 1.0137 - val\_accuracy: 0.6998

Epoch 15/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.4173 - accuracy: 0.8510 - val\_loss: 1.0486 - val\_accuracy: 0.6999

Epoch 16/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.3982 - accuracy: 0.8580 - val\_loss: 1.0590 - val\_accuracy: 0.6958

Epoch 17/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.3794 - accuracy: 0.8649 - val\_loss: 1.0998 - val\_accuracy: 0.6971

Epoch 18/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.3524 - accuracy: 0.8753 - val\_loss: 1.1886 - val\_accuracy: 0.6873

Epoch 19/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.3310 - accuracy: 0.8803 - val\_loss: 1.2886 - val\_accuracy: 0.6722

Epoch 20/20

2500/2500 [==============================] - 10s 4ms/step - loss: 0.3155 - accuracy: 0.8892 - val\_loss: 1.2483 - val\_accuracy: 0.6849

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# A\_01 b=24

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Epoch 1/20

2084/2084 [==============================] - 10s 5ms/step - loss: 1.7275 - accuracy: 0.3598 - val\_loss: 1.2271 - val\_accuracy: 0.5570

Epoch 2/20

2084/2084 [==============================] - 9s 4ms/step - loss: 1.1582 - accuracy: 0.5952 - val\_loss: 1.0338 - val\_accuracy: 0.6376

Epoch 3/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.9850 - accuracy: 0.6539 - val\_loss: 0.9489 - val\_accuracy: 0.6694

Epoch 4/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.8695 - accuracy: 0.6976 - val\_loss: 0.8943 - val\_accuracy: 0.6874

Epoch 5/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.7922 - accuracy: 0.7208 - val\_loss: 0.9328 - val\_accuracy: 0.6758

Epoch 6/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.7302 - accuracy: 0.7448 - val\_loss: 0.8599 - val\_accuracy: 0.7080

Epoch 7/20

2084/2084 [==============================] - 9s 5ms/step - loss: 0.6757 - accuracy: 0.7632 - val\_loss: 0.9260 - val\_accuracy: 0.6946

Epoch 8/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.6276 - accuracy: 0.7795 - val\_loss: 0.8714 - val\_accuracy: 0.7091

Epoch 9/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.5792 - accuracy: 0.7961 - val\_loss: 0.9075 - val\_accuracy: 0.7055

Epoch 10/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.5483 - accuracy: 0.8085 - val\_loss: 0.9076 - val\_accuracy: 0.7055

Epoch 11/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.5069 - accuracy: 0.8216 - val\_loss: 0.9665 - val\_accuracy: 0.6951

Epoch 12/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.4711 - accuracy: 0.8331 - val\_loss: 0.9646 - val\_accuracy: 0.7038

Epoch 13/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.4321 - accuracy: 0.8494 - val\_loss: 0.9513 - val\_accuracy: 0.7094

Epoch 14/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.4094 - accuracy: 0.8556 - val\_loss: 1.0084 - val\_accuracy: 0.7024

Epoch 15/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.3731 - accuracy: 0.8676 - val\_loss: 1.0173 - val\_accuracy: 0.7066

Epoch 16/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.3436 - accuracy: 0.8765 - val\_loss: 1.0771 - val\_accuracy: 0.7004

Epoch 17/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.3252 - accuracy: 0.8830 - val\_loss: 1.1469 - val\_accuracy: 0.6918

Epoch 18/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.3051 - accuracy: 0.8916 - val\_loss: 1.1523 - val\_accuracy: 0.7008

Epoch 19/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.2824 - accuracy: 0.8993 - val\_loss: 1.2764 - val\_accuracy: 0.6926

Epoch 20/20

2084/2084 [==============================] - 9s 4ms/step - loss: 0.2652 - accuracy: 0.9041 - val\_loss: 1.2632 - val\_accuracy: 0.7054

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# A\_01 b=32

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Epoch 1/20

1563/1563 [==============================] - 8s 5ms/step - loss: 1.7797 - accuracy: 0.3430 - val\_loss: 1.2574 - val\_accuracy: 0.5438

Epoch 2/20

1563/1563 [==============================] - 7s 4ms/step - loss: 1.2251 - accuracy: 0.5646 - val\_loss: 1.1018 - val\_accuracy: 0.6095

Epoch 3/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0611 - accuracy: 0.6241 - val\_loss: 1.0458 - val\_accuracy: 0.6265

Epoch 4/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.9653 - accuracy: 0.6599 - val\_loss: 0.9953 - val\_accuracy: 0.6501

Epoch 5/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8897 - accuracy: 0.6859 - val\_loss: 0.9364 - val\_accuracy: 0.6693

Epoch 6/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8170 - accuracy: 0.7119 - val\_loss: 0.9425 - val\_accuracy: 0.6658

Epoch 7/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7633 - accuracy: 0.7326 - val\_loss: 0.8746 - val\_accuracy: 0.7003

Epoch 8/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7199 - accuracy: 0.7464 - val\_loss: 0.8970 - val\_accuracy: 0.6963

Epoch 9/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6790 - accuracy: 0.7604 - val\_loss: 0.9257 - val\_accuracy: 0.6902

Epoch 10/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6378 - accuracy: 0.7748 - val\_loss: 0.9016 - val\_accuracy: 0.6971

Epoch 11/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6018 - accuracy: 0.7878 - val\_loss: 0.9528 - val\_accuracy: 0.6947

Epoch 12/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5706 - accuracy: 0.7954 - val\_loss: 0.9930 - val\_accuracy: 0.6863

Epoch 13/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5375 - accuracy: 0.8106 - val\_loss: 0.9245 - val\_accuracy: 0.7001

Epoch 14/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.5047 - accuracy: 0.8210 - val\_loss: 0.9650 - val\_accuracy: 0.6965

Epoch 15/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.4853 - accuracy: 0.8269 - val\_loss: 0.9710 - val\_accuracy: 0.7021

Epoch 16/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4513 - accuracy: 0.8388 - val\_loss: 1.0117 - val\_accuracy: 0.6993

Epoch 17/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4191 - accuracy: 0.8513 - val\_loss: 1.0569 - val\_accuracy: 0.6910

Epoch 18/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3974 - accuracy: 0.8562 - val\_loss: 1.0933 - val\_accuracy: 0.6967

Epoch 19/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3716 - accuracy: 0.8656 - val\_loss: 1.0889 - val\_accuracy: 0.6926

Epoch 20/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3623 - accuracy: 0.8708 - val\_loss: 1.2337 - val\_accuracy: 0.6785

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# A\_01 b=64

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Epoch 1/20

782/782 [==============================] - 5s 5ms/step - loss: 1.7995 - accuracy: 0.3311 - val\_loss: 1.2969 - val\_accuracy: 0.5359

Epoch 2/20

782/782 [==============================] - 4s 5ms/step - loss: 1.2533 - accuracy: 0.5504 - val\_loss: 1.1215 - val\_accuracy: 0.5968

Epoch 3/20

782/782 [==============================] - 4s 5ms/step - loss: 1.0772 - accuracy: 0.6185 - val\_loss: 1.0124 - val\_accuracy: 0.6405

Epoch 4/20

782/782 [==============================] - 4s 5ms/step - loss: 0.9546 - accuracy: 0.6665 - val\_loss: 1.0142 - val\_accuracy: 0.6516

Epoch 5/20

782/782 [==============================] - 4s 5ms/step - loss: 0.8856 - accuracy: 0.6913 - val\_loss: 0.9536 - val\_accuracy: 0.6696

Epoch 6/20

782/782 [==============================] - 4s 5ms/step - loss: 0.8293 - accuracy: 0.7127 - val\_loss: 0.8788 - val\_accuracy: 0.6975

Epoch 7/20

782/782 [==============================] - 4s 5ms/step - loss: 0.7680 - accuracy: 0.7293 - val\_loss: 0.8986 - val\_accuracy: 0.6931

Epoch 8/20

782/782 [==============================] - 4s 5ms/step - loss: 0.7278 - accuracy: 0.7464 - val\_loss: 0.8997 - val\_accuracy: 0.6927

Epoch 9/20

782/782 [==============================] - 4s 5ms/step - loss: 0.6895 - accuracy: 0.7576 - val\_loss: 0.8689 - val\_accuracy: 0.7051

Epoch 10/20

782/782 [==============================] - 4s 5ms/step - loss: 0.6391 - accuracy: 0.7778 - val\_loss: 0.8935 - val\_accuracy: 0.7027

Epoch 11/20

782/782 [==============================] - 4s 5ms/step - loss: 0.6118 - accuracy: 0.7869 - val\_loss: 0.8506 - val\_accuracy: 0.7130

Epoch 12/20

782/782 [==============================] - 4s 5ms/step - loss: 0.5694 - accuracy: 0.8001 - val\_loss: 0.8403 - val\_accuracy: 0.7141

Epoch 13/20

782/782 [==============================] - 4s 5ms/step - loss: 0.5320 - accuracy: 0.8141 - val\_loss: 0.8776 - val\_accuracy: 0.7080

Epoch 14/20

782/782 [==============================] - 4s 5ms/step - loss: 0.5026 - accuracy: 0.8239 - val\_loss: 0.9584 - val\_accuracy: 0.7049

Epoch 15/20

782/782 [==============================] - 4s 5ms/step - loss: 0.4823 - accuracy: 0.8277 - val\_loss: 0.9352 - val\_accuracy: 0.7090

Epoch 16/20

782/782 [==============================] - 4s 5ms/step - loss: 0.4464 - accuracy: 0.8436 - val\_loss: 0.9303 - val\_accuracy: 0.7155

Epoch 17/20

782/782 [==============================] - 4s 5ms/step - loss: 0.4312 - accuracy: 0.8477 - val\_loss: 1.0045 - val\_accuracy: 0.7059

Epoch 18/20

782/782 [==============================] - 4s 5ms/step - loss: 0.4024 - accuracy: 0.8575 - val\_loss: 0.9936 - val\_accuracy: 0.7139

Epoch 19/20

782/782 [==============================] - 4s 5ms/step - loss: 0.3743 - accuracy: 0.8697 - val\_loss: 1.0462 - val\_accuracy: 0.7026

Epoch 20/20

782/782 [==============================] - 4s 5ms/step - loss: 0.3593 - accuracy: 0.8717 - val\_loss: 1.0238 - val\_accuracy: 0.7110

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# A\_01 b=128

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Epoch 1/20

391/391 [==============================] - 4s 8ms/step - loss: 1.8538 - accuracy: 0.3144 - val\_loss: 1.4026 - val\_accuracy: 0.5009

Epoch 2/20

391/391 [==============================] - 2s 6ms/step - loss: 1.3271 - accuracy: 0.5235 - val\_loss: 1.1917 - val\_accuracy: 0.5755

Epoch 3/20

391/391 [==============================] - 2s 6ms/step - loss: 1.1700 - accuracy: 0.5861 - val\_loss: 1.1152 - val\_accuracy: 0.6062

Epoch 4/20

391/391 [==============================] - 2s 6ms/step - loss: 1.0666 - accuracy: 0.6229 - val\_loss: 1.0529 - val\_accuracy: 0.6337

Epoch 5/20

391/391 [==============================] - 2s 6ms/step - loss: 0.9907 - accuracy: 0.6499 - val\_loss: 0.9718 - val\_accuracy: 0.6605

Epoch 6/20

391/391 [==============================] - 2s 6ms/step - loss: 0.9290 - accuracy: 0.6750 - val\_loss: 0.9382 - val\_accuracy: 0.6751

Epoch 7/20

391/391 [==============================] - 2s 6ms/step - loss: 0.8822 - accuracy: 0.6937 - val\_loss: 0.9447 - val\_accuracy: 0.6740

Epoch 8/20

391/391 [==============================] - 2s 6ms/step - loss: 0.8434 - accuracy: 0.7059 - val\_loss: 0.9038 - val\_accuracy: 0.6876

Epoch 9/20

391/391 [==============================] - 2s 6ms/step - loss: 0.7860 - accuracy: 0.7269 - val\_loss: 0.9118 - val\_accuracy: 0.6861

Epoch 10/20

391/391 [==============================] - 2s 6ms/step - loss: 0.7697 - accuracy: 0.7287 - val\_loss: 0.8843 - val\_accuracy: 0.6991

Epoch 11/20

391/391 [==============================] - 2s 6ms/step - loss: 0.7348 - accuracy: 0.7424 - val\_loss: 0.9283 - val\_accuracy: 0.6826

Epoch 12/20

391/391 [==============================] - 2s 6ms/step - loss: 0.7131 - accuracy: 0.7506 - val\_loss: 0.8488 - val\_accuracy: 0.7144

Epoch 13/20

391/391 [==============================] - 2s 6ms/step - loss: 0.6727 - accuracy: 0.7644 - val\_loss: 0.8533 - val\_accuracy: 0.7104

Epoch 14/20

391/391 [==============================] - 2s 6ms/step - loss: 0.6501 - accuracy: 0.7732 - val\_loss: 0.8247 - val\_accuracy: 0.7271

Epoch 15/20

391/391 [==============================] - 2s 6ms/step - loss: 0.6157 - accuracy: 0.7891 - val\_loss: 0.8165 - val\_accuracy: 0.7279

Epoch 16/20

391/391 [==============================] - 2s 6ms/step - loss: 0.5940 - accuracy: 0.7949 - val\_loss: 0.8742 - val\_accuracy: 0.7136

Epoch 17/20

391/391 [==============================] - 2s 6ms/step - loss: 0.5803 - accuracy: 0.7967 - val\_loss: 0.8790 - val\_accuracy: 0.7170

Epoch 18/20

391/391 [==============================] - 2s 6ms/step - loss: 0.5462 - accuracy: 0.8105 - val\_loss: 0.8577 - val\_accuracy: 0.7190

Epoch 19/20

391/391 [==============================] - 2s 6ms/step - loss: 0.5250 - accuracy: 0.8181 - val\_loss: 0.8747 - val\_accuracy: 0.7169

Epoch 20/20

391/391 [==============================] - 2s 6ms/step - loss: 0.5010 - accuracy: 0.8247 - val\_loss: 0.8915 - val\_accuracy: 0.7193

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# A\_01 b= 256

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Epoch 1/20

196/196 [==============================] - 3s 11ms/step - loss: 1.9302 - accuracy: 0.2850 - val\_loss: 1.4654 - val\_accuracy: 0.4638

Epoch 2/20

196/196 [==============================] - 2s 9ms/step - loss: 1.4343 - accuracy: 0.4806 - val\_loss: 1.3182 - val\_accuracy: 0.5203

Epoch 3/20

196/196 [==============================] - 2s 9ms/step - loss: 1.3066 - accuracy: 0.5333 - val\_loss: 1.2233 - val\_accuracy: 0.5652

Epoch 4/20

196/196 [==============================] - 2s 9ms/step - loss: 1.1917 - accuracy: 0.5801 - val\_loss: 1.1674 - val\_accuracy: 0.5873

Epoch 5/20

196/196 [==============================] - 2s 9ms/step - loss: 1.1235 - accuracy: 0.6065 - val\_loss: 1.1562 - val\_accuracy: 0.5883

Epoch 6/20

196/196 [==============================] - 2s 9ms/step - loss: 1.0755 - accuracy: 0.6227 - val\_loss: 1.0646 - val\_accuracy: 0.6286

Epoch 7/20

196/196 [==============================] - 2s 9ms/step - loss: 1.0297 - accuracy: 0.6385 - val\_loss: 1.0841 - val\_accuracy: 0.6183

Epoch 8/20

196/196 [==============================] - 2s 9ms/step - loss: 0.9855 - accuracy: 0.6542 - val\_loss: 1.0689 - val\_accuracy: 0.6257

Epoch 9/20

196/196 [==============================] - 2s 9ms/step - loss: 0.9478 - accuracy: 0.6712 - val\_loss: 0.9946 - val\_accuracy: 0.6528

Epoch 10/20

196/196 [==============================] - 2s 9ms/step - loss: 0.9160 - accuracy: 0.6782 - val\_loss: 0.9743 - val\_accuracy: 0.6564

Epoch 11/20

196/196 [==============================] - 2s 9ms/step - loss: 0.8887 - accuracy: 0.6920 - val\_loss: 0.9473 - val\_accuracy: 0.6733

Epoch 12/20

196/196 [==============================] - 2s 9ms/step - loss: 0.8514 - accuracy: 0.7027 - val\_loss: 0.9265 - val\_accuracy: 0.6809

Epoch 13/20

196/196 [==============================] - 2s 9ms/step - loss: 0.8267 - accuracy: 0.7126 - val\_loss: 0.9088 - val\_accuracy: 0.6839

Epoch 14/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7971 - accuracy: 0.7191 - val\_loss: 0.9121 - val\_accuracy: 0.6853

Epoch 15/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7833 - accuracy: 0.7274 - val\_loss: 0.9043 - val\_accuracy: 0.6870

Epoch 16/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7653 - accuracy: 0.7318 - val\_loss: 0.8980 - val\_accuracy: 0.6888

Epoch 17/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7335 - accuracy: 0.7449 - val\_loss: 0.8822 - val\_accuracy: 0.6958

Epoch 18/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7133 - accuracy: 0.7519 - val\_loss: 0.8827 - val\_accuracy: 0.6978

Epoch 19/20

196/196 [==============================] - 2s 9ms/step - loss: 0.7025 - accuracy: 0.7544 - val\_loss: 0.8499 - val\_accuracy: 0.7097

Epoch 20/20

196/196 [==============================] - 2s 9ms/step - loss: 0.6696 - accuracy: 0.7674 - val\_loss: 0.8761 - val\_accuracy: 0.7026

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# A\_01 b=512

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Epoch 1/20

98/98 [==============================] - 3s 20ms/step - loss: 2.0207 - accuracy: 0.2573 - val\_loss: 1.5695 - val\_accuracy: 0.4344

Epoch 2/20

98/98 [==============================] - 1s 15ms/step - loss: 1.5235 - accuracy: 0.4491 - val\_loss: 1.4143 - val\_accuracy: 0.4880

Epoch 3/20

98/98 [==============================] - 1s 15ms/step - loss: 1.3735 - accuracy: 0.5069 - val\_loss: 1.3172 - val\_accuracy: 0.5296

Epoch 4/20

98/98 [==============================] - 1s 15ms/step - loss: 1.2949 - accuracy: 0.5399 - val\_loss: 1.2744 - val\_accuracy: 0.5535

Epoch 5/20

98/98 [==============================] - 1s 15ms/step - loss: 1.2176 - accuracy: 0.5707 - val\_loss: 1.1828 - val\_accuracy: 0.5853

Epoch 6/20

98/98 [==============================] - 2s 17ms/step - loss: 1.1537 - accuracy: 0.5958 - val\_loss: 1.1475 - val\_accuracy: 0.5911

Epoch 7/20

98/98 [==============================] - 1s 15ms/step - loss: 1.1042 - accuracy: 0.6093 - val\_loss: 1.1038 - val\_accuracy: 0.6064

Epoch 8/20

98/98 [==============================] - 1s 15ms/step - loss: 1.0575 - accuracy: 0.6280 - val\_loss: 1.0474 - val\_accuracy: 0.6340

Epoch 9/20

98/98 [==============================] - 1s 15ms/step - loss: 1.0175 - accuracy: 0.6448 - val\_loss: 1.0278 - val\_accuracy: 0.6371

Epoch 10/20

98/98 [==============================] - 1s 15ms/step - loss: 0.9783 - accuracy: 0.6590 - val\_loss: 1.0233 - val\_accuracy: 0.6326

Epoch 11/20

98/98 [==============================] - 1s 15ms/step - loss: 0.9361 - accuracy: 0.6739 - val\_loss: 1.0043 - val\_accuracy: 0.6475

Epoch 12/20

98/98 [==============================] - 1s 15ms/step - loss: 0.9164 - accuracy: 0.6812 - val\_loss: 0.9640 - val\_accuracy: 0.6674

Epoch 13/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8992 - accuracy: 0.6860 - val\_loss: 0.9810 - val\_accuracy: 0.6580

Epoch 14/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8856 - accuracy: 0.6905 - val\_loss: 0.9386 - val\_accuracy: 0.6765

Epoch 15/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8515 - accuracy: 0.7032 - val\_loss: 0.9493 - val\_accuracy: 0.6719

Epoch 16/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8152 - accuracy: 0.7156 - val\_loss: 0.9106 - val\_accuracy: 0.6841

Epoch 17/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8194 - accuracy: 0.7192 - val\_loss: 0.9041 - val\_accuracy: 0.6917

Epoch 18/20

98/98 [==============================] - 1s 15ms/step - loss: 0.8049 - accuracy: 0.7241 - val\_loss: 0.8774 - val\_accuracy: 0.6943

Epoch 19/20

98/98 [==============================] - 1s 15ms/step - loss: 0.7720 - accuracy: 0.7327 - val\_loss: 0.8863 - val\_accuracy: 0.6944

Epoch 20/20

98/98 [==============================] - 1s 15ms/step - loss: 0.7648 - accuracy: 0.7334 - val\_loss: 0.8907 - val\_accuracy: 0.6929

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# A\_01 b=1024

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Epoch 1/20

49/49 [==============================] - 3s 40ms/step - loss: 2.1777 - accuracy: 0.1944 - val\_loss: 1.8018 - val\_accuracy: 0.3599

Epoch 2/20

49/49 [==============================] - 1s 26ms/step - loss: 1.7149 - accuracy: 0.3825 - val\_loss: 1.5554 - val\_accuracy: 0.4407

Epoch 3/20

49/49 [==============================] - 1s 26ms/step - loss: 1.5173 - accuracy: 0.4493 - val\_loss: 1.4615 - val\_accuracy: 0.4731

Epoch 4/20

49/49 [==============================] - 1s 26ms/step - loss: 1.4175 - accuracy: 0.4914 - val\_loss: 1.3560 - val\_accuracy: 0.5157

Epoch 5/20

49/49 [==============================] - 1s 26ms/step - loss: 1.3280 - accuracy: 0.5277 - val\_loss: 1.3008 - val\_accuracy: 0.5364

Epoch 6/20

49/49 [==============================] - 1s 26ms/step - loss: 1.2624 - accuracy: 0.5506 - val\_loss: 1.3010 - val\_accuracy: 0.5395

Epoch 7/20

49/49 [==============================] - 1s 26ms/step - loss: 1.2577 - accuracy: 0.5551 - val\_loss: 1.2461 - val\_accuracy: 0.5631

Epoch 8/20

49/49 [==============================] - 1s 26ms/step - loss: 1.2031 - accuracy: 0.5755 - val\_loss: 1.1956 - val\_accuracy: 0.5702

Epoch 9/20

49/49 [==============================] - 1s 26ms/step - loss: 1.1782 - accuracy: 0.5854 - val\_loss: 1.1632 - val\_accuracy: 0.5930

Epoch 10/20

49/49 [==============================] - 1s 26ms/step - loss: 1.1337 - accuracy: 0.6028 - val\_loss: 1.1278 - val\_accuracy: 0.6104

Epoch 11/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0991 - accuracy: 0.6185 - val\_loss: 1.1326 - val\_accuracy: 0.6018

Epoch 12/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0845 - accuracy: 0.6207 - val\_loss: 1.1254 - val\_accuracy: 0.6089

Epoch 13/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0704 - accuracy: 0.6278 - val\_loss: 1.0905 - val\_accuracy: 0.6179

Epoch 14/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0496 - accuracy: 0.6350 - val\_loss: 1.0632 - val\_accuracy: 0.6309

Epoch 15/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0191 - accuracy: 0.6478 - val\_loss: 1.0535 - val\_accuracy: 0.6336

Epoch 16/20

49/49 [==============================] - 1s 26ms/step - loss: 1.0134 - accuracy: 0.6474 - val\_loss: 1.0332 - val\_accuracy: 0.6399

Epoch 17/20

49/49 [==============================] - 1s 26ms/step - loss: 0.9755 - accuracy: 0.6596 - val\_loss: 1.0339 - val\_accuracy: 0.6419

Epoch 18/20

49/49 [==============================] - 1s 26ms/step - loss: 0.9603 - accuracy: 0.6655 - val\_loss: 1.0033 - val\_accuracy: 0.6555

Epoch 19/20

49/49 [==============================] - 1s 26ms/step - loss: 0.9507 - accuracy: 0.6708 - val\_loss: 0.9875 - val\_accuracy: 0.6593

Epoch 20/20

49/49 [==============================] - 1s 26ms/step - loss: 0.9213 - accuracy: 0.6772 - val\_loss: 0.9951 - val\_accuracy: 0.6541

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# A\_01 b=2048

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Epoch 1/20

25/25 [==============================] - 3s 70ms/step - loss: 2.2206 - accuracy: 0.1781 - val\_loss: 1.9901 - val\_accuracy: 0.2616

Epoch 2/20

25/25 [==============================] - 1s 47ms/step - loss: 1.9257 - accuracy: 0.2929 - val\_loss: 1.7724 - val\_accuracy: 0.3610

Epoch 3/20

25/25 [==============================] - 1s 47ms/step - loss: 1.7404 - accuracy: 0.3724 - val\_loss: 1.6499 - val\_accuracy: 0.4035

Epoch 4/20

25/25 [==============================] - 1s 47ms/step - loss: 1.6298 - accuracy: 0.4144 - val\_loss: 1.5561 - val\_accuracy: 0.4403

Epoch 5/20

25/25 [==============================] - 1s 47ms/step - loss: 1.5335 - accuracy: 0.4476 - val\_loss: 1.4779 - val\_accuracy: 0.4648

Epoch 6/20

25/25 [==============================] - 1s 48ms/step - loss: 1.4711 - accuracy: 0.4755 - val\_loss: 1.5905 - val\_accuracy: 0.4473

Epoch 7/20

25/25 [==============================] - 1s 47ms/step - loss: 1.4709 - accuracy: 0.4758 - val\_loss: 1.3979 - val\_accuracy: 0.4940

Epoch 8/20

25/25 [==============================] - 1s 47ms/step - loss: 1.3873 - accuracy: 0.5035 - val\_loss: 1.3614 - val\_accuracy: 0.5123

Epoch 9/20

25/25 [==============================] - 1s 47ms/step - loss: 1.3522 - accuracy: 0.5213 - val\_loss: 1.3279 - val\_accuracy: 0.5248

Epoch 10/20

25/25 [==============================] - 1s 47ms/step - loss: 1.3224 - accuracy: 0.5300 - val\_loss: 1.3093 - val\_accuracy: 0.5326

Epoch 11/20

25/25 [==============================] - 1s 47ms/step - loss: 1.2941 - accuracy: 0.5438 - val\_loss: 1.3448 - val\_accuracy: 0.5211

Epoch 12/20

25/25 [==============================] - 1s 47ms/step - loss: 1.2825 - accuracy: 0.5459 - val\_loss: 1.2730 - val\_accuracy: 0.5448

Epoch 13/20

25/25 [==============================] - 1s 48ms/step - loss: 1.2538 - accuracy: 0.5608 - val\_loss: 1.2674 - val\_accuracy: 0.5525

Epoch 14/20

25/25 [==============================] - 1s 47ms/step - loss: 1.2372 - accuracy: 0.5639 - val\_loss: 1.2263 - val\_accuracy: 0.5659

Epoch 15/20

25/25 [==============================] - 1s 47ms/step - loss: 1.1961 - accuracy: 0.5817 - val\_loss: 1.2332 - val\_accuracy: 0.5596

Epoch 16/20

25/25 [==============================] - 1s 47ms/step - loss: 1.1878 - accuracy: 0.5823 - val\_loss: 1.2161 - val\_accuracy: 0.5677

Epoch 17/20

25/25 [==============================] - 1s 47ms/step - loss: 1.1737 - accuracy: 0.5923 - val\_loss: 1.1862 - val\_accuracy: 0.5831

Epoch 18/20

25/25 [==============================] - 1s 56ms/step - loss: 1.1785 - accuracy: 0.5863 - val\_loss: 1.1610 - val\_accuracy: 0.5890

Epoch 19/20

25/25 [==============================] - 1s 48ms/step - loss: 1.1228 - accuracy: 0.6090 - val\_loss: 1.1426 - val\_accuracy: 0.5968

Epoch 20/20

25/25 [==============================] - 1s 47ms/step - loss: 1.1188 - accuracy: 0.6096 - val\_loss: 1.1406 - val\_accuracy: 0.5948

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# A\_01 b=4096

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Epoch 1/20

13/13 [==============================] - 3s 122ms/step - loss: 2.2671 - accuracy: 0.1401 - val\_loss: 2.0704 - val\_accuracy: 0.2523

Epoch 2/20

13/13 [==============================] - 1s 91ms/step - loss: 2.0024 - accuracy: 0.2863 - val\_loss: 1.8845 - val\_accuracy: 0.3235

Epoch 3/20

13/13 [==============================] - 1s 93ms/step - loss: 1.8515 - accuracy: 0.3309 - val\_loss: 1.7761 - val\_accuracy: 0.3622

Epoch 4/20

13/13 [==============================] - 1s 92ms/step - loss: 1.7467 - accuracy: 0.3683 - val\_loss: 1.6896 - val\_accuracy: 0.3913

Epoch 5/20

13/13 [==============================] - 1s 92ms/step - loss: 1.6878 - accuracy: 0.3886 - val\_loss: 1.6186 - val\_accuracy: 0.4161

Epoch 6/20

13/13 [==============================] - 1s 91ms/step - loss: 1.6034 - accuracy: 0.4199 - val\_loss: 1.6215 - val\_accuracy: 0.4234

Epoch 7/20

13/13 [==============================] - 1s 91ms/step - loss: 1.5736 - accuracy: 0.4320 - val\_loss: 1.5236 - val\_accuracy: 0.4485

Epoch 8/20

13/13 [==============================] - 1s 92ms/step - loss: 1.5158 - accuracy: 0.4485 - val\_loss: 1.5117 - val\_accuracy: 0.4484

Epoch 9/20

13/13 [==============================] - 1s 92ms/step - loss: 1.5087 - accuracy: 0.4540 - val\_loss: 1.5028 - val\_accuracy: 0.4546

Epoch 10/20

13/13 [==============================] - 1s 92ms/step - loss: 1.4636 - accuracy: 0.4699 - val\_loss: 1.4664 - val\_accuracy: 0.4785

Epoch 11/20

13/13 [==============================] - 1s 92ms/step - loss: 1.4447 - accuracy: 0.4834 - val\_loss: 1.4094 - val\_accuracy: 0.4895

Epoch 12/20

13/13 [==============================] - 1s 92ms/step - loss: 1.3959 - accuracy: 0.4982 - val\_loss: 1.3785 - val\_accuracy: 0.4967

Epoch 13/20

13/13 [==============================] - 1s 92ms/step - loss: 1.3646 - accuracy: 0.5129 - val\_loss: 1.3554 - val\_accuracy: 0.5135

Epoch 14/20

13/13 [==============================] - 1s 92ms/step - loss: 1.3414 - accuracy: 0.5234 - val\_loss: 1.3865 - val\_accuracy: 0.5153

Epoch 15/20

13/13 [==============================] - 1s 92ms/step - loss: 1.3626 - accuracy: 0.5182 - val\_loss: 1.3336 - val\_accuracy: 0.5224

Epoch 16/20

13/13 [==============================] - 1s 91ms/step - loss: 1.3129 - accuracy: 0.5354 - val\_loss: 1.3811 - val\_accuracy: 0.5048

Epoch 17/20

13/13 [==============================] - 1s 92ms/step - loss: 1.3235 - accuracy: 0.5295 - val\_loss: 1.3106 - val\_accuracy: 0.5331

Epoch 18/20

13/13 [==============================] - 1s 91ms/step - loss: 1.2809 - accuracy: 0.5462 - val\_loss: 1.2978 - val\_accuracy: 0.5414

Epoch 19/20

13/13 [==============================] - 1s 92ms/step - loss: 1.2625 - accuracy: 0.5513 - val\_loss: 1.2603 - val\_accuracy: 0.5518

Epoch 20/20

13/13 [==============================] - 1s 90ms/step - loss: 1.2512 - accuracy: 0.5552 - val\_loss: 1.2768 - val\_accuracy: 0.5509

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# A\_01 b=8192

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Epoch 1/20

7/7 [==============================] - 4s 229ms/step - loss: 2.2884 - accuracy: 0.1156 - val\_loss: 2.2056 - val\_accuracy: 0.1937

Epoch 2/20

7/7 [==============================] - 1s 218ms/step - loss: 2.1671 - accuracy: 0.2167 - val\_loss: 2.0732 - val\_accuracy: 0.2726

Epoch 3/20

7/7 [==============================] - 1s 170ms/step - loss: 2.0348 - accuracy: 0.2705 - val\_loss: 1.9460 - val\_accuracy: 0.3059

Epoch 4/20

7/7 [==============================] - 1s 171ms/step - loss: 1.9254 - accuracy: 0.3095 - val\_loss: 1.8952 - val\_accuracy: 0.3181

Epoch 5/20

7/7 [==============================] - 1s 171ms/step - loss: 1.8666 - accuracy: 0.3325 - val\_loss: 1.7975 - val\_accuracy: 0.3559

Epoch 6/20

7/7 [==============================] - 1s 170ms/step - loss: 1.7839 - accuracy: 0.3604 - val\_loss: 1.7710 - val\_accuracy: 0.3569

Epoch 7/20

7/7 [==============================] - 1s 170ms/step - loss: 1.7482 - accuracy: 0.3710 - val\_loss: 1.7270 - val\_accuracy: 0.3764

Epoch 8/20

7/7 [==============================] - 1s 173ms/step - loss: 1.7010 - accuracy: 0.3890 - val\_loss: 1.6507 - val\_accuracy: 0.4041

Epoch 9/20

7/7 [==============================] - 1s 176ms/step - loss: 1.6463 - accuracy: 0.4093 - val\_loss: 1.6130 - val\_accuracy: 0.4175

Epoch 10/20

7/7 [==============================] - 1s 173ms/step - loss: 1.6090 - accuracy: 0.4198 - val\_loss: 1.6278 - val\_accuracy: 0.4013

Epoch 11/20

7/7 [==============================] - 1s 171ms/step - loss: 1.5986 - accuracy: 0.4214 - val\_loss: 1.5522 - val\_accuracy: 0.4388

Epoch 12/20

7/7 [==============================] - 1s 172ms/step - loss: 1.5477 - accuracy: 0.4451 - val\_loss: 1.5327 - val\_accuracy: 0.4490

Epoch 13/20

7/7 [==============================] - 1s 168ms/step - loss: 1.5214 - accuracy: 0.4536 - val\_loss: 1.5231 - val\_accuracy: 0.4523

Epoch 14/20

7/7 [==============================] - 1s 170ms/step - loss: 1.5012 - accuracy: 0.4603 - val\_loss: 1.4829 - val\_accuracy: 0.4681

Epoch 15/20

7/7 [==============================] - 1s 168ms/step - loss: 1.4752 - accuracy: 0.4728 - val\_loss: 1.4645 - val\_accuracy: 0.4710

Epoch 16/20

7/7 [==============================] - 1s 172ms/step - loss: 1.4531 - accuracy: 0.4781 - val\_loss: 1.4455 - val\_accuracy: 0.4822

Epoch 17/20

7/7 [==============================] - 1s 172ms/step - loss: 1.4290 - accuracy: 0.4924 - val\_loss: 1.4833 - val\_accuracy: 0.4703

Epoch 18/20

7/7 [==============================] - 1s 174ms/step - loss: 1.4869 - accuracy: 0.4699 - val\_loss: 1.4406 - val\_accuracy: 0.4812

Epoch 19/20

7/7 [==============================] - 1s 171ms/step - loss: 1.4379 - accuracy: 0.4869 - val\_loss: 1.4243 - val\_accuracy: 0.4904

Epoch 20/20

7/7 [==============================] - 1s 165ms/step - loss: 1.4043 - accuracy: 0.5035 - val\_loss: 1.3829 - val\_accuracy: 0.5073

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# A\_01 b=10,000

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Epoch 1/20

5/5 [==============================] - 4s 327ms/step - loss: 2.2969 - accuracy: 0.1135 - val\_loss: 2.2461 - val\_accuracy: 0.2170

Epoch 2/20

5/5 [==============================] - 1s 243ms/step - loss: 2.2168 - accuracy: 0.2283 - val\_loss: 2.1000 - val\_accuracy: 0.2596

Epoch 3/20

5/5 [==============================] - 1s 244ms/step - loss: 2.0726 - accuracy: 0.2580 - val\_loss: 1.9900 - val\_accuracy: 0.2808

Epoch 4/20

5/5 [==============================] - 1s 244ms/step - loss: 1.9789 - accuracy: 0.2769 - val\_loss: 1.9372 - val\_accuracy: 0.2918

Epoch 5/20

5/5 [==============================] - 1s 246ms/step - loss: 1.9167 - accuracy: 0.3004 - val\_loss: 1.8664 - val\_accuracy: 0.3180

Epoch 6/20

5/5 [==============================] - 1s 248ms/step - loss: 1.8644 - accuracy: 0.3219 - val\_loss: 1.8180 - val\_accuracy: 0.3466

Epoch 7/20

5/5 [==============================] - 1s 244ms/step - loss: 1.8094 - accuracy: 0.3443 - val\_loss: 1.7664 - val\_accuracy: 0.3668

Epoch 8/20

5/5 [==============================] - 1s 246ms/step - loss: 1.7626 - accuracy: 0.3662 - val\_loss: 1.7180 - val\_accuracy: 0.3850

Epoch 9/20

5/5 [==============================] - 1s 247ms/step - loss: 1.7320 - accuracy: 0.3804 - val\_loss: 1.6817 - val\_accuracy: 0.3966

Epoch 10/20

5/5 [==============================] - 1s 243ms/step - loss: 1.7005 - accuracy: 0.3893 - val\_loss: 1.6614 - val\_accuracy: 0.4068

Epoch 11/20

5/5 [==============================] - 1s 245ms/step - loss: 1.6619 - accuracy: 0.4029 - val\_loss: 1.6467 - val\_accuracy: 0.4069

Epoch 12/20

5/5 [==============================] - 1s 246ms/step - loss: 1.6397 - accuracy: 0.4135 - val\_loss: 1.6190 - val\_accuracy: 0.4227

Epoch 13/20

5/5 [==============================] - 1s 247ms/step - loss: 1.6055 - accuracy: 0.4229 - val\_loss: 1.5774 - val\_accuracy: 0.4349

Epoch 14/20

5/5 [==============================] - 1s 245ms/step - loss: 1.5785 - accuracy: 0.4323 - val\_loss: 1.5682 - val\_accuracy: 0.4385

Epoch 15/20

5/5 [==============================] - 1s 248ms/step - loss: 1.5570 - accuracy: 0.4390 - val\_loss: 1.5404 - val\_accuracy: 0.4472

Epoch 16/20

5/5 [==============================] - 1s 242ms/step - loss: 1.5255 - accuracy: 0.4516 - val\_loss: 1.5116 - val\_accuracy: 0.4563

Epoch 17/20

5/5 [==============================] - 1s 250ms/step - loss: 1.5070 - accuracy: 0.4590 - val\_loss: 1.4889 - val\_accuracy: 0.4682

Epoch 18/20

5/5 [==============================] - 1s 249ms/step - loss: 1.4908 - accuracy: 0.4684 - val\_loss: 1.4692 - val\_accuracy: 0.4773

Epoch 19/20

5/5 [==============================] - 1s 238ms/step - loss: 1.4634 - accuracy: 0.4759 - val\_loss: 1.5060 - val\_accuracy: 0.4645

Epoch 20/20

5/5 [==============================] - 1s 239ms/step - loss: 1.5208 - accuracy: 0.4564 - val\_loss: 1.4965 - val\_accuracy: 0.4679

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# A\_01 b=15,000

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Epoch 1/20

4/4 [==============================] - 5s 775ms/step - loss: 2.3058 - accuracy: 0.1092 - val\_loss: 2.2782 - val\_accuracy: 0.1589

Epoch 2/20

4/4 [==============================] - 1s 291ms/step - loss: 2.2684 - accuracy: 0.1703 - val\_loss: 2.2076 - val\_accuracy: 0.2204

Epoch 3/20

4/4 [==============================] - 1s 293ms/step - loss: 2.1841 - accuracy: 0.2252 - val\_loss: 2.0796 - val\_accuracy: 0.2346

Epoch 4/20

4/4 [==============================] - 1s 294ms/step - loss: 2.0798 - accuracy: 0.2400 - val\_loss: 2.0543 - val\_accuracy: 0.2568

Epoch 5/20

4/4 [==============================] - 1s 291ms/step - loss: 2.0257 - accuracy: 0.2686 - val\_loss: 1.9771 - val\_accuracy: 0.2855

Epoch 6/20

4/4 [==============================] - 1s 293ms/step - loss: 1.9618 - accuracy: 0.2880 - val\_loss: 1.9176 - val\_accuracy: 0.3129

Epoch 7/20

4/4 [==============================] - 1s 291ms/step - loss: 1.9143 - accuracy: 0.3083 - val\_loss: 1.8771 - val\_accuracy: 0.3281

Epoch 8/20

4/4 [==============================] - 1s 296ms/step - loss: 1.8746 - accuracy: 0.3264 - val\_loss: 1.8407 - val\_accuracy: 0.3423

Epoch 9/20

4/4 [==============================] - 1s 292ms/step - loss: 1.8433 - accuracy: 0.3386 - val\_loss: 1.8104 - val\_accuracy: 0.3570

Epoch 10/20

4/4 [==============================] - 1s 291ms/step - loss: 1.8073 - accuracy: 0.3560 - val\_loss: 1.7795 - val\_accuracy: 0.3705

Epoch 11/20

4/4 [==============================] - 1s 292ms/step - loss: 1.7770 - accuracy: 0.3674 - val\_loss: 1.7433 - val\_accuracy: 0.3831

Epoch 12/20

4/4 [==============================] - 1s 295ms/step - loss: 1.7427 - accuracy: 0.3814 - val\_loss: 1.7194 - val\_accuracy: 0.3928

Epoch 13/20

4/4 [==============================] - 1s 378ms/step - loss: 1.7123 - accuracy: 0.3906 - val\_loss: 1.7083 - val\_accuracy: 0.3997

Epoch 14/20

4/4 [==============================] - 1s 293ms/step - loss: 1.7076 - accuracy: 0.3922 - val\_loss: 1.6818 - val\_accuracy: 0.3954

Epoch 15/20

4/4 [==============================] - 1s 299ms/step - loss: 1.6734 - accuracy: 0.4023 - val\_loss: 1.6452 - val\_accuracy: 0.4113

Epoch 16/20

4/4 [==============================] - 1s 296ms/step - loss: 1.6424 - accuracy: 0.4156 - val\_loss: 1.6212 - val\_accuracy: 0.4247

Epoch 17/20

4/4 [==============================] - 1s 295ms/step - loss: 1.6205 - accuracy: 0.4214 - val\_loss: 1.6049 - val\_accuracy: 0.4333

Epoch 18/20

4/4 [==============================] - 1s 297ms/step - loss: 1.6015 - accuracy: 0.4319 - val\_loss: 1.5824 - val\_accuracy: 0.4371

Epoch 19/20

4/4 [==============================] - 1s 280ms/step - loss: 1.5789 - accuracy: 0.4371 - val\_loss: 1.5653 - val\_accuracy: 0.4445

Epoch 20/20

4/4 [==============================] - 1s 284ms/step - loss: 1.5608 - accuracy: 0.4459 - val\_loss: 1.5539 - val\_accuracy: 0.4435

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# Optimization algorithms

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# A\_01 opt='adadelta'

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Epoch 1/20

1563/1563 [==============================] - 7s 4ms/step - loss: 2.3014 - accuracy: 0.1205 - val\_loss: 2.2948 - val\_accuracy: 0.1393

Epoch 2/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2938 - accuracy: 0.1299 - val\_loss: 2.2882 - val\_accuracy: 0.1320

Epoch 3/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2865 - accuracy: 0.1281 - val\_loss: 2.2813 - val\_accuracy: 0.1341

Epoch 4/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2796 - accuracy: 0.1306 - val\_loss: 2.2731 - val\_accuracy: 0.1463

Epoch 5/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2724 - accuracy: 0.1452 - val\_loss: 2.2631 - val\_accuracy: 0.1588

Epoch 6/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2601 - accuracy: 0.1600 - val\_loss: 2.2507 - val\_accuracy: 0.1694

Epoch 7/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2477 - accuracy: 0.1694 - val\_loss: 2.2357 - val\_accuracy: 0.1743

Epoch 8/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2323 - accuracy: 0.1777 - val\_loss: 2.2193 - val\_accuracy: 0.1819

Epoch 9/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2158 - accuracy: 0.1817 - val\_loss: 2.2022 - val\_accuracy: 0.1904

Epoch 10/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1992 - accuracy: 0.1929 - val\_loss: 2.1847 - val\_accuracy: 0.1929

Epoch 11/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1817 - accuracy: 0.1950 - val\_loss: 2.1675 - val\_accuracy: 0.2027

Epoch 12/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1663 - accuracy: 0.2029 - val\_loss: 2.1511 - val\_accuracy: 0.2073

Epoch 13/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1495 - accuracy: 0.2054 - val\_loss: 2.1355 - val\_accuracy: 0.2134

Epoch 14/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1375 - accuracy: 0.2112 - val\_loss: 2.1214 - val\_accuracy: 0.2192

Epoch 15/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1206 - accuracy: 0.2183 - val\_loss: 2.1076 - val\_accuracy: 0.2362

Epoch 16/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.1063 - accuracy: 0.2318 - val\_loss: 2.0954 - val\_accuracy: 0.2407

Epoch 17/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.0971 - accuracy: 0.2374 - val\_loss: 2.0835 - val\_accuracy: 0.2518

Epoch 18/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.0849 - accuracy: 0.2424 - val\_loss: 2.0727 - val\_accuracy: 0.2583

Epoch 19/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.0778 - accuracy: 0.2458 - val\_loss: 2.0625 - val\_accuracy: 0.2635

Epoch 20/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.0666 - accuracy: 0.2510 - val\_loss: 2.0527 - val\_accuracy: 0.2667

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# A\_01 opt='adagrad'

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Epoch 1/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.2816 - accuracy: 0.1434 - val\_loss: 2.1360 - val\_accuracy: 0.2224

Epoch 2/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.0686 - accuracy: 0.2513 - val\_loss: 1.9743 - val\_accuracy: 0.2847

Epoch 3/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.9569 - accuracy: 0.2913 - val\_loss: 1.9168 - val\_accuracy: 0.3078

Epoch 4/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.8937 - accuracy: 0.3168 - val\_loss: 1.8416 - val\_accuracy: 0.3380

Epoch 5/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.8213 - accuracy: 0.3450 - val\_loss: 1.7756 - val\_accuracy: 0.3638

Epoch 6/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.7598 - accuracy: 0.3672 - val\_loss: 1.7274 - val\_accuracy: 0.3846

Epoch 7/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.7170 - accuracy: 0.3871 - val\_loss: 1.6857 - val\_accuracy: 0.3989

Epoch 8/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.6799 - accuracy: 0.3948 - val\_loss: 1.6541 - val\_accuracy: 0.4088

Epoch 9/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.6483 - accuracy: 0.4116 - val\_loss: 1.6284 - val\_accuracy: 0.4182

Epoch 10/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.6304 - accuracy: 0.4149 - val\_loss: 1.6086 - val\_accuracy: 0.4240

Epoch 11/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.6029 - accuracy: 0.4245 - val\_loss: 1.5900 - val\_accuracy: 0.4307

Epoch 12/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5928 - accuracy: 0.4272 - val\_loss: 1.5748 - val\_accuracy: 0.4353

Epoch 13/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5697 - accuracy: 0.4366 - val\_loss: 1.5600 - val\_accuracy: 0.4389

Epoch 14/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5551 - accuracy: 0.4383 - val\_loss: 1.5501 - val\_accuracy: 0.4405

Epoch 15/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5473 - accuracy: 0.4417 - val\_loss: 1.5380 - val\_accuracy: 0.4488

Epoch 16/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5351 - accuracy: 0.4497 - val\_loss: 1.5276 - val\_accuracy: 0.4443

Epoch 17/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5234 - accuracy: 0.4533 - val\_loss: 1.5150 - val\_accuracy: 0.4534

Epoch 18/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5042 - accuracy: 0.4595 - val\_loss: 1.5100 - val\_accuracy: 0.4580

Epoch 19/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.5049 - accuracy: 0.4601 - val\_loss: 1.4975 - val\_accuracy: 0.4627

Epoch 20/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.4922 - accuracy: 0.4639 - val\_loss: 1.4958 - val\_accuracy: 0.4659

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# A\_01 opt='adam'

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Epoch 1/20

1563/1563 [==============================] - 8s 5ms/step - loss: 1.7797 - accuracy: 0.3430 - val\_loss: 1.2574 - val\_accuracy: 0.5438

Epoch 2/20

1563/1563 [==============================] - 7s 4ms/step - loss: 1.2251 - accuracy: 0.5646 - val\_loss: 1.1018 - val\_accuracy: 0.6095

Epoch 3/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0611 - accuracy: 0.6241 - val\_loss: 1.0458 - val\_accuracy: 0.6265

Epoch 4/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.9653 - accuracy: 0.6599 - val\_loss: 0.9953 - val\_accuracy: 0.6501

Epoch 5/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8897 - accuracy: 0.6859 - val\_loss: 0.9364 - val\_accuracy: 0.6693

Epoch 6/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8170 - accuracy: 0.7119 - val\_loss: 0.9425 - val\_accuracy: 0.6658

Epoch 7/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7633 - accuracy: 0.7326 - val\_loss: 0.8746 - val\_accuracy: 0.7003

Epoch 8/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7199 - accuracy: 0.7464 - val\_loss: 0.8970 - val\_accuracy: 0.6963

Epoch 9/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6790 - accuracy: 0.7604 - val\_loss: 0.9257 - val\_accuracy: 0.6902

Epoch 10/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6378 - accuracy: 0.7748 - val\_loss: 0.9016 - val\_accuracy: 0.6971

Epoch 11/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6018 - accuracy: 0.7878 - val\_loss: 0.9528 - val\_accuracy: 0.6947

Epoch 12/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5706 - accuracy: 0.7954 - val\_loss: 0.9930 - val\_accuracy: 0.6863

Epoch 13/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5375 - accuracy: 0.8106 - val\_loss: 0.9245 - val\_accuracy: 0.7001

Epoch 14/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.5047 - accuracy: 0.8210 - val\_loss: 0.9650 - val\_accuracy: 0.6965

Epoch 15/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.4853 - accuracy: 0.8269 - val\_loss: 0.9710 - val\_accuracy: 0.7021

Epoch 16/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4513 - accuracy: 0.8388 - val\_loss: 1.0117 - val\_accuracy: 0.6993

Epoch 17/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4191 - accuracy: 0.8513 - val\_loss: 1.0569 - val\_accuracy: 0.6910

Epoch 18/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3974 - accuracy: 0.8562 - val\_loss: 1.0933 - val\_accuracy: 0.6967

Epoch 19/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3716 - accuracy: 0.8656 - val\_loss: 1.0889 - val\_accuracy: 0.6926

Epoch 20/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3623 - accuracy: 0.8708 - val\_loss: 1.2337 - val\_accuracy: 0.6785

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# A\_01 opt='adamax'

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Epoch 1/20

1563/1563 [==============================] - 7s 4ms/step - loss: 1.8415 - accuracy: 0.3134 - val\_loss: 1.4045 - val\_accuracy: 0.4976

Epoch 2/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.3568 - accuracy: 0.5144 - val\_loss: 1.2220 - val\_accuracy: 0.5657

Epoch 3/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.2036 - accuracy: 0.5779 - val\_loss: 1.0914 - val\_accuracy: 0.6191

Epoch 4/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.0805 - accuracy: 0.6209 - val\_loss: 1.1119 - val\_accuracy: 0.6062

Epoch 5/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.0148 - accuracy: 0.6454 - val\_loss: 0.9968 - val\_accuracy: 0.6534

Epoch 6/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.9412 - accuracy: 0.6739 - val\_loss: 0.9536 - val\_accuracy: 0.6691

Epoch 7/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.8814 - accuracy: 0.6940 - val\_loss: 0.9068 - val\_accuracy: 0.6830

Epoch 8/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.8385 - accuracy: 0.7105 - val\_loss: 0.8990 - val\_accuracy: 0.6884

Epoch 9/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.7827 - accuracy: 0.7283 - val\_loss: 0.9027 - val\_accuracy: 0.6911

Epoch 10/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.7460 - accuracy: 0.7398 - val\_loss: 0.8857 - val\_accuracy: 0.6924

Epoch 11/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.7051 - accuracy: 0.7572 - val\_loss: 0.8783 - val\_accuracy: 0.6980

Epoch 12/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.6765 - accuracy: 0.7677 - val\_loss: 0.8473 - val\_accuracy: 0.7034

Epoch 13/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.6461 - accuracy: 0.7776 - val\_loss: 0.8156 - val\_accuracy: 0.7203

Epoch 14/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.6135 - accuracy: 0.7888 - val\_loss: 0.8199 - val\_accuracy: 0.7205

Epoch 15/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5823 - accuracy: 0.7999 - val\_loss: 0.8348 - val\_accuracy: 0.7200

Epoch 16/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5581 - accuracy: 0.8068 - val\_loss: 0.8693 - val\_accuracy: 0.7110

Epoch 17/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5345 - accuracy: 0.8189 - val\_loss: 0.8467 - val\_accuracy: 0.7232

Epoch 18/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.5031 - accuracy: 0.8242 - val\_loss: 0.9028 - val\_accuracy: 0.7146

Epoch 19/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.4891 - accuracy: 0.8336 - val\_loss: 0.8357 - val\_accuracy: 0.7345

Epoch 20/20

1563/1563 [==============================] - 6s 4ms/step - loss: 0.4565 - accuracy: 0.8434 - val\_loss: 0.8730 - val\_accuracy: 0.7253

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# A\_01 opt='ftrl'

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Epoch 1/20

1563/1563 [==============================] - 7s 4ms/step - loss: 2.3026 - accuracy: 0.0977 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 2/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0996 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 3/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0988 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 4/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0988 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 5/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1000 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 6/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0989 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 7/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0974 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 8/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0952 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 9/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0979 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 10/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0977 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 11/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1007 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 12/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1019 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 13/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0976 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 14/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0988 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 15/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1007 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 16/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1015 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 17/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.0980 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 18/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1016 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 19/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1009 - val\_loss: 2.3026 - val\_accuracy: 0.1000

Epoch 20/20

1563/1563 [==============================] - 6s 4ms/step - loss: 2.3026 - accuracy: 0.1018 - val\_loss: 2.3026 - val\_accuracy: 0.1000

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# A\_01 opt='nadam'

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Epoch 1/20

1563/1563 [==============================] - 13s 7ms/step - loss: 1.7160 - accuracy: 0.3675 - val\_loss: 1.2421 - val\_accuracy: 0.5519

Epoch 2/20

1563/1563 [==============================] - 10s 6ms/step - loss: 1.1470 - accuracy: 0.5954 - val\_loss: 1.0491 - val\_accuracy: 0.6287

Epoch 3/20

1563/1563 [==============================] - 10s 7ms/step - loss: 0.9702 - accuracy: 0.6622 - val\_loss: 0.9521 - val\_accuracy: 0.6621

Epoch 4/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.8528 - accuracy: 0.7012 - val\_loss: 0.9790 - val\_accuracy: 0.6712

Epoch 5/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.7723 - accuracy: 0.7296 - val\_loss: 0.8642 - val\_accuracy: 0.7024

Epoch 6/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.7009 - accuracy: 0.7545 - val\_loss: 0.8552 - val\_accuracy: 0.7058

Epoch 7/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.6514 - accuracy: 0.7727 - val\_loss: 0.8807 - val\_accuracy: 0.7010

Epoch 8/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.6115 - accuracy: 0.7871 - val\_loss: 0.8748 - val\_accuracy: 0.7096

Epoch 9/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.5607 - accuracy: 0.8038 - val\_loss: 0.8785 - val\_accuracy: 0.7165

Epoch 10/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.5236 - accuracy: 0.8150 - val\_loss: 0.9136 - val\_accuracy: 0.7088

Epoch 11/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.4831 - accuracy: 0.8293 - val\_loss: 0.9151 - val\_accuracy: 0.7123

Epoch 12/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.4463 - accuracy: 0.8404 - val\_loss: 0.9410 - val\_accuracy: 0.7024

Epoch 13/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.4138 - accuracy: 0.8527 - val\_loss: 0.9777 - val\_accuracy: 0.7091

Epoch 14/20

1563/1563 [==============================] - 10s 6ms/step - loss: 0.3800 - accuracy: 0.8673 - val\_loss: 1.0282 - val\_accuracy: 0.7075

Epoch 15/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.3583 - accuracy: 0.8724 - val\_loss: 1.0374 - val\_accuracy: 0.7007

Epoch 16/20

1563/1563 [==============================] - 14s 9ms/step - loss: 0.3293 - accuracy: 0.8835 - val\_loss: 1.1212 - val\_accuracy: 0.7104

Epoch 17/20

1563/1563 [==============================] - 14s 9ms/step - loss: 0.3059 - accuracy: 0.8933 - val\_loss: 1.1241 - val\_accuracy: 0.7060

Epoch 18/20

1563/1563 [==============================] - 14s 9ms/step - loss: 0.2766 - accuracy: 0.9021 - val\_loss: 1.2019 - val\_accuracy: 0.7008

Epoch 19/20

1563/1563 [==============================] - 14s 9ms/step - loss: 0.2576 - accuracy: 0.9090 - val\_loss: 1.2285 - val\_accuracy: 0.7020

Epoch 20/20

1563/1563 [==============================] - 14s 9ms/step - loss: 0.2419 - accuracy: 0.9145 - val\_loss: 1.3374 - val\_accuracy: 0.6938

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# A\_01 opt='rmsprop'

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Epoch 1/20

1563/1563 [==============================] - 13s 8ms/step - loss: 1.7899 - accuracy: 0.3457 - val\_loss: 1.3038 - val\_accuracy: 0.5299

Epoch 2/20

1563/1563 [==============================] - 12s 8ms/step - loss: 1.1861 - accuracy: 0.5818 - val\_loss: 1.0621 - val\_accuracy: 0.6275

Epoch 3/20

1563/1563 [==============================] - 12s 8ms/step - loss: 0.9892 - accuracy: 0.6529 - val\_loss: 1.0070 - val\_accuracy: 0.6516

Epoch 4/20

1563/1563 [==============================] - 12s 8ms/step - loss: 0.8660 - accuracy: 0.6985 - val\_loss: 0.9499 - val\_accuracy: 0.6744

Epoch 5/20

1563/1563 [==============================] - 12s 8ms/step - loss: 0.7815 - accuracy: 0.7266 - val\_loss: 0.9500 - val\_accuracy: 0.6752

Epoch 6/20

1563/1563 [==============================] - 12s 8ms/step - loss: 0.7067 - accuracy: 0.7544 - val\_loss: 0.9116 - val\_accuracy: 0.6966

Epoch 7/20

1563/1563 [==============================] - 12s 8ms/step - loss: 0.6567 - accuracy: 0.7734 - val\_loss: 0.8677 - val\_accuracy: 0.7133

Epoch 8/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.6147 - accuracy: 0.7878 - val\_loss: 0.9108 - val\_accuracy: 0.7076

Epoch 9/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.5683 - accuracy: 0.8014 - val\_loss: 0.9568 - val\_accuracy: 0.7082

Epoch 10/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.5353 - accuracy: 0.8128 - val\_loss: 0.9289 - val\_accuracy: 0.7108

Epoch 11/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4999 - accuracy: 0.8286 - val\_loss: 0.9445 - val\_accuracy: 0.7270

Epoch 12/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.4752 - accuracy: 0.8388 - val\_loss: 1.0512 - val\_accuracy: 0.6783

Epoch 13/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4547 - accuracy: 0.8459 - val\_loss: 1.1491 - val\_accuracy: 0.7139

Epoch 14/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4311 - accuracy: 0.8508 - val\_loss: 1.3113 - val\_accuracy: 0.6466

Epoch 15/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4254 - accuracy: 0.8537 - val\_loss: 1.1362 - val\_accuracy: 0.6950

Epoch 16/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.4104 - accuracy: 0.8599 - val\_loss: 1.0958 - val\_accuracy: 0.6847

Epoch 17/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4125 - accuracy: 0.8616 - val\_loss: 1.2348 - val\_accuracy: 0.7167

Epoch 18/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.4080 - accuracy: 0.8664 - val\_loss: 1.3755 - val\_accuracy: 0.7097

Epoch 19/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3957 - accuracy: 0.8669 - val\_loss: 1.5001 - val\_accuracy: 0.6736

Epoch 20/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.3986 - accuracy: 0.8697 - val\_loss: 1.5332 - val\_accuracy: 0.6843

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# A\_01 opt='sgd'

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Epoch 1/20

1563/1563 [==============================] - 8s 5ms/step - loss: 2.1971 - accuracy: 0.1790 - val\_loss: 1.9631 - val\_accuracy: 0.2940

Epoch 2/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.7426 - accuracy: 0.3751 - val\_loss: 1.7569 - val\_accuracy: 0.3892

Epoch 3/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.5134 - accuracy: 0.4564 - val\_loss: 1.5137 - val\_accuracy: 0.4530

Epoch 4/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.3973 - accuracy: 0.4992 - val\_loss: 1.3212 - val\_accuracy: 0.5236

Epoch 5/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.3040 - accuracy: 0.5401 - val\_loss: 1.4419 - val\_accuracy: 0.4922

Epoch 6/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.2343 - accuracy: 0.5625 - val\_loss: 1.4117 - val\_accuracy: 0.4943

Epoch 7/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.1726 - accuracy: 0.5841 - val\_loss: 1.1537 - val\_accuracy: 0.5907

Epoch 8/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.1154 - accuracy: 0.6116 - val\_loss: 1.1125 - val\_accuracy: 0.6001

Epoch 9/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0580 - accuracy: 0.6259 - val\_loss: 1.2300 - val\_accuracy: 0.5716

Epoch 10/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0047 - accuracy: 0.6493 - val\_loss: 1.0622 - val\_accuracy: 0.6251

Epoch 11/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.9610 - accuracy: 0.6641 - val\_loss: 1.0324 - val\_accuracy: 0.6390

Epoch 12/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.9381 - accuracy: 0.6721 - val\_loss: 1.0311 - val\_accuracy: 0.6389

Epoch 13/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.8920 - accuracy: 0.6877 - val\_loss: 0.9734 - val\_accuracy: 0.6644

Epoch 14/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.8628 - accuracy: 0.7003 - val\_loss: 1.0801 - val\_accuracy: 0.6311

Epoch 15/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.8223 - accuracy: 0.7133 - val\_loss: 0.9709 - val\_accuracy: 0.6564

Epoch 16/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7952 - accuracy: 0.7211 - val\_loss: 0.9785 - val\_accuracy: 0.6613

Epoch 17/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7699 - accuracy: 0.7291 - val\_loss: 1.1240 - val\_accuracy: 0.6237

Epoch 18/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7409 - accuracy: 0.7411 - val\_loss: 1.0031 - val\_accuracy: 0.6560

Epoch 19/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7206 - accuracy: 0.7473 - val\_loss: 1.0078 - val\_accuracy: 0.6607

Epoch 20/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6942 - accuracy: 0.7581 - val\_loss: 0.8945 - val\_accuracy: 0.6962

===========================================================================================================================================================================================================================

# A\_01 loss=BinaryCrossentropy 01

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Epoch 1/20

1563/1563 [==============================] - 10s 6ms/step - loss: -40.1164 - accuracy: 0.1012 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 2/20

1563/1563 [==============================] - 9s 5ms/step - loss: -40.9311 - accuracy: 0.0998 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 3/20

1563/1563 [==============================] - 8s 5ms/step - loss: -41.3187 - accuracy: 0.1026 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 4/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.1021 - accuracy: 0.1001 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 5/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.3733 - accuracy: 0.1002 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 6/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.1656 - accuracy: 0.1010 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 7/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.0406 - accuracy: 0.0995 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 8/20

1563/1563 [==============================] - 9s 5ms/step - loss: -40.8885 - accuracy: 0.0982 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 9/20

1563/1563 [==============================] - 8s 5ms/step - loss: -41.2075 - accuracy: 0.1011 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 10/20

1563/1563 [==============================] - 8s 5ms/step - loss: -41.0936 - accuracy: 0.1023 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 11/20

1563/1563 [==============================] - 9s 6ms/step - loss: -40.9812 - accuracy: 0.1009 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 12/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.1478 - accuracy: 0.0997 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 13/20

1563/1563 [==============================] - 9s 6ms/step - loss: -40.8694 - accuracy: 0.1009 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 14/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.0209 - accuracy: 0.0997 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 15/20

1563/1563 [==============================] - 9s 5ms/step - loss: -40.8898 - accuracy: 0.0993 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 16/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.0882 - accuracy: 0.1014 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 17/20

1563/1563 [==============================] - 8s 5ms/step - loss: -41.1708 - accuracy: 0.1000 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 18/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.1911 - accuracy: 0.0997 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 19/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.0372 - accuracy: 0.0986 - val\_loss: -41.0938 - val\_accuracy: 0.1000

Epoch 20/20

1563/1563 [==============================] - 9s 5ms/step - loss: -41.1023 - accuracy: 0.1009 - val\_loss: -41.0938 - val\_accuracy: 0.1000

###########################################################################################################################################################################################################################

# Loss functions

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===========================================================================================================================================================================================================================

# A\_01 loss=SparseCategoricalCrossentropy(from\_logits=True) 02

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Epoch 1/20

1563/1563 [==============================] - 8s 5ms/step - loss: 1.7797 - accuracy: 0.3430 - val\_loss: 1.2574 - val\_accuracy: 0.5438

Epoch 2/20

1563/1563 [==============================] - 7s 4ms/step - loss: 1.2251 - accuracy: 0.5646 - val\_loss: 1.1018 - val\_accuracy: 0.6095

Epoch 3/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0611 - accuracy: 0.6241 - val\_loss: 1.0458 - val\_accuracy: 0.6265

Epoch 4/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.9653 - accuracy: 0.6599 - val\_loss: 0.9953 - val\_accuracy: 0.6501

Epoch 5/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8897 - accuracy: 0.6859 - val\_loss: 0.9364 - val\_accuracy: 0.6693

Epoch 6/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8170 - accuracy: 0.7119 - val\_loss: 0.9425 - val\_accuracy: 0.6658

Epoch 7/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7633 - accuracy: 0.7326 - val\_loss: 0.8746 - val\_accuracy: 0.7003

Epoch 8/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7199 - accuracy: 0.7464 - val\_loss: 0.8970 - val\_accuracy: 0.6963

Epoch 9/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6790 - accuracy: 0.7604 - val\_loss: 0.9257 - val\_accuracy: 0.6902

Epoch 10/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6378 - accuracy: 0.7748 - val\_loss: 0.9016 - val\_accuracy: 0.6971

Epoch 11/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6018 - accuracy: 0.7878 - val\_loss: 0.9528 - val\_accuracy: 0.6947

Epoch 12/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5706 - accuracy: 0.7954 - val\_loss: 0.9930 - val\_accuracy: 0.6863

Epoch 13/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5375 - accuracy: 0.8106 - val\_loss: 0.9245 - val\_accuracy: 0.7001

Epoch 14/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.5047 - accuracy: 0.8210 - val\_loss: 0.9650 - val\_accuracy: 0.6965

Epoch 15/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.4853 - accuracy: 0.8269 - val\_loss: 0.9710 - val\_accuracy: 0.7021

Epoch 16/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4513 - accuracy: 0.8388 - val\_loss: 1.0117 - val\_accuracy: 0.6993

Epoch 17/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4191 - accuracy: 0.8513 - val\_loss: 1.0569 - val\_accuracy: 0.6910

Epoch 18/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3974 - accuracy: 0.8562 - val\_loss: 1.0933 - val\_accuracy: 0.6967

Epoch 19/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3716 - accuracy: 0.8656 - val\_loss: 1.0889 - val\_accuracy: 0.6926

Epoch 20/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3623 - accuracy: 0.8708 - val\_loss: 1.2337 - val\_accuracy: 0.6785

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# A\_01 loss=CategoricalHinge 03

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Epoch 1/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1141 - accuracy: 0.1004 - val\_loss: 0.1098 - val\_accuracy: 0.0988

Epoch 2/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1098 - accuracy: 0.0970 - val\_loss: 0.1103 - val\_accuracy: 0.1001

Epoch 3/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1086 - accuracy: 0.1000 - val\_loss: 0.1104 - val\_accuracy: 0.1000

Epoch 4/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1113 - accuracy: 0.1001 - val\_loss: 0.1102 - val\_accuracy: 0.1000

Epoch 5/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1068 - accuracy: 0.0989 - val\_loss: 0.1102 - val\_accuracy: 0.1000

Epoch 6/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1119 - accuracy: 0.1004 - val\_loss: 0.1106 - val\_accuracy: 0.1000

Epoch 7/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1116 - accuracy: 0.1016 - val\_loss: 0.1106 - val\_accuracy: 0.1000

Epoch 8/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1113 - accuracy: 0.1006 - val\_loss: 0.1102 - val\_accuracy: 0.1000

Epoch 9/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1089 - accuracy: 0.1028 - val\_loss: 0.1103 - val\_accuracy: 0.1000

Epoch 10/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1104 - accuracy: 0.1015 - val\_loss: 0.1101 - val\_accuracy: 0.1000

Epoch 11/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1114 - accuracy: 0.0981 - val\_loss: 0.1103 - val\_accuracy: 0.1000

Epoch 12/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1096 - accuracy: 0.1012 - val\_loss: 0.1101 - val\_accuracy: 0.1000

Epoch 13/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1081 - accuracy: 0.1025 - val\_loss: 0.1101 - val\_accuracy: 0.1000

Epoch 14/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1102 - accuracy: 0.0998 - val\_loss: 0.1103 - val\_accuracy: 0.1000

Epoch 15/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1086 - accuracy: 0.0963 - val\_loss: 0.1102 - val\_accuracy: 0.1000

Epoch 16/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1108 - accuracy: 0.0997 - val\_loss: 0.1103 - val\_accuracy: 0.0999

Epoch 17/20

1563/1563 [==============================] - 8s 5ms/step - loss: 0.1109 - accuracy: 0.0999 - val\_loss: 0.1102 - val\_accuracy: 0.0999

Epoch 18/20

1563/1563 [==============================] - 9s 6ms/step - loss: 0.1129 - accuracy: 0.0992 - val\_loss: 0.1101 - val\_accuracy: 0.1000

Epoch 19/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1075 - accuracy: 0.1021 - val\_loss: 0.1101 - val\_accuracy: 0.1000

Epoch 20/20

1563/1563 [==============================] - 9s 5ms/step - loss: 0.1104 - accuracy: 0.1031 - val\_loss: 0.1100 - val\_accuracy: 0.1000

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# Architectures

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===========================================================================================================================================================================================================================

# Architecture 01

===========================================================================================================================================================================================================================

#### Create the convolutional base

model.add(tf.keras.layers.Conv2D(32, (3, 3), activation=param\_act\_fn, input\_shape=(32, 32, 3)))

model.add(tf.keras.layers.MaxPooling2D((2, 2)))

model.add(tf.keras.layers.Conv2D(64, (3, 3), activation=param\_act\_fn))

model.add(tf.keras.layers.MaxPooling2D((2, 2)))

model.add(tf.keras.layers.Conv2D(64, (3, 3), activation=param\_act\_fn))

#### Add Dense layers on top

model.add(tf.keras.layers.Flatten())

model.add(tf.keras.layers.Dense(64, activation=param\_act\_fn))

model.add(tf.keras.layers.Dense(10))

Model: "sequential"

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Layer (type) Output Shape Param #

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conv2d (Conv2D) (None, 30, 30, 32) 896

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max\_pooling2d (MaxPooling2D) (None, 15, 15, 32) 0

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conv2d\_1 (Conv2D) (None, 13, 13, 64) 18496

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max\_pooling2d\_1 (MaxPooling2 (None, 6, 6, 64) 0

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conv2d\_2 (Conv2D) (None, 4, 4, 64) 36928

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flatten (Flatten) (None, 1024) 0

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dense (Dense) (None, 64) 65600

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dense\_1 (Dense) (None, 10) 650

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Total params: 122,570

Trainable params: 122,570

Non-trainable params: 0

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Epoch 1/20

1563/1563 [==============================] - 8s 5ms/step - loss: 1.7797 - accuracy: 0.3430 - val\_loss: 1.2574 - val\_accuracy: 0.5438

Epoch 2/20

1563/1563 [==============================] - 7s 4ms/step - loss: 1.2251 - accuracy: 0.5646 - val\_loss: 1.1018 - val\_accuracy: 0.6095

Epoch 3/20

1563/1563 [==============================] - 7s 5ms/step - loss: 1.0611 - accuracy: 0.6241 - val\_loss: 1.0458 - val\_accuracy: 0.6265

Epoch 4/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.9653 - accuracy: 0.6599 - val\_loss: 0.9953 - val\_accuracy: 0.6501

Epoch 5/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8897 - accuracy: 0.6859 - val\_loss: 0.9364 - val\_accuracy: 0.6693

Epoch 6/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.8170 - accuracy: 0.7119 - val\_loss: 0.9425 - val\_accuracy: 0.6658

Epoch 7/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.7633 - accuracy: 0.7326 - val\_loss: 0.8746 - val\_accuracy: 0.7003

Epoch 8/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.7199 - accuracy: 0.7464 - val\_loss: 0.8970 - val\_accuracy: 0.6963

Epoch 9/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6790 - accuracy: 0.7604 - val\_loss: 0.9257 - val\_accuracy: 0.6902

Epoch 10/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.6378 - accuracy: 0.7748 - val\_loss: 0.9016 - val\_accuracy: 0.6971

Epoch 11/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.6018 - accuracy: 0.7878 - val\_loss: 0.9528 - val\_accuracy: 0.6947

Epoch 12/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5706 - accuracy: 0.7954 - val\_loss: 0.9930 - val\_accuracy: 0.6863

Epoch 13/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.5375 - accuracy: 0.8106 - val\_loss: 0.9245 - val\_accuracy: 0.7001

Epoch 14/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.5047 - accuracy: 0.8210 - val\_loss: 0.9650 - val\_accuracy: 0.6965

Epoch 15/20

1563/1563 [==============================] - 7s 5ms/step - loss: 0.4853 - accuracy: 0.8269 - val\_loss: 0.9710 - val\_accuracy: 0.7021

Epoch 16/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4513 - accuracy: 0.8388 - val\_loss: 1.0117 - val\_accuracy: 0.6993

Epoch 17/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.4191 - accuracy: 0.8513 - val\_loss: 1.0569 - val\_accuracy: 0.6910

Epoch 18/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3974 - accuracy: 0.8562 - val\_loss: 1.0933 - val\_accuracy: 0.6967

Epoch 19/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3716 - accuracy: 0.8656 - val\_loss: 1.0889 - val\_accuracy: 0.6926

Epoch 20/20

1563/1563 [==============================] - 7s 4ms/step - loss: 0.3623 - accuracy: 0.8708 - val\_loss: 1.2337 - val\_accuracy: 0.6785

===========================================================================================================================================================================================================================

# Architecture 02

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#### Create the convolutional base

model.add(tf.keras.layers.Conv2D(32, (3, 3), activation=param\_act\_fn, input\_shape=(32, 32, 3)))

model.add(tf.keras.layers.MaxPooling2D((2, 2)))

#### Add Dense layers on top

model.add(tf.keras.layers.Flatten())

model.add(tf.keras.layers.Dense(64, activation=param\_act\_fn))

model.add(tf.keras.layers.Dense(10))

Model: "sequential\_1"

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Layer (type) Output Shape Param #

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conv2d\_36 (Conv2D) (None, 30, 30, 32) 896

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max\_pooling2d\_18 (MaxPooling (None, 15, 15, 32) 0

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flatten\_6 (Flatten) (None, 7200) 0

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dense\_11 (Dense) (None, 64) 460864

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dense\_12 (Dense) (None, 10) 650

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Total params: 462,410

Trainable params: 462,410

Non-trainable params: 0

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Epoch 1/20

1563/1563 [==============================] - 6s 4ms/step - loss: 1.8162 - accuracy: 0.3388 - val\_loss: 1.3559 - val\_accuracy: 0.5269

Epoch 2/20

1563/1563 [==============================] - 5s 3ms/step - loss: 1.2951 - accuracy: 0.5438 - val\_loss: 1.2140 - val\_accuracy: 0.5694

Epoch 3/20

1563/1563 [==============================] - 5s 3ms/step - loss: 1.1571 - accuracy: 0.5937 - val\_loss: 1.1358 - val\_accuracy: 0.6055

Epoch 4/20

1563/1563 [==============================] - 5s 3ms/step - loss: 1.0783 - accuracy: 0.6266 - val\_loss: 1.0933 - val\_accuracy: 0.6220

Epoch 5/20

1563/1563 [==============================] - 5s 3ms/step - loss: 1.0076 - accuracy: 0.6495 - val\_loss: 1.0815 - val\_accuracy: 0.6270

Epoch 6/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.9523 - accuracy: 0.6691 - val\_loss: 1.1016 - val\_accuracy: 0.6224

Epoch 7/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.9063 - accuracy: 0.6852 - val\_loss: 1.0750 - val\_accuracy: 0.6306

Epoch 8/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.8537 - accuracy: 0.7014 - val\_loss: 1.0499 - val\_accuracy: 0.6429

Epoch 9/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.8517 - accuracy: 0.7027 - val\_loss: 1.0645 - val\_accuracy: 0.6391

Epoch 10/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.8161 - accuracy: 0.7199 - val\_loss: 1.1150 - val\_accuracy: 0.6250

Epoch 11/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.7889 - accuracy: 0.7289 - val\_loss: 1.0822 - val\_accuracy: 0.6393

Epoch 12/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.7699 - accuracy: 0.7348 - val\_loss: 1.0888 - val\_accuracy: 0.6362

Epoch 13/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.7431 - accuracy: 0.7443 - val\_loss: 1.0906 - val\_accuracy: 0.6331

Epoch 14/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.7276 - accuracy: 0.7474 - val\_loss: 1.0813 - val\_accuracy: 0.6421

Epoch 15/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.7041 - accuracy: 0.7543 - val\_loss: 1.0903 - val\_accuracy: 0.6418

Epoch 16/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.6823 - accuracy: 0.7619 - val\_loss: 1.1353 - val\_accuracy: 0.6393

Epoch 17/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.6701 - accuracy: 0.7669 - val\_loss: 1.1213 - val\_accuracy: 0.6384

Epoch 18/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.6583 - accuracy: 0.7725 - val\_loss: 1.1753 - val\_accuracy: 0.6256

Epoch 19/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.6325 - accuracy: 0.7794 - val\_loss: 1.1644 - val\_accuracy: 0.6372

Epoch 20/20

1563/1563 [==============================] - 5s 3ms/step - loss: 0.6158 - accuracy: 0.7873 - val\_loss: 1.1746 - val\_accuracy: 0.6324

===========================================================================================================================================================================================================================

# Architecture 03

===========================================================================================================================================================================================================================

y\_train, y\_test = train\_labels.flatten(), test\_labels.flatten()

# number of classes

K = len(set(y\_train))

print("number of classes:", K)

from tensorflow.keras.layers import Input, Conv2D, Dense, Flatten, \

Dropout, GlobalMaxPooling2D, MaxPooling2D, \

BatchNormalization

#### Create the convolutional base

i = Input(shape=train\_images[0].shape)

x = Conv2D(32, (3, 3), activation='relu', padding='same')(i)

x = BatchNormalization()(x)

x = Conv2D(32, (3, 3), activation='relu', padding='same')(x)

x = BatchNormalization()(x)

x = MaxPooling2D((2, 2))(x)

x = Conv2D(64, (3, 3), activation='relu', padding='same')(x)

x = BatchNormalization()(x)

x = Conv2D(64, (3, 3), activation='relu', padding='same')(x)

x = BatchNormalization()(x)

x = MaxPooling2D((2, 2))(x)

x = Conv2D(128, (3, 3), activation='relu', padding='same')(x)

x = BatchNormalization()(x)

x = Conv2D(128, (3, 3), activation='relu', padding='same')(x)

x = BatchNormalization()(x)

x = MaxPooling2D((2, 2))(x)

#### Add Dense layers on top

x = Flatten()(x)

x = Dropout(0.2)(x)

x = Dense(1024, activation='relu')(x)

x = Dropout(0.2)(x)

x = Dense(K, activation='softmax')(x)

model = tf.keras.models.Model(i, x)

Model: "model\_1"

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Layer (type) Output Shape Param #

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input\_3 (InputLayer) [(None, 32, 32, 3)] 0

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conv2d\_12 (Conv2D) (None, 32, 32, 32) 896

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batch\_normalization\_12 (Batc (None, 32, 32, 32) 128

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conv2d\_13 (Conv2D) (None, 32, 32, 32) 9248

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batch\_normalization\_13 (Batc (None, 32, 32, 32) 128

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max\_pooling2d\_6 (MaxPooling2 (None, 16, 16, 32) 0

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conv2d\_14 (Conv2D) (None, 16, 16, 64) 18496

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batch\_normalization\_14 (Batc (None, 16, 16, 64) 256

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conv2d\_15 (Conv2D) (None, 16, 16, 64) 36928

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batch\_normalization\_15 (Batc (None, 16, 16, 64) 256

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max\_pooling2d\_7 (MaxPooling2 (None, 8, 8, 64) 0

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conv2d\_16 (Conv2D) (None, 8, 8, 128) 73856

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batch\_normalization\_16 (Batc (None, 8, 8, 128) 512

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conv2d\_17 (Conv2D) (None, 8, 8, 128) 147584

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batch\_normalization\_17 (Batc (None, 8, 8, 128) 512

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max\_pooling2d\_8 (MaxPooling2 (None, 4, 4, 128) 0

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flatten\_2 (Flatten) (None, 2048) 0

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dropout\_4 (Dropout) (None, 2048) 0

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dense\_3 (Dense) (None, 1024) 2098176

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dropout\_5 (Dropout) (None, 1024) 0

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dense\_4 (Dense) (None, 10) 10250

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Total params: 2,397,226

Trainable params: 2,396,330

Non-trainable params: 896

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Epoch 1/20

1563/1563 [==============================] - 13s 8ms/step - loss: 1.6950 - accuracy: 0.4487 - val\_loss: 0.9943 - val\_accuracy: 0.6566

Epoch 2/20

1563/1563 [==============================] - 12s 7ms/step - loss: 0.8759 - accuracy: 0.6952 - val\_loss: 0.8773 - val\_accuracy: 0.6991

Epoch 3/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.7077 - accuracy: 0.7541 - val\_loss: 0.6951 - val\_accuracy: 0.7625

Epoch 4/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.5803 - accuracy: 0.7994 - val\_loss: 0.7189 - val\_accuracy: 0.7701

Epoch 5/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.4717 - accuracy: 0.8379 - val\_loss: 0.6566 - val\_accuracy: 0.7831

Epoch 6/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.4088 - accuracy: 0.8591 - val\_loss: 0.6379 - val\_accuracy: 0.7982

Epoch 7/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.3424 - accuracy: 0.8811 - val\_loss: 0.7040 - val\_accuracy: 0.7857

Epoch 8/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.2743 - accuracy: 0.9051 - val\_loss: 0.7340 - val\_accuracy: 0.7834

Epoch 9/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.2342 - accuracy: 0.9177 - val\_loss: 0.6666 - val\_accuracy: 0.8053

Epoch 10/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.2036 - accuracy: 0.9284 - val\_loss: 0.6525 - val\_accuracy: 0.8142

Epoch 11/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.1763 - accuracy: 0.9397 - val\_loss: 0.6226 - val\_accuracy: 0.8315

Epoch 12/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.1497 - accuracy: 0.9485 - val\_loss: 0.6984 - val\_accuracy: 0.8290

Epoch 13/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.1436 - accuracy: 0.9509 - val\_loss: 0.6758 - val\_accuracy: 0.8283

Epoch 14/20

1563/1563 [==============================] - 12s 7ms/step - loss: 0.1274 - accuracy: 0.9563 - val\_loss: 0.6991 - val\_accuracy: 0.8250

Epoch 15/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.1190 - accuracy: 0.9590 - val\_loss: 0.6958 - val\_accuracy: 0.8285

Epoch 16/20

1563/1563 [==============================] - 12s 7ms/step - loss: 0.1101 - accuracy: 0.9632 - val\_loss: 0.8000 - val\_accuracy: 0.8222

Epoch 17/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.1111 - accuracy: 0.9636 - val\_loss: 0.8107 - val\_accuracy: 0.8251

Epoch 18/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.0950 - accuracy: 0.9683 - val\_loss: 0.7232 - val\_accuracy: 0.8254

Epoch 19/20

1563/1563 [==============================] - 12s 7ms/step - loss: 0.0947 - accuracy: 0.9681 - val\_loss: 0.6816 - val\_accuracy: 0.8357

Epoch 20/20

1563/1563 [==============================] - 11s 7ms/step - loss: 0.0829 - accuracy: 0.9725 - val\_loss: 0.8145 - val\_accuracy: 0.8420