1 cnn-6

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 894s 18ms/step - loss: 1.5067 - acc: 0.4942 - val\_loss: 1.0453 - val\_acc: 0.6310

Epoch 2/20

50000/50000 [==============================] - 887s 18ms/step - loss: 1.0531 - acc: 0.6323 - val\_loss: 0.8817 - val\_acc: 0.6908

Epoch 3/20

50000/50000 [==============================] - 888s 18ms/step - loss: 0.8843 - acc: 0.6923 - val\_loss: 0.7957 - val\_acc: 0.7234

Epoch 4/20

50000/50000 [==============================] - 891s 18ms/step - loss: 0.7745 - acc: 0.7297 - val\_loss: 0.7427 - val\_acc: 0.7447

Epoch 5/20

50000/50000 [==============================] - 889s 18ms/step - loss: 0.6966 - acc: 0.7587 - val\_loss: 0.6771 - val\_acc: 0.7678

Epoch 6/20

50000/50000 [==============================] - 893s 18ms/step - loss: 0.6248 - acc: 0.7823 - val\_loss: 0.6649 - val\_acc: 0.7723

Epoch 7/20

50000/50000 [==============================] - 900s 18ms/step - loss: 0.5741 - acc: 0.7997 - val\_loss: 0.6510 - val\_acc: 0.7811

Epoch 8/20

50000/50000 [==============================] - 897s 18ms/step - loss: 0.5301 - acc: 0.8137 - val\_loss: 0.6223 - val\_acc: 0.7869

Epoch 9/20

50000/50000 [==============================] - 893s 18ms/step - loss: 0.4945 - acc: 0.8273 - val\_loss: 0.6654 - val\_acc: 0.7808

Epoch 10/20

50000/50000 [==============================] - 904s 18ms/step - loss: 0.4534 - acc: 0.8392 - val\_loss: 0.6047 - val\_acc: 0.7938

Epoch 11/20

50000/50000 [==============================] - 895s 18ms/step - loss: 0.4262 - acc: 0.8501 - val\_loss: 0.5870 - val\_acc: 0.8016

Epoch 12/20

50000/50000 [==============================] - 886s 18ms/step - loss: 0.4017 - acc: 0.8571 - val\_loss: 0.5869 - val\_acc: 0.8020

Epoch 13/20

50000/50000 [==============================] - 893s 18ms/step - loss: 0.3721 - acc: 0.8681 - val\_loss: 0.5712 - val\_acc: 0.8112

Epoch 14/20

50000/50000 [==============================] - 899s 18ms/step - loss: 0.3542 - acc: 0.8751 - val\_loss: 0.5597 - val\_acc: 0.8145

Epoch 15/20

50000/50000 [==============================] - 904s 18ms/step - loss: 0.3339 - acc: 0.8810 - val\_loss: 0.6072 - val\_acc: 0.8043

Epoch 16/20

50000/50000 [==============================] - 904s 18ms/step - loss: 0.3145 - acc: 0.8883 - val\_loss: 0.6052 - val\_acc: 0.8026

Epoch 17/20

50000/50000 [==============================] - 903s 18ms/step - loss: 0.2961 - acc: 0.8952 - val\_loss: 0.5731 - val\_acc: 0.8159

Epoch 18/20

50000/50000 [==============================] - 901s 18ms/step - loss: 0.2866 - acc: 0.8987 - val\_loss: 0.5820 - val\_acc: 0.8155

Epoch 19/20

50000/50000 [==============================] - 909s 18ms/step - loss: 0.2777 - acc: 0.9019 - val\_loss: 0.5698 - val\_acc: 0.8183

Epoch 20/20

50000/50000 [==============================] - 897s 18ms/step - loss: 0.2604 - acc: 0.9083 - val\_loss: 0.5735 - val\_acc: 0.8155

Test loss: 0.5734669551372528

Test accuracy: 0.8155

2 cnn-5

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 723s 14ms/step - loss: 1.9003 - acc: 0.3063 - val\_loss: 1.4785 - val\_acc: 0.4579

Epoch 2/20

50000/50000 [==============================] - 722s 14ms/step - loss: 1.4511 - acc: 0.4793 - val\_loss: 1.2964 - val\_acc: 0.5354

Epoch 3/20

50000/50000 [==============================] - 727s 15ms/step - loss: 1.2458 - acc: 0.5576 - val\_loss: 1.0831 - val\_acc: 0.6164

Epoch 4/20

50000/50000 [==============================] - 717s 14ms/step - loss: 1.0990 - acc: 0.6117 - val\_loss: 1.0041 - val\_acc: 0.6488

Epoch 5/20

50000/50000 [==============================] - 719s 14ms/step - loss: 0.9913 - acc: 0.6519 - val\_loss: 0.8950 - val\_acc: 0.6902

Epoch 6/20

50000/50000 [==============================] - 718s 14ms/step - loss: 0.9078 - acc: 0.6835 - val\_loss: 0.8441 - val\_acc: 0.7101

Epoch 7/20

50000/50000 [==============================] - 711s 14ms/step - loss: 0.8444 - acc: 0.7068 - val\_loss: 0.8484 - val\_acc: 0.7017

Epoch 8/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.7834 - acc: 0.7283 - val\_loss: 0.8401 - val\_acc: 0.7097

Epoch 9/20

50000/50000 [==============================] - 722s 14ms/step - loss: 0.7313 - acc: 0.7440 - val\_loss: 0.7648 - val\_acc: 0.7393

Epoch 10/20

50000/50000 [==============================] - 715s 14ms/step - loss: 0.6942 - acc: 0.7574 - val\_loss: 0.7164 - val\_acc: 0.7534

Epoch 11/20

50000/50000 [==============================] - 710s 14ms/step - loss: 0.6524 - acc: 0.7731 - val\_loss: 0.7100 - val\_acc: 0.7553

Epoch 12/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.6202 - acc: 0.7836 - val\_loss: 0.7162 - val\_acc: 0.7581

Epoch 13/20

50000/50000 [==============================] - 716s 14ms/step - loss: 0.5875 - acc: 0.7955 - val\_loss: 0.7578 - val\_acc: 0.7534

Epoch 14/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.5629 - acc: 0.8039 - val\_loss: 0.6821 - val\_acc: 0.7689

Epoch 15/20

50000/50000 [==============================] - 713s 14ms/step - loss: 0.5385 - acc: 0.8116 - val\_loss: 0.7045 - val\_acc: 0.7631

Epoch 16/20

50000/50000 [==============================] - 713s 14ms/step - loss: 0.5191 - acc: 0.8176 - val\_loss: 0.6858 - val\_acc: 0.7713

Epoch 17/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.4914 - acc: 0.8284 - val\_loss: 0.6938 - val\_acc: 0.7744

Epoch 18/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.4779 - acc: 0.8315 - val\_loss: 0.7459 - val\_acc: 0.7551

Epoch 19/20

50000/50000 [==============================] - 721s 14ms/step - loss: 0.4577 - acc: 0.8398 - val\_loss: 0.6713 - val\_acc: 0.7794

Epoch 20/20

50000/50000 [==============================] - 715s 14ms/step - loss: 0.4526 - acc: 0.8430 - val\_loss: 0.6818 - val\_acc: 0.7778

Test loss: 0.6817790030002594

Test accuracy: 0.7778

3 cnn-4

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 618s 12ms/step - loss: 1.7624 - acc: 0.3617 - val\_loss: 1.6071 - val\_acc: 0.4124

Epoch 2/20

50000/50000 [==============================] - 709s 14ms/step - loss: 1.2017 - acc: 0.5759 - val\_loss: 1.1460 - val\_acc: 0.6013

Epoch 3/20

50000/50000 [==============================] - 711s 14ms/step - loss: 0.9439 - acc: 0.6693 - val\_loss: 0.9542 - val\_acc: 0.6744

Epoch 4/20

50000/50000 [==============================] - 714s 14ms/step - loss: 0.7697 - acc: 0.7327 - val\_loss: 0.8713 - val\_acc: 0.6992

Epoch 5/20

50000/50000 [==============================] - 731s 15ms/step - loss: 0.6377 - acc: 0.7759 - val\_loss: 0.7894 - val\_acc: 0.7374

Epoch 6/20

50000/50000 [==============================] - 721s 14ms/step - loss: 0.5190 - acc: 0.8171 - val\_loss: 0.8041 - val\_acc: 0.7267

Epoch 7/20

50000/50000 [==============================] - 720s 14ms/step - loss: 0.3978 - acc: 0.8624 - val\_loss: 0.8066 - val\_acc: 0.7414

Epoch 8/20

50000/50000 [==============================] - 712s 14ms/step - loss: 0.2892 - acc: 0.9009 - val\_loss: 0.9463 - val\_acc: 0.7301

Epoch 9/20

50000/50000 [==============================] - 699s 14ms/step - loss: 0.2017 - acc: 0.9303 - val\_loss: 1.1177 - val\_acc: 0.7371

Epoch 10/20

50000/50000 [==============================] - 690s 14ms/step - loss: 0.1391 - acc: 0.9522 - val\_loss: 1.0530 - val\_acc: 0.7531

Epoch 11/20

50000/50000 [==============================] - 695s 14ms/step - loss: 0.0910 - acc: 0.9706 - val\_loss: 1.2356 - val\_acc: 0.7416

Epoch 12/20

50000/50000 [==============================] - 697s 14ms/step - loss: 0.0626 - acc: 0.9799 - val\_loss: 1.3389 - val\_acc: 0.7462

Epoch 13/20

50000/50000 [==============================] - 699s 14ms/step - loss: 0.0480 - acc: 0.9847 - val\_loss: 1.4041 - val\_acc: 0.7544

Epoch 14/20

50000/50000 [==============================] - 696s 14ms/step - loss: 0.0355 - acc: 0.9884 - val\_loss: 1.5708 - val\_acc: 0.7410

Epoch 15/20

50000/50000 [==============================] - 697s 14ms/step - loss: 0.0361 - acc: 0.9877 - val\_loss: 1.6969 - val\_acc: 0.7356

Epoch 16/20

50000/50000 [==============================] - 698s 14ms/step - loss: 0.0359 - acc: 0.9884 - val\_loss: 1.6197 - val\_acc: 0.7526

Epoch 17/20

50000/50000 [==============================] - 701s 14ms/step - loss: 0.0228 - acc: 0.9929 - val\_loss: 1.7412 - val\_acc: 0.7440

Epoch 18/20

50000/50000 [==============================] - 700s 14ms/step - loss: 0.0202 - acc: 0.9939 - val\_loss: 1.9122 - val\_acc: 0.7397

Epoch 19/20

50000/50000 [==============================] - 699s 14ms/step - loss: 0.0179 - acc: 0.9940 - val\_loss: 1.8083 - val\_acc: 0.7587

Epoch 20/20

50000/50000 [==============================] - 698s 14ms/step - loss: 0.0210 - acc: 0.9936 - val\_loss: 1.9243 - val\_acc: 0.7450

Test loss: 1.9243225465774536

Test accuracy: 0.745

4 cnn-3

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 589s 12ms/step - loss: 1.6695 - acc: 0.4015 - val\_loss: 1.2529 - val\_acc: 0.5499

Epoch 2/20

50000/50000 [==============================] - 596s 12ms/step - loss: 1.1454 - acc: 0.5949 - val\_loss: 1.1107 - val\_acc: 0.6133

Epoch 3/20

50000/50000 [==============================] - 598s 12ms/step - loss: 0.9325 - acc: 0.6736 - val\_loss: 0.9553 - val\_acc: 0.6675

Epoch 4/20

50000/50000 [==============================] - 601s 12ms/step - loss: 0.7741 - acc: 0.7298 - val\_loss: 0.9819 - val\_acc: 0.6561

Epoch 5/20

50000/50000 [==============================] - 595s 12ms/step - loss: 0.6333 - acc: 0.7780 - val\_loss: 0.9102 - val\_acc: 0.6957

Epoch 6/20

50000/50000 [==============================] - 595s 12ms/step - loss: 0.4957 - acc: 0.8272 - val\_loss: 0.8335 - val\_acc: 0.7213

Epoch 7/20

50000/50000 [==============================] - 597s 12ms/step - loss: 0.3581 - acc: 0.8781 - val\_loss: 0.8853 - val\_acc: 0.7243

Epoch 8/20

50000/50000 [==============================] - 597s 12ms/step - loss: 0.2347 - acc: 0.9211 - val\_loss: 0.9868 - val\_acc: 0.7223

Epoch 9/20

50000/50000 [==============================] - 594s 12ms/step - loss: 0.1394 - acc: 0.9564 - val\_loss: 1.1454 - val\_acc: 0.7200

Epoch 10/20

50000/50000 [==============================] - 590s 12ms/step - loss: 0.0746 - acc: 0.9788 - val\_loss: 1.2194 - val\_acc: 0.7280

Epoch 11/20

50000/50000 [==============================] - 587s 12ms/step - loss: 0.0421 - acc: 0.9887 - val\_loss: 1.2595 - val\_acc: 0.7415

Epoch 12/20

50000/50000 [==============================] - 588s 12ms/step - loss: 0.0244 - acc: 0.9939 - val\_loss: 1.4201 - val\_acc: 0.7339

Epoch 13/20

50000/50000 [==============================] - 591s 12ms/step - loss: 0.0177 - acc: 0.9961 - val\_loss: 1.4565 - val\_acc: 0.7367

Epoch 14/20

50000/50000 [==============================] - 590s 12ms/step - loss: 0.0047 - acc: 0.9994 - val\_loss: 1.5357 - val\_acc: 0.7503

Epoch 15/20

50000/50000 [==============================] - 594s 12ms/step - loss: 0.0022 - acc: 0.9997 - val\_loss: 1.6122 - val\_acc: 0.7486

Epoch 16/20

50000/50000 [==============================] - 588s 12ms/step - loss: 0.0113 - acc: 0.9974 - val\_loss: 1.6146 - val\_acc: 0.7461

Epoch 17/20

50000/50000 [==============================] - 589s 12ms/step - loss: 9.6893e-04 - acc: 0.9999 - val\_loss: 1.6716 - val\_acc: 0.7465

Epoch 18/20

50000/50000 [==============================] - 588s 12ms/step - loss: 4.4495e-04 - acc: 0.9999 - val\_loss: 1.7211 - val\_acc: 0.7489

Epoch 19/20

50000/50000 [==============================] - 588s 12ms/step - loss: 2.3986e-04 - acc: 1.0000 - val\_loss: 1.7726 - val\_acc: 0.7483

Epoch 20/20

50000/50000 [==============================] - 589s 12ms/step - loss: 1.3092e-04 - acc: 1.0000 - val\_loss: 1.8111 - val\_acc: 0.7486

Test loss: 1.811063880944252

Test accuracy: 0.7486

5 cnn-2

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 223s 4ms/step - loss: 1.6731 - acc: 0.4019 - val\_loss: 1.4917 - val\_acc: 0.4818

Epoch 2/20

50000/50000 [==============================] - 223s 4ms/step - loss: 1.1834 - acc: 0.5804 - val\_loss: 1.1635 - val\_acc: 0.5933

Epoch 3/20

50000/50000 [==============================] - 224s 4ms/step - loss: 0.9746 - acc: 0.6582 - val\_loss: 0.9911 - val\_acc: 0.6551

Epoch 4/20

50000/50000 [==============================] - 226s 5ms/step - loss: 0.8341 - acc: 0.7061 - val\_loss: 0.9154 - val\_acc: 0.6807

Epoch 5/20

50000/50000 [==============================] - 226s 5ms/step - loss: 0.7111 - acc: 0.7515 - val\_loss: 0.8673 - val\_acc: 0.7036

Epoch 6/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.5944 - acc: 0.7927 - val\_loss: 0.8764 - val\_acc: 0.7004

Epoch 7/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.4793 - acc: 0.8358 - val\_loss: 0.8787 - val\_acc: 0.7183

Epoch 8/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.3671 - acc: 0.8773 - val\_loss: 0.9758 - val\_acc: 0.6965

Epoch 9/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.2627 - acc: 0.9139 - val\_loss: 0.9440 - val\_acc: 0.7232

Epoch 10/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.1708 - acc: 0.9460 - val\_loss: 1.1293 - val\_acc: 0.7116

Epoch 11/20

50000/50000 [==============================] - 225s 4ms/step - loss: 0.1071 - acc: 0.9690 - val\_loss: 1.1710 - val\_acc: 0.7168

Epoch 12/20

50000/50000 [==============================] - 225s 4ms/step - loss: 0.0620 - acc: 0.9834 - val\_loss: 1.3918 - val\_acc: 0.7071

Epoch 13/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.0397 - acc: 0.9905 - val\_loss: 1.2910 - val\_acc: 0.7346

Epoch 14/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.0237 - acc: 0.9950 - val\_loss: 1.4239 - val\_acc: 0.7312

Epoch 15/20

50000/50000 [==============================] - 225s 5ms/step - loss: 0.0102 - acc: 0.9983 - val\_loss: 1.5969 - val\_acc: 0.7287

Epoch 16/20

50000/50000 [==============================] - 225s 4ms/step - loss: 0.0261 - acc: 0.9950 - val\_loss: 1.5277 - val\_acc: 0.7309

Epoch 17/20

50000/50000 [==============================] - 225s 4ms/step - loss: 0.0040 - acc: 0.9995 - val\_loss: 1.6656 - val\_acc: 0.7317

Epoch 18/20

50000/50000 [==============================] - 224s 4ms/step - loss: 0.0021 - acc: 0.9997 - val\_loss: 1.7095 - val\_acc: 0.7389

Epoch 19/20

50000/50000 [==============================] - 225s 4ms/step - loss: 0.0019 - acc: 0.9996 - val\_loss: 1.7702 - val\_acc: 0.7380

Epoch 20/20

50000/50000 [==============================] - 226s 5ms/step - loss: 9.3844e-04 - acc: 0.9998 - val\_loss: 1.8124 - val\_acc: 0.7379

Test loss: 1.812427275133133

Test accuracy: 0.7379

6 cnn-1

Train on 50000 samples, validate on 10000 samples

Epoch 1/20

50000/50000 [==============================] - 198s 4ms/step - loss: 1.6651 - acc: 0.4025 - val\_loss: 1.2827 - val\_acc: 0.5477

Epoch 2/20

50000/50000 [==============================] - 198s 4ms/step - loss: 1.1837 - acc: 0.5835 - val\_loss: 1.0858 - val\_acc: 0.6147

Epoch 3/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.9800 - acc: 0.6567 - val\_loss: 1.0791 - val\_acc: 0.6145

Epoch 4/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.8491 - acc: 0.7036 - val\_loss: 0.9721 - val\_acc: 0.6655

Epoch 5/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.7390 - acc: 0.7437 - val\_loss: 0.8808 - val\_acc: 0.6983

Epoch 6/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.6339 - acc: 0.7807 - val\_loss: 0.8407 - val\_acc: 0.7169

Epoch 7/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.5297 - acc: 0.8163 - val\_loss: 0.8800 - val\_acc: 0.7113

Epoch 8/20

50000/50000 [==============================] - 198s 4ms/step - loss: 0.4357 - acc: 0.8504 - val\_loss: 1.0311 - val\_acc: 0.6879

Epoch 9/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.3439 - acc: 0.8836 - val\_loss: 0.9781 - val\_acc: 0.7015

Epoch 10/20

50000/50000 [==============================] - 201s 4ms/step - loss: 0.2599 - acc: 0.9139 - val\_loss: 1.0087 - val\_acc: 0.7210

Epoch 11/20

50000/50000 [==============================] - 201s 4ms/step - loss: 0.1857 - acc: 0.9392 - val\_loss: 1.0899 - val\_acc: 0.7199

Epoch 12/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.1312 - acc: 0.9599 - val\_loss: 1.1707 - val\_acc: 0.7139

Epoch 13/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.0858 - acc: 0.9759 - val\_loss: 1.2727 - val\_acc: 0.7178

Epoch 14/20

50000/50000 [==============================] - 199s 4ms/step - loss: 0.0566 - acc: 0.9847 - val\_loss: 1.3768 - val\_acc: 0.7170

Epoch 15/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.0385 - acc: 0.9902 - val\_loss: 1.4524 - val\_acc: 0.7203

Epoch 16/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.0264 - acc: 0.9944 - val\_loss: 1.5423 - val\_acc: 0.7227

Epoch 17/20

50000/50000 [==============================] - 200s 4ms/step - loss: 0.0149 - acc: 0.9970 - val\_loss: 2.2531 - val\_acc: 0.6638

Epoch 18/20

50000/50000 [==============================] - 199s 4ms/step - loss: 0.0096 - acc: 0.9983 - val\_loss: 1.6897 - val\_acc: 0.7274

Epoch 19/20

50000/50000 [==============================] - 199s 4ms/step - loss: 0.0100 - acc: 0.9977 - val\_loss: 1.7054 - val\_acc: 0.7280

Epoch 20/20

50000/50000 [==============================] - 199s 4ms/step - loss: 0.0029 - acc: 0.9996 - val\_loss: 1.8201 - val\_acc: 0.7233

Test loss: 1.8201171399593352

Test accuracy: 0.7233