

lab 9 Report

Data

We load MNIST dataset through `datasets.mnist.load_data`, we set train size as 60000 and test size as 10000, the dimension of train picture is 28x28 with the channels of 1

Preprocess

We normalize the pixel value from 0-255 to 0-1

Model

The model is a 3 layer CNN,

The first layer is a convolutional layer with 32 3x3 convolution kernel and RELU activation function, the pooling layer is MaxPooling with the pooling size of 2x2.

The second layer is a convolutional layer with 64 3x3 convolution kernel and RELU activation function, the pooling layer is MaxPooling with the pooling size of 2x2.

The third layer is a convolutional layer with 64 3x3 convolution kernel and RELU activation function, the output layer use softmax to normalize its output.

Training

Model: "sequential"		
Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 32)	320
max_pooling2d (MaxPooling2D)	(None, 13, 13, 32)	0
conv2d_1 (Conv2D)	(None, 11, 11, 64)	18496
max_pooling2d_1 (MaxPooling2D)	(None, 5, 5, 64)	0
conv2d_2 (Conv2D)	(None, 3, 3, 64)	36928
flatten (Flatten)	(None, 576)	0
dense (Dense)	(None, 64)	36928
dense_1 (Dense)	(None, 10)	650

Total params: 93,322
Trainable params: 93,322
Non-trainable params: 0

Train on 60000 samples

Epoch 1/5

9888/60000 [==>.....] - ETA: 13s - loss: 0.4502 -
accuracy: 0.8639

Epoch 00001: saving model to ./ckpt/cp-0001.ckpt

19904/60000 [=====>.....] - ETA: 10s - loss: 0.2855 -
accuracy: 0.9129

Epoch 00001: saving model to ./ckpt/cp-0001.ckpt

29888/60000 [=====>.....] - ETA: 7s - loss: 0.2225 -
accuracy: 0.9319

Epoch 00001: saving model to ./ckpt/cp-0001.ckpt

39968/60000 [=====>.....] - ETA: 5s - loss: 0.1855 -
accuracy: 0.9433

Epoch 00001: saving model to ./ckpt/cp-0001.ckpt

49888/60000 [=====>.....] - ETA: 2s - loss: 0.1619 -
accuracy: 0.9502

Epoch 00001: saving model to ./ckpt/cp-0001.ckpt

60000/60000 [=====>.....] - 16s 261us/sample - loss: 0.1460
- accuracy: 0.9552

Epoch 2/5

32/60000 [.....] - ETA: 17s - loss: 0.0533 -
accuracy: 0.9688

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

10048/60000 [==>.....] - ETA: 13s - loss: 0.0522 -
accuracy: 0.9840

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

19936/60000 [=====>.....] - ETA: 10s - loss: 0.0510 -
accuracy: 0.9840

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

29920/60000 [=====>.....] - ETA: 7s - loss: 0.0519 -
accuracy: 0.9842

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

40096/60000 [=====>.....] - ETA: 5s - loss: 0.0503 -
accuracy: 0.9844

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

50048/60000 [=====>.....] - ETA: 2s - loss: 0.0493 -
accuracy: 0.9847

Epoch 00002: saving model to ./ckpt/cp-0002.ckpt

60000/60000 [=====>.....] - 16s 264us/sample - loss: 0.0476
- accuracy: 0.9854

Epoch 3/5

32/60000 [.....] - ETA: 15s - loss: 0.0016 -
accuracy: 1.0000

Epoch 00003: saving model to ./ckpt/cp-0003.ckpt

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10048/60000 [====>.....] - ETA: 13s - loss: 0.0340 -  
accuracy: 0.9893  
Epoch 00003: saving model to ./ckpt/cp-0003.ckpt  
20128/60000 [=====>.....] - ETA: 10s - loss: 0.0362 -  
accuracy: 0.9881  
Epoch 00003: saving model to ./ckpt/cp-0003.ckpt  
30048/60000 [=====>.....] - ETA: 7s - loss: 0.0350 -  
accuracy: 0.9885  
Epoch 00003: saving model to ./ckpt/cp-0003.ckpt  
40096/60000 [=====>.....] - ETA: 5s - loss: 0.0340 -  
accuracy: 0.9891  
Epoch 00003: saving model to ./ckpt/cp-0003.ckpt  
50208/60000 [=====>.....] - ETA: 2s - loss: 0.0344 -  
accuracy: 0.9893  
Epoch 00003: saving model to ./ckpt/cp-0003.ckpt  
60000/60000 [=====>.....] - 16s 264us/sample - loss: 0.0339  
- accuracy: 0.9893  
Epoch 4/5  
224/60000 [.....] - ETA: 15s - loss: 0.0116 -  
accuracy: 0.9955  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
10208/60000 [====>.....] - ETA: 13s - loss: 0.0199 -  
accuracy: 0.9937  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
20096/60000 [=====>.....] - ETA: 10s - loss: 0.0239 -  
accuracy: 0.9927  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
30272/60000 [=====>.....] - ETA: 7s - loss: 0.0239 -  
accuracy: 0.9929  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
40224/60000 [=====>.....] - ETA: 5s - loss: 0.0249 -  
accuracy: 0.9925  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
50272/60000 [=====>.....] - ETA: 2s - loss: 0.0260 -  
accuracy: 0.9923  
Epoch 00004: saving model to ./ckpt/cp-0004.ckpt  
60000/60000 [=====>.....] - 16s 267us/sample - loss: 0.0260  
- accuracy: 0.9921  
Epoch 5/5  
224/60000 [.....] - ETA: 15s - loss: 0.0100 -  
accuracy: 0.9955  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt  
10272/60000 [====>.....] - ETA: 13s - loss: 0.0157 -  
accuracy: 0.9945  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt  
20352/60000 [=====>.....] - ETA: 10s - loss: 0.0166 -  
accuracy: 0.9947  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt
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30368/60000 [=====>.....] - ETA: 7s - loss: 0.0170 -  
accuracy: 0.9946  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt  
40256/60000 [=====>.....] - ETA: 5s - loss: 0.0187 -  
accuracy: 0.9944  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt  
50432/60000 [=====>.....] - ETA: 2s - loss: 0.0195 -  
accuracy: 0.9942  
Epoch 00005: saving model to ./ckpt/cp-0005.ckpt  
60000/60000 [=====] - 16s 267us/sample - loss: 0.0206  
- accuracy: 0.9937  
10000/10000 [=====] - 0s 46us/sample - loss: 0.0339 -  
accuracy: 0.9890  
准确率: 0.9890, 共测试了10000张图片
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Test

It got 0.989 accuracy in a 10000 size of dataset.