

```

1  # -*- coding: utf-8 -*-
2  """
3  Training the convnet on MNIST images
4
5  """
6  from keras import layers
7  from keras import models
8
9  model = models.Sequential()
10
11  model.add(layers.Conv2D(32, (3, 3),
12                          use_bias=False, #True
13                          #strides=(1,1), #strides=(2,2),
14                          padding='same', # 'valid'
15                          activation='relu', input_shape=(28, 28, 1)))
16
17  model.add(layers.MaxPooling2D((2, 2)))
18
19  model.add(layers.Conv2D(64,
20                          (3, 3),
21                          padding='same',
22                          activation='relu'))
23
24  model.add(layers.MaxPooling2D((2, 2)))
25
26  model.add(layers.Conv2D(64,
27                          (3, 3),
28                          padding='same',
29                          activation='relu'))
30  model.add(layers.MaxPooling2D((2, 2)))
31
32  model.add(layers.Flatten())
33
34  model.add(layers.Dense(64, activation='relu'))
35
36  model.add(layers.Dense(10, activation='softmax'))
37
38
39  model.summary()
40
41  from keras.datasets import mnist
42  from keras.utils import to_categorical
43
44  (train_images, train_labels), (test_images, test_labels) = \
45  mnist.load_data()
46
47  train_images = train_images.reshape((60000, 28, 28, 1))
48  train_images = train_images.astype('float32') / 255
49  test_images = test_images.reshape((10000, 28, 28, 1))
50  test_images = test_images.astype('float32') / 255
51
52  train_labels = to_categorical(train_labels)
53  test_labels = to_categorical(test_labels)
54
55  from keras import losses
56  model.compile(optimizer='rmsprop',
57               loss='categorical_crossentropy', #losses.sparse_categorical_crossentropy
58               metrics=['accuracy'])
59
60  model.fit(train_images,
61           train_labels,
62           epochs=3,
63           batch_size=32,
64           validation_split=0.1)
65
66  test_loss, test_acc = model.evaluate(test_images, test_labels)
67  print("test_acc=", test_acc)
68
69  model.save('mnist_conv_model')
70
71

```