

1-2

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In [13]: # feed(train) the model
model.fit(train_images, train_labels, epochs=10)

Train on 60000 samples
Epoch 1/10
60000/60000 [=====] - 3s 54us/sample - loss: 0.4990 - accuracy: 0.8236
Epoch 2/10
60000/60000 [=====] - 3s 44us/sample - loss: 0.3746 - accuracy: 0.8648
Epoch 3/10
60000/60000 [=====] - 3s 46us/sample - loss: 0.3345 - accuracy: 0.8780
Epoch 4/10
60000/60000 [=====] - 3s 45us/sample - loss: 0.3107 - accuracy: 0.8864
Epoch 5/10
60000/60000 [=====] - 4s 74us/sample - loss: 0.2956 - accuracy: 0.8912
Epoch 6/10
60000/60000 [=====] - 3s 44us/sample - loss: 0.2788 - accuracy: 0.8967
Epoch 7/10
60000/60000 [=====] - 3s 46us/sample - loss: 0.2677 - accuracy: 0.9007
Epoch 8/10
60000/60000 [=====] - 3s 44us/sample - loss: 0.2566 - accuracy: 0.9045
Epoch 9/10
60000/60000 [=====] - 3s 50us/sample - loss: 0.2472 - accuracy: 0.9082
Epoch 10/10
60000/60000 [=====] - 3s 56us/sample - loss: 0.2372 - accuracy: 0.9128

Out[13]: <tensorflow.python.keras.callbacks.History at 0x2e132d1a48>

In [14]: test_loss, test_acc = model.evaluate(test_images, test_labels, verbose=2)
print('\nTest accuracy:', test_acc)

10000/1 - 0s - loss: 0.2672 - accuracy: 0.8795

Test accuracy: 0.8795
```

1-3

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In [26]: # train the model
model.fit(train_images,
          train_labels,
          batch_size=64,
          epochs=10,
          validation_data=(val_images, val_labels))

Train on 50000 samples, validate on 10000 samples
Epoch 1/10
50000/50000 [=====] - 3s 56us/sample - loss: 0.1304 - accuracy: 0.9507 - val_loss: 0.2242 - val_accuracy: 0.927
2
Epoch 2/10
50000/50000 [=====] - 3s 55us/sample - loss: 0.1281 - accuracy: 0.9516 - val_loss: 0.2293 - val_accuracy: 0.925
5
Epoch 3/10
50000/50000 [=====] - 3s 56us/sample - loss: 0.1251 - accuracy: 0.9524 - val_loss: 0.2206 - val_accuracy: 0.926
2
Epoch 4/10
50000/50000 [=====] - 5s 99us/sample - loss: 0.1259 - accuracy: 0.9520 - val_loss: 0.2291 - val_accuracy: 0.926
6
Epoch 5/10
50000/50000 [=====] - 3s 55us/sample - loss: 0.1247 - accuracy: 0.9525 - val_loss: 0.2281 - val_accuracy: 0.928
7
Epoch 6/10
50000/50000 [=====] - 3s 54us/sample - loss: 0.1200 - accuracy: 0.9546 - val_loss: 0.2235 - val_accuracy: 0.927
6
Epoch 7/10
50000/50000 [=====] - 3s 55us/sample - loss: 0.1198 - accuracy: 0.9553 - val_loss: 0.2360 - val_accuracy: 0.926
6
Epoch 8/10
50000/50000 [=====] - 3s 54us/sample - loss: 0.1165 - accuracy: 0.9556 - val_loss: 0.2557 - val_accuracy: 0.925
6
Epoch 9/10
50000/50000 [=====] - 3s 56us/sample - loss: 0.1167 - accuracy: 0.9556 - val_loss: 0.2380 - val_accuracy: 0.928
3
Epoch 10/10
50000/50000 [=====] - 3s 57us/sample - loss: 0.1150 - accuracy: 0.9570 - val_loss: 0.2334 - val_accuracy: 0.926
5

Out[26]: <tensorflow.python.keras.callbacks.History at 0x1a2cf57f648>

In [29]: score = model.evaluate(test_images, test_labels, verbose=0)

In [30]: print(score[1])

0.9284
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