

```
In [1]: pip install keras
```

```
Requirement already satisfied: keras in d:\anaconda3\lib\site-packages (2.10.0)
Note: you may need to restart the kernel to use updated packages.
```

```
In [2]: pip install tensorflow
```

```
Collecting tensorflow
  Downloading tensorflow-2.10.0-cp39-cp39-win_amd64.whl (455.9 MB)
    ----- 455.9/455.9 MB 1.5 MB/s eta 0:00:00
Collecting opt-einsum>=2.3.2
  Downloading opt_einsum-3.3.0-py3-none-any.whl (65 kB)
    ----- 65.5/65.5 kB 1.2 MB/s eta 0:00:00
Requirement already satisfied: wrapt>=1.11.0 in d:\anaconda3\lib\site-packages (from tensorflow) (1.14.1)
Requirement already satisfied: numpy>=1.20 in d:\anaconda3\lib\site-packages (from tensorflow) (1.21.5)
Collecting termcolor>=1.1.0
  Downloading termcolor-2.1.0-py3-none-any.whl (5.8 kB)
Collecting tensorflow-io-gcs-filesystem>=0.23.1
  Downloading tensorflow_io_gcs_filesystem-0.27.0-cp39-cp39-win_amd64.whl (1.5 MB)
    ----- 1.5/1.5 MB 3.4 MB/s eta 0:00:00
Requirement already satisfied: setuptools in d:\anaconda3\lib\site-packages (from tensorflow) (63.4.1)
Collecting gast<=0.4.0,>=0.2.1
  Downloading gast-0.4.0-py3-none-any.whl (9.8 kB)
Requirement already satisfied: packaging in d:\anaconda3\lib\site-packages (from tensorflow) (21.3)
Collecting keras-preprocessing>=1.1.1
  Downloading Keras_Preprocessing-1.1.2-py2.py3-none-any.whl (42 kB)
    ----- 42.6/42.6 kB 2.2 MB/s eta 0:00:00
Collecting tensorboard<2.11,>=2.10
  Downloading tensorboard-2.10.1-py3-none-any.whl (5.9 MB)
    ----- 5.9/5.9 MB 2.0 MB/s eta 0:00:00
Collecting protobuf<3.20,>=3.9.2
  Downloading protobuf-3.19.6-cp39-cp39-win_amd64.whl (895 kB)
    ----- 895.9/895.9 kB 3.5 MB/s eta 0:00:00
Collecting absl-py>=1.0.0
  Downloading absl_py-1.3.0-py3-none-any.whl (124 kB)
    ----- 124.6/124.6 kB 7.1 MB/s eta 0:00:00
Collecting grpcio<2.0,>=1.24.3
  Downloading grpcio-1.50.0-cp39-cp39-win_amd64.whl (3.7 MB)
    ----- 3.7/3.7 MB 3.3 MB/s eta 0:00:00
Requirement already satisfied: six>=1.12.0 in d:\anaconda3\lib\site-packages (from tensorflow) (1.16.0)
Collecting libclang>=13.0.0
  Downloading libclang-14.0.6-py2.py3-none-win_amd64.whl (14.2 MB)
    ----- 14.2/14.2 MB 3.2 MB/s eta 0:00:00
Requirement already satisfied: typing-extensions>=3.6.6 in d:\anaconda3\lib\site-packages (from tensorflow) (4.3.0)
Collecting astunparse>=1.6.0
  Downloading astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Requirement already satisfied: h5py>=2.9.0 in d:\anaconda3\lib\site-packages (from tensorflow) (3.7.0)
Collecting tensorflow-estimator<2.11,>=2.10.0
  Downloading tensorflow_estimator-2.10.0-py2.py3-none-any.whl (438 kB)
    ----- 438.7/438.7 kB 2.7 MB/s eta 0:00:00
Collecting google-pasta>=0.1.1
  Downloading google_pasta-0.2.0-py3-none-any.whl (57 kB)
    ----- 57.5/57.5 kB 1.5 MB/s eta 0:00:00
Requirement already satisfied: keras<2.11,>=2.10.0 in d:\anaconda3\lib\site-packages (from tensorflow) (2.10.0)
Collecting flatbuffers>=2.0
  Downloading flatbuffers-22.10.26-py2.py3-none-any.whl (26 kB)
Requirement already satisfied: wheel<1.0,>=0.23.0 in d:\anaconda3\lib\site-packages (from astunparse>=1.6.0->tensorflow) (0.37.1)
Collecting google-auth<3,>=1.6.3
```

```

  Downloading google_auth-2.14.0-py2.py3-none-any.whl (175 kB)
  ----- 175.0/175.0 kB 2.6 MB/s eta 0:00:00
Requirement already satisfied: markdown>=2.6.8 in d:\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10->tensorflow) (3.3.4)
Requirement already satisfied: requests<3,>=2.21.0 in d:\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10->tensorflow) (2.28.1)
Collecting tensorflow-data-server<0.7.0,>=0.6.0
  Downloading tensorflow_data_server-0.6.1-py3-none-any.whl (2.4 kB)
Collecting tensorflow-plugin-wit>=1.6.0
  Downloading tensorflow_plugin_wit-1.8.1-py3-none-any.whl (781 kB)
  ----- 781.3/781.3 kB 2.1 MB/s eta 0:00:00
Collecting google-auth-oauthlib<0.5,>=0.4.1
  Downloading google_auth_oauthlib-0.4.6-py2.py3-none-any.whl (18 kB)
Requirement already satisfied: werkzeug>=1.0.1 in d:\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10->tensorflow) (2.0.3)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in d:\anaconda3\lib\site-packages (from packaging->tensorflow) (3.0.9)
Collecting cachetools<6.0,>=2.0.0
  Downloading cachetools-5.2.0-py3-none-any.whl (9.3 kB)
Requirement already satisfied: pyasn1-modules>=0.2.1 in d:\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorflow<2.11,>=2.10->tensorflow) (0.2.8)
Collecting rsa<5,>=3.1.4
  Downloading rsa-4.9-py3-none-any.whl (34 kB)
Collecting requests-oauthlib>=0.7.0
  Downloading requests_oauthlib-1.3.1-py2.py3-none-any.whl (23 kB)
Requirement already satisfied: idna<4,>=2.5 in d:\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow<2.11,>=2.10->tensorflow) (3.3)
Requirement already satisfied: charset-normalizer<3,>=2 in d:\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow<2.11,>=2.10->tensorflow) (2.0.4)
Requirement already satisfied: certifi>=2017.4.17 in d:\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow<2.11,>=2.10->tensorflow) (2022.9.14)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in d:\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow<2.11,>=2.10->tensorflow) (1.26.11)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in d:\anaconda3\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorflow<2.11,>=2.10->tensorflow) (0.4.8)
Collecting oauthlib>=3.0.0
  Downloading oauthlib-3.2.2-py3-none-any.whl (151 kB)
  ----- 151.7/151.7 kB 2.3 MB/s eta 0:00:00
Installing collected packages: tensorflow-plugin-wit, libclang, flatbuffers, termcolor, tensorflow-io-gcs-filesystem, tensorflow-estimator, tensorflow-data-server, rsa, protobuf, opt-einsum, oauthlib, keras-preprocessing, grpcio, google-pasta, gast, cachetools, astunparse, absl-py, requests-oauthlib, google-auth, google-auth-oauthlib, tensorflow, tensorflow
Successfully installed absl-py-1.3.0 astunparse-1.6.3 cachetools-5.2.0 flatbuffers-2.10.26 gast-0.4.0 google-auth-2.14.0 google-auth-oauthlib-0.4.6 google-pasta-0.2.0 grpcio-1.50.0 keras-preprocessing-1.1.2 libclang-14.0.6 oauthlib-3.2.2 opt-einsum-3.3.0 protobuf-3.19.6 requests-oauthlib-1.3.1 rsa-4.9 tensorflow-2.10.1 tensorflow-data-server-0.6.1 tensorflow-plugin-wit-1.8.1 tensorflow-2.10.0 tensorflow-estimator-2.10.0 tensorflow-io-gcs-filesystem-0.27.0 termcolor-2.1.0
Note: you may need to restart the kernel to use updated packages.

```

In [3]: `import numpy as np`

In [4]: `import matplotlib.pyplot as plt`

In [5]: `from tensorflow.keras.datasets import fashion_mnist`

In [6]: `(x_train,y_train),(x_test,y_test)=fashion_mnist.load_data()`

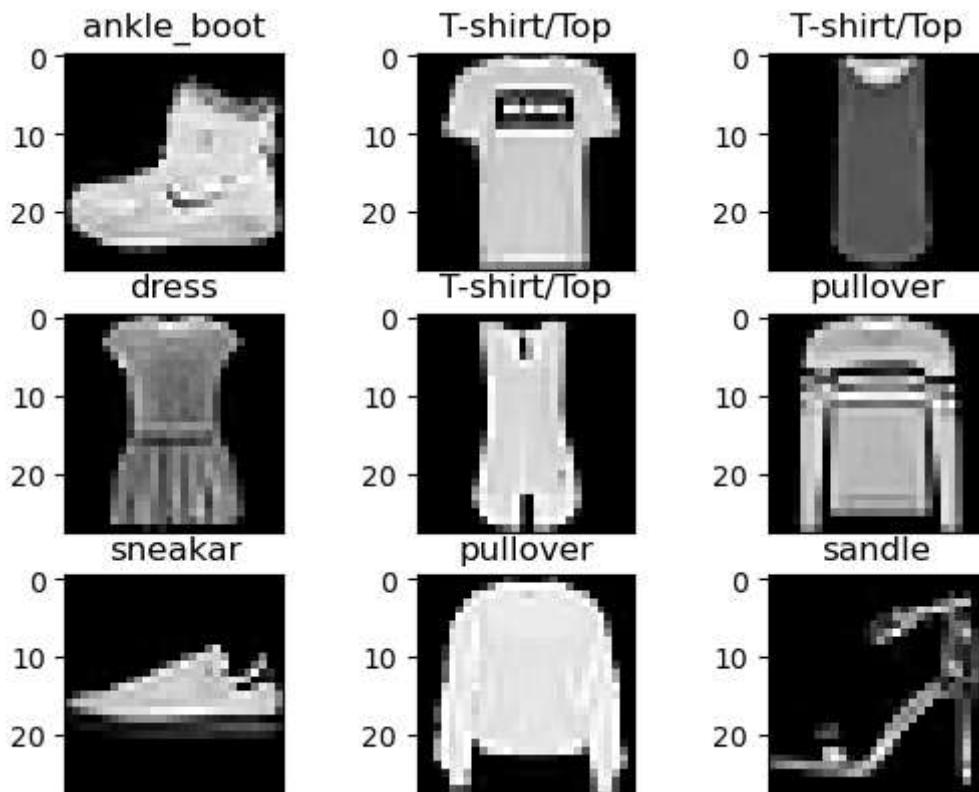
```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-labels-idx1-ubyte.gz
29515/29515 [=====] - 0s 3us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-images-idx3-ubyte.gz
26421880/26421880 [=====] - 11s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [=====] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [=====] - 3s 1us/step
```

```
In [7]: y_train
```

```
Out[7]: array([9, 0, 0, ..., 3, 0, 5], dtype=uint8)
```

```
In [8]: class_names=['T-shirt/Top','Trousers','Pullover','Dress','Coat','Sandal','Shirt','Sneaker']
```

```
In [9]: for i in range(9):
    plt.subplot(3,3,i+1)
    plt.imshow(x_train[i],cmap='gray')
    plt.title(class_names[y_train[i]])
    plt.xticks([])
```



```
In [10]: x_train.shape
```

```
Out[10]: (60000, 28, 28)
```

```
In [11]: y_test.shape
```

```
Out[11]: (10000,)
```

```
In [13]: x_test.shape
```

```
Out[13]: (10000, 28, 28)
```

```
In [14]: #features scale  
x_train=x_train/255  
x_test=x_test/255
```

```
In [15]: from tensorflow.keras.models import Sequential  
from tensorflow.keras.layers import Dense, Flatten
```

```
In [16]: model=Sequential([Flatten(input_shape=(28,28)),Dense(128,activation='relu'),Dense(10,activation='softmax')])
```

```
In [17]: model.summary()
```

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
<hr/>		
flatten (Flatten)	(None, 784)	0
dense (Dense)	(None, 128)	100480
dense_1 (Dense)	(None, 10)	1290
<hr/>		
Total params: 101,770		
Trainable params: 101,770		
Non-trainable params: 0		

```
In [18]: model.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

```
In [19]: model.fit(x_train,y_train,epochs=10,batch_size=5)
```

```
Epoch 1/10
12000/12000 [=====] - 41s 3ms/step - loss: 0.4786 - accuracy: 0.8284
Epoch 2/10
12000/12000 [=====] - 37s 3ms/step - loss: 0.3701 - accuracy: 0.8638
Epoch 3/10
12000/12000 [=====] - 41s 3ms/step - loss: 0.3386 - accuracy: 0.8764
Epoch 4/10
12000/12000 [=====] - 40s 3ms/step - loss: 0.3190 - accuracy: 0.8825
Epoch 5/10
12000/12000 [=====] - 40s 3ms/step - loss: 0.3034 - accuracy: 0.8884
Epoch 6/10
12000/12000 [=====] - 48s 4ms/step - loss: 0.2912 - accuracy: 0.8925
Epoch 7/10
12000/12000 [=====] - 36s 3ms/step - loss: 0.2803 - accuracy: 0.8948
Epoch 8/10
12000/12000 [=====] - 36s 3ms/step - loss: 0.2742 - accuracy: 0.8985
Epoch 9/10
12000/12000 [=====] - 39s 3ms/step - loss: 0.2651 - accuracy: 0.9011
Epoch 10/10
12000/12000 [=====] - 37s 3ms/step - loss: 0.2588 - accuracy: 0.9040
Out[19]: <keras.callbacks.History at 0x15b082da670>
```

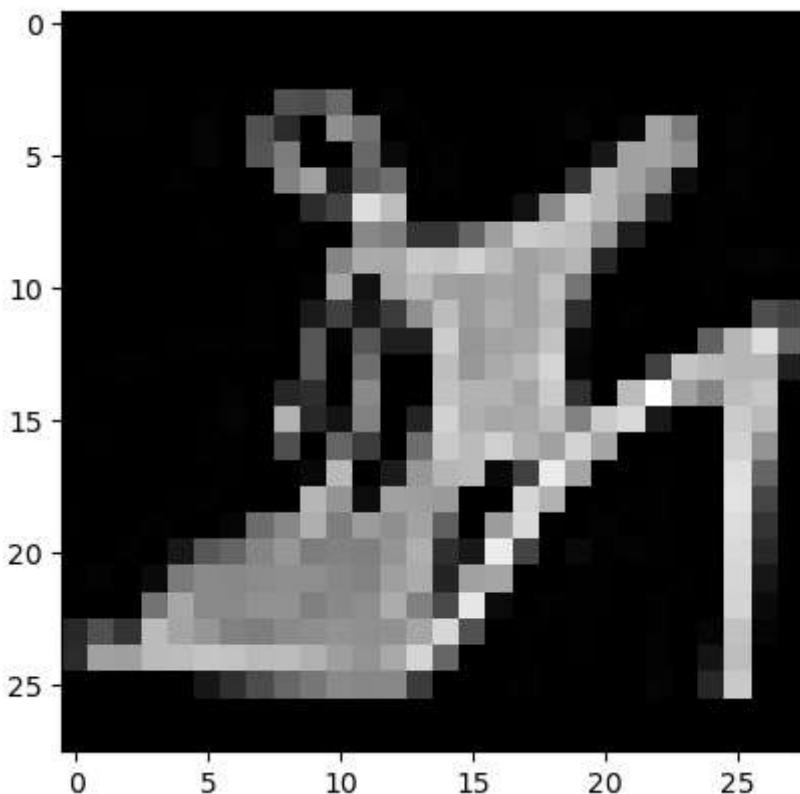
```
In [20]: test_loss,test_acc=model.evaluate(x_test,y_test)

313/313 [=====] - 2s 6ms/step - loss: 0.3624 - accuracy: 0.802
```

```
In [21]: new=x_train[345]
```

```
In [22]: plt.imshow(new,cmap='gray')

Out[22]: <matplotlib.image.AxesImage at 0x15b08596640>
```



```
In [23]: predictions=model.predict(x_train)  
data=np.argmax(predictions[345])  
class_names[data]
```

```
1875/1875 [=====] - 9s 5ms/step  
Out[23]: 'sandle'
```

```
In [ ]:
```