```
from tensorflow.keras.datasets import fashion_mnist
import matplotlib.pyplot as plt
```

```
(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 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-images-idx3-ubyte.gz
26421880/26421880 [==============================] - 0s 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 [==============================] - 0s 0us/step
```

```
def shape():
  print("Train Shape :",x_train.shape)
  print("Test Shape :",x_test.shape)
  print("y_train shape :",y_train.shape)
  print("y_test shape :",y_test.shape)
shape()
```

```
Train Shape : (60000, 28, 28)
Test Shape : (10000, 28, 28)
y_train shape : (60000,)
y_test shape : (10000,)
```

```
x_train[0]
```

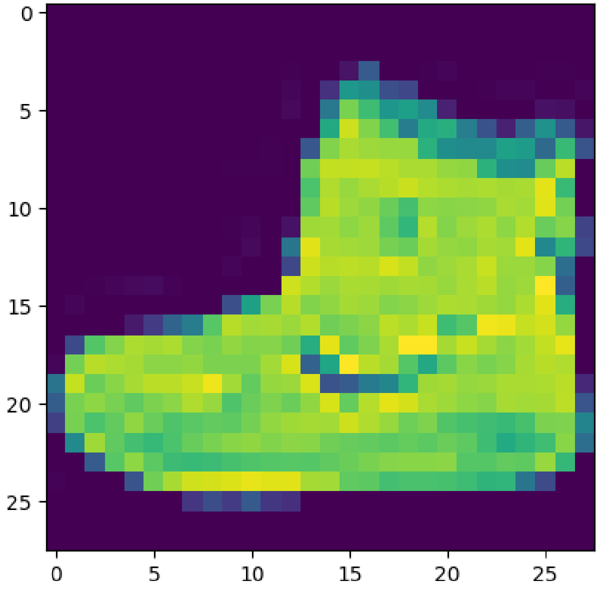
```
ndarray (28, 28) hide data
array([[  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   1,
          0,   0,  13,  73,   0,   0,   1,   4,   0,   0,   0,   0,   1,
          1,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   3,
          0,  36, 136, 127,  62,  54,   0,   0,   0,   1,   3,   4,   0,
          0,   3],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   6,
          0, 102, 204, 176, 134, 144, 123,  23,   0,   0,   0,   0,  12,
         10,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0, 155, 236, 207, 178, 107, 156, 161, 109,  64,  23,  77, 130,
         72,  15],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   1,   0,
         69, 207, 223, 218, 216, 216, 163, 127, 121, 122, 146, 141,  88,
        172,  66],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   1,   1,   1,   0,
        200, 232, 232, 233, 229, 223, 223, 215, 213, 164, 127, 123, 196,
        229,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
        183, 225, 216, 223, 228, 235, 227, 224, 222, 224, 221, 223, 245,
        173,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
        193, 228, 218, 213, 198, 180, 212, 210, 211, 213, 223, 220, 243,
        202,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   1,   3,   0,  12,
        219, 220, 212, 218, 192, 169, 227, 208, 218, 224, 212, 226, 197,
        209,  52],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   6,   0,  99,
        244, 222, 220, 218, 203, 198, 221, 215, 213, 222, 220, 245, 119,
        167,  56],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   4,   0,   0,  55,
        236, 228, 230, 228, 240, 232, 213, 218, 223, 234, 217, 217, 209,
         92,   0],
       [  0,   0,   1,   4,   6,   7,   2,   0,   0,   0,   0,   0, 237,
        226, 217, 223, 222, 219, 222, 221, 216, 223, 229, 215, 218, 255,
         77,   0],
       [  0,   3,   0,   0,   0,   0,   0,   0,   0,  62, 145, 204, 228,
        207, 213, 221, 218, 208, 211, 218, 224, 223, 219, 215, 224, 244,
        159,   0],
       [  0,   0,   0,   0,  18,  44,  82, 107, 189, 228, 220, 222, 217,
        226, 200, 205, 211, 230, 224, 234, 176, 188, 250, 248, 233, 238,
        215,   0],
       [  0,  57, 187, 208, 224, 221, 224, 208, 204, 214, 208, 209, 200,
        159, 245, 193, 206, 223, 255, 255, 221, 234, 221, 211, 220, 232,
        246,   0],
       [  3, 202, 228, 224, 221, 211, 211, 214, 205, 205, 205, 220, 240,
       [  3, 202, 228, 224, 221, 211, 211, 214, 205, 205, 205, 220, 240,
         80, 150, 255, 229, 221, 188, 154, 191, 210, 204, 209, 222, 228,
        225,   0],
       [ 98, 233, 198, 210, 222, 229, 229, 234, 249, 220, 194, 215, 217,
        241,  65,  73, 106, 117, 168, 219, 221, 215, 217, 223, 223, 224,
        229,  29],
       [ 75, 204, 212, 204, 193, 205, 211, 225, 216, 185, 197, 206, 198,
        213, 240, 195, 227, 245, 239, 223, 218, 212, 209, 222, 220, 221,
        230,  67],
       [ 48, 203, 183, 194, 213, 197, 185, 190, 194, 192, 202, 214, 219,
        221, 220, 236, 225, 216, 199, 206, 186, 181, 177, 172, 181, 205,
        206, 115],
       [  0, 122, 219, 193, 179, 171, 183, 196, 204, 210, 213, 207, 211,
        210, 200, 196, 194, 191, 195, 191, 198, 192, 176, 156, 167, 177,
        210,  92],
       [  0,   0,  74, 189, 212, 191, 175, 172, 175, 181, 185, 188, 189,
        188, 193, 198, 204, 209, 210, 210, 211, 188, 188, 194, 192, 216,
        170,   0],
       [  2,   0,   0,   0,  66, 200, 222, 237, 239, 242, 246, 243, 244,
        221, 220, 193, 191, 179, 182, 182, 181, 176, 166, 168,  99,  58,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,  40,  61,  44,  72,  41,  35,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0]], dtype=uint8)
```

```
y_train[0]
```

```
9
```

```
plt.imshow(x_train[0])
```

```
<matplotlib.image.AxesImage at 0x7e7232355330>
```



```
class_names=['T-shirt/top','Trouser','Pullover','Dress','Coat','Sandal','Shirt','Sneaker','Bag','Ankleboot']
```

```
x_train = x_train/255
x_test = x_test/255
```

```
x_train = x_train.reshape(60000, 28, 28, 1)
x_test = x_test.reshape(10000, 28, 28, 1)
```

```
shape()
```

```
Train Shape : (60000, 28, 28, 1)
Test Shape : (10000, 28, 28, 1)
y_train shape : (60000,)
y_test shape : (10000,)
```

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, MaxPooling2D, Flatten
```

```
model=Sequential()
model.add(Conv2D(64, (3,3), activation='relu', input_shape=(28,28,1)))
model.add(MaxPooling2D((2,2)))
model.add(Conv2D(64, (3,3), activation='relu'))
model.add(MaxPooling2D((2,2)))
model.add(Flatten())
model.add(Dense(128,activation='relu'))
model.add(Dense(10,activation='softmax'))
model.compile(optimizer='adam', loss='sparse_categorical_crossentropy',metrics=['accuracy'])
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 26, 26, 64)        640

 max_pooling2d (MaxPooling2  (None, 13, 13, 64)        0
 D)

 conv2d_1 (Conv2D)           (None, 11, 11, 64)        36928

 max_pooling2d_1 (MaxPoolin  (None, 5, 5, 64)          0
 g2D)

 flatten (Flatten)           (None, 1600)              0

 dense (Dense)               (None, 128)               204928

 dense_1 (Dense)             (None, 10)                1290

=================================================================
Total params: 243786 (952.29 KB)
Trainable params: 243786 (952.29 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
model.fit(x_train, y_train, epochs=3, verbose=1, validation_data=(x_test,y_test))
```

```
Epoch 1/3
1875/1875 [==============================] - 112s 59ms/step - loss: 0.1482 - accuracy: 0.9448 - val_loss: 0.2634 - val_accuracy: 0.9115
Epoch 2/3
1875/1875 [==============================] - 89s 48ms/step - loss: 0.1304 - accuracy: 0.9512 - val_loss: 0.2776 - val_accuracy: 0.9117
Epoch 3/3
1875/1875 [==============================] - 87s 47ms/step - loss: 0.1155 - accuracy: 0.9563 - val_loss: 0.2938 - val_accuracy: 0.9075
<keras.src.callbacks.History at 0x7e72101f7e80>
```

```
predictions = model.predict(x_test)
```

```
313/313 [==============================] - 5s 16ms/step
```

```
import numpy as np
image_index=8
print(predictions[image_index])
final_value=np.argmax(predictions[image_index])
print("Actual label :",y_test[image_index])
print("Predicted label :",final_value)
print("Class :",class_names[final_value])
```

```
[2.1503855e-07 1.7898776e-10 6.5193495e-10 6.8687493e-11 4.1765029e-12
 9.9999899e-01 1.7809918e-11 5.5469303e-07 7.7889084e-08 4.2481502e-13]
Actual label : 5
Predicted label : 5
Class : Sandal
```

```
plt.imshow(x_test[image_index])
```

```
<matplotlib.image.AxesImage at 0x7e721020b190>
```