Source Code with

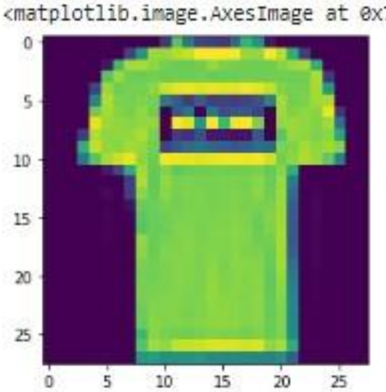
Outputimport tensorflow as
tf import matplotlib.pyplot as
plt from tensorflow import
keras import numpy as np

(x_train, y_train), (x_test, y_test) = keras.datasets.fashion_mnist.load_data()

There are 10 image classes in this dataset and each class has a mapping corresponding to the following labels:

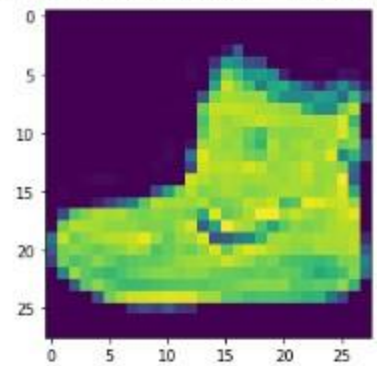
#0 T-shirt/top
#1 Trouser
#2 pullover
#3 Dress
#4 Coat
#5 sandals
#6 shirt
#7 sneaker
#8 bag #9 ankle boot
plt.imshow(x_train[1])

<matplotlib.image.AxesImage at 0x7f85874f3a00>



plt.imshow(x_train[0])

<matplotlib.image.AxesImage at 0x7f8584b93d00>



Next, we will preprocess the data by scaling the pixel values to be between 0 and 1, and then reshaping the images to be 28x28 pixels.

```
x_train = x_train.astype('float32') / 255.0
x_test = x_test.astype('float32') / 255.0

x_train = x_train.reshape(-1, 28, 28, 1)
x_test = x_test.reshape(-1, 28, 28, 1)
```

\# 28, 28 comes from width, height, 1 comes from the number of channels

\# -1 means that the length in that dimension is inferred.

\# This is done based on the constraint that the number of elements in an ndarray or Tensor when reshaped must remain the same.

\# each image is a row vector (784 elements) and there are lots of such rows (let it be n, so there are 784n elements). So TensorFlow can infer that -1 is n.

\# converting the training_images array to 4 dimensional array with sizes 60000, 28, 28, 1 for 0th to 3rd dimension. x_train.shape (60000, 28, 28) x_test.shape (10000, 28, 28, 1) y_train.shape (60000,) y_test.shape (10000,)

\# We will use a convolutional neural network (CNN) to classify the fashion items.

\# The CNN will consist of multiple convolutional layers followed by max pooling, # dropout, and dense layers. Here is the code for the model: model = keras.Sequential([keras.layers.Conv2D(32, (3,3), activation='relu', input_shape=(28,28,1)),

\# 32 filters (default), randomly initialized

\# 3*3 is Size of Filter

\# 28,28,1 size of Input Image

```
    # No zero-padding: every output 2 pixels less in every dimension
    # in Paramter shwon 320 is value of weights: (3x3 filter weights + 32 bias) * 32 filters
    # 32*3*3=288(Total)+32(bias)= 320
    keras.layers.MaxPooling2D((2,2)),
    # It shown 13 * 13 size image with 32 channel or filter or depth.
    keras.layers.Dropout(0.25),
    # Reduce Overfitting of Training sample drop out 25% Neuron
    keras.layers.Conv2D(64, (3,3), activation='relu'),
    # Deeper layers use 64 filters
    # 3*3 is Size of Filter
    # Observe how the input image on 28x28x1 is transformed to a 3x3x64 feature map
    # 13(Size)-3(Filter Size )+1(bias)=11 Size for Width and Height with 64 Depth or filtter or channel
    # in Paramter shwon 18496 is value of weights: (3x3 filter weights + 64 bias) * 64 filters
    # 64*3*3=576+1=577*32 + 32(bias)=18496
keras.layers.MaxPooling2D((2,2)),
    # It shown 5 * 5 size image with 64 channel or filter or depth.
 keras.layers.Dropout(0.25),
     keras.layers.Conv2D(128, (3,3), activation='relu'),
    # Deeper layers use 128 filters
    # 3*3 is Size of Filter
    # Observe how the input image on 28x28x1 is transformed to a 3x3x128 feature map
      # It show 5(Size)-3(Filter Size )+1(bias)=3 Size for Width and Height with 64 Depth or filtter or
channel
    # 128*3*3=1152+1=1153*64 + 64(bias)= 73856
    # To classify the images, we still need a Dense and Softmax layer.
    # We need to flatten the 3x3x128 feature map to a vector of size 1152
      keras.layers.Flatten(),
    keras.layers.Dense(128, activation='relu'),
    # 128 Size of Node in Dense Layer
    # 1152*128 = 147584
    keras.layers.Dropout(0.25),
    keras.layers.Dense(10, activation='softmax')
    # 10 Size of Node another Dense Layer
    # 128*10+10 bias= 1290
 ])
```

```
model.summary()
Model: "sequential"
_________________________________________________________________
Layer (type)            Output Shape          Param #
=================================================================
 conv2d (Conv2D)           (None, 26, 26, 32)       320

max_pooling2d (MaxPooling2D  (None, 13, 13, 32)      0
)

dropout (Dropout)         (None, 13, 13, 32)       0

conv2d_1 (Conv2D)         (None, 11, 11, 64)       18496

max_pooling2d_1 (MaxPooling  (None, 5, 5, 64)        0
2D)

dropout_1 (Dropout)       (None, 5, 5, 64)         0
conv2d_2 (Conv2D)         (None, 3, 3, 128)        73856

flatten (Flatten)         (None, 1152)             0

dense (Dense)             (None, 128)              147584

dropout_2 (Dropout)       (None, 128)              0

dense_1 (Dense)           (None, 10)               1290

=================================================================
Total params: 241,546
Trainable params: 241,546
Non-trainable params: 0
# Compile and Train the Model
# After defining the model, we will compile it and train it on the training data.
model.compile(optimizer='adam', loss='sparse_categorical_crossentropy',
metrics=['accuracy']) history = model.fit(x_train, y_train, epochs=10, validation_data=(x_test,
```

y_test)) # 1875 is a number of batches. By default batches contain 32 samles.60000 / 32 =
1875 # Finally, we will evaluate the performance of the model on the test data. test_loss,
test_acc = model.evaluate(x_test, y_test) print('Test accuracy:', test_acc)

```
313/313 [==============================] - 3s 10ms/step - loss: 0.2606 - accuracy: 0.9031
Test accuracy: 0.9031000137329102
```