

practical-no-3

April 10, 2024

```
[1]: import tensorflow as tf
import matplotlib.pyplot as plt
from tensorflow import keras
import numpy as np
```

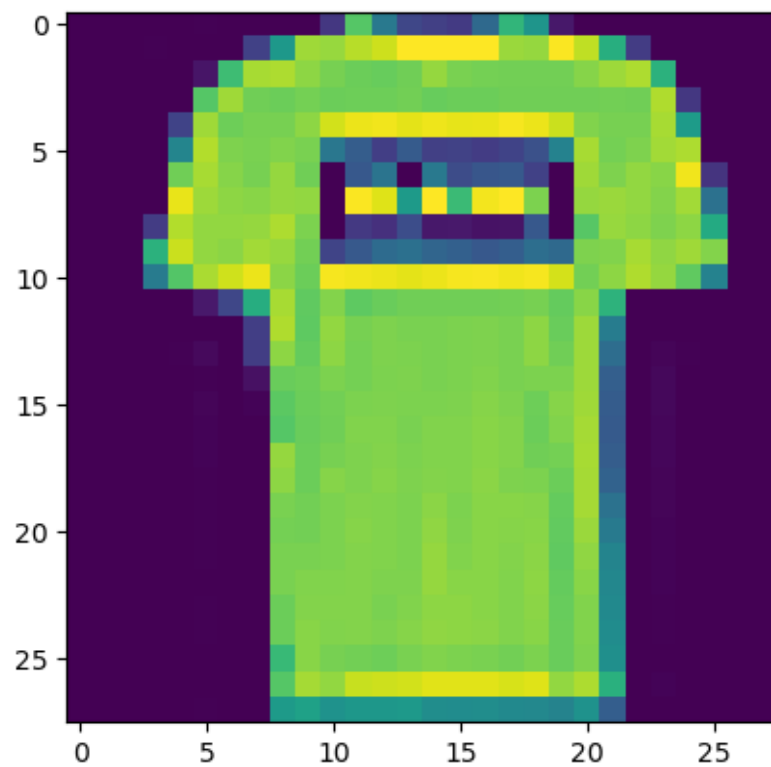
```
WARNING:tensorflow:From C:\Users\harsh\Documents\anaconda\Lib\site-
packages\keras\src\losses.py:2976: The name
tf.losses.sparse_softmax_cross_entropy is deprecated. Please use
tf.compat.v1.losses.sparse_softmax_cross_entropy instead.
```

```
[2]: (x_train, y_train), (x_test, y_test) = keras.datasets.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 [=====] - 12s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [=====] - 0s 0s/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [=====] - 2s 0us/step
```

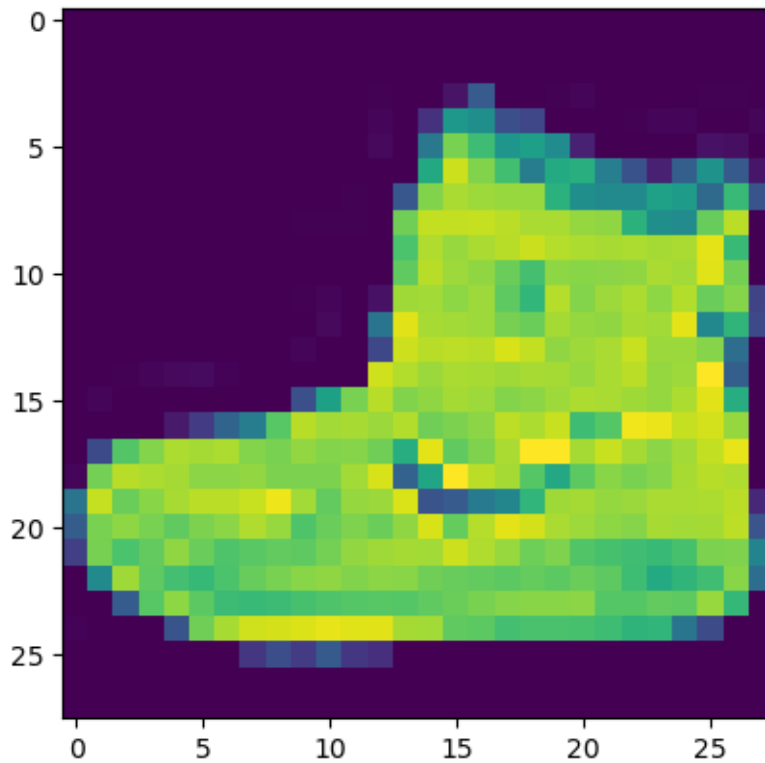
```
[3]: plt.imshow(x_train[1])
```

```
[3]: <matplotlib.image.AxesImage at 0x2a2285cfdd0>
```



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

```
[4]: <matplotlib.image.AxesImage at 0x2a228669290>
```



```
[5]: 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)
```

```
[6]: x_train.shape
```

```
[6]: (60000, 28, 28, 1)
```

```
[7]: x_test.shape
```

```
[7]: (10000, 28, 28, 1)
```

```
[8]: y_train.shape
```

```
[8]: (60000,)
```

```
[9]: y_test.shape
```

```
[9]: (10000,)
```

```
[10]: model = keras.Sequential([
keras.layers.Conv2D(32, (3,3), activation='relu', input_shape=(28,28,1)),
keras.layers.MaxPooling2D((2,2)),
keras.layers.Dropout(0.25),
keras.layers.Conv2D(64, (3,3), activation='relu'),
keras.layers.MaxPooling2D((2,2)),
keras.layers.Dropout(0.25),
keras.layers.Conv2D(128, (3,3), activation='relu'),
keras.layers.Flatten(),
keras.layers.Dense(128, activation='relu'),
keras.layers.Dropout(0.25),
keras.layers.Dense(10, activation='softmax')
])
model.summary()
Model: "sequential"
```

WARNING:tensorflow:From C:\Users\harsh\Documents\anaconda\Lib\site-packages\keras\src\backend.py:873: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.

WARNING:tensorflow:From C:\Users\harsh\Documents\anaconda\Lib\site-packages\keras\src\layers\pooling\max_pooling2d.py:161: The name tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.

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 (MaxPooling2D)	(None, 5, 5, 64)	0
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: 241546 (943.54 KB)
Trainable params: 241546 (943.54 KB)
Non-trainable params: 0 (0.00 Byte)
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```

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[12]: 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))
    test_loss, test_acc = model.evaluate(x_test, y_test)
    print('Test accuracy:', test_acc)

```

```

Epoch 1/10
1875/1875 [=====] - 27s 14ms/step - loss: 0.2263 -
accuracy: 0.9143 - val_loss: 0.2511 - val_accuracy: 0.9108
Epoch 2/10
1875/1875 [=====] - 32s 17ms/step - loss: 0.2214 -
accuracy: 0.9158 - val_loss: 0.2536 - val_accuracy: 0.9094
Epoch 3/10
1875/1875 [=====] - 30s 16ms/step - loss: 0.2187 -
accuracy: 0.9171 - val_loss: 0.2573 - val_accuracy: 0.9062
Epoch 4/10
1875/1875 [=====] - 27s 14ms/step - loss: 0.2143 -
accuracy: 0.9191 - val_loss: 0.2626 - val_accuracy: 0.9096
Epoch 5/10
1875/1875 [=====] - 27s 15ms/step - loss: 0.2062 -
accuracy: 0.9230 - val_loss: 0.2730 - val_accuracy: 0.9089
Epoch 6/10
1875/1875 [=====] - 28s 15ms/step - loss: 0.2043 -
accuracy: 0.9221 - val_loss: 0.2627 - val_accuracy: 0.9104
Epoch 7/10
1875/1875 [=====] - 26s 14ms/step - loss: 0.2004 -
accuracy: 0.9238 - val_loss: 0.2731 - val_accuracy: 0.9098
Epoch 8/10
1875/1875 [=====] - 30s 16ms/step - loss: 0.1980 -
accuracy: 0.9239 - val_loss: 0.2667 - val_accuracy: 0.9071
Epoch 9/10
1875/1875 [=====] - 27s 15ms/step - loss: 0.1971 -
accuracy: 0.9255 - val_loss: 0.2621 - val_accuracy: 0.9107
Epoch 10/10
1875/1875 [=====] - 28s 15ms/step - loss: 0.1927 -
accuracy: 0.9270 - val_loss: 0.2822 - val_accuracy: 0.9026

```

```
313/313 [=====] - 2s 6ms/step - loss: 0.2822 -  
accuracy: 0.9026  
Test accuracy: 0.9025999903678894
```

[]: