FashionMNIST_CNN

September 1, 2021

1 Training on the Fashion MNIST dataset

1.1 Importing required modules

[1]:
```
from __future__ import absolute_import, division, print_function

# import TensforFlow and TensorFlow Datasets
import tensorflow as tf
import tensorflow_datasets as tfds

# Helper libs
import math
import numpy as np
import matplotlib.pyplot as plt

print(tf.__version__)
tf.config.list_physical_devices('GPU')
```

```
2.5.0
```

[1]:
```
[PhysicalDevice(name='/physical_device:GPU:0', device_type='GPU')]
```

[2]:
```
from jupyterthemes import jtplot
jtplot.style(theme='onedork')
```

1.2 Loading the fashion MNIST dataset

[3]:
```
dataset, metadata = tfds.load('fashion_mnist', as_supervised=True,␣
↪with_info=True)
train_dataset, test_dataset = dataset['train'], dataset['test']
```

1.2.1 Mapping class names

Label	Class
0	T-shirt/top
1	Trouser
2	Pullover
3	Dress

Label	Class
4	Coat
5	Sandal
6	Shirt
7	Sneaker
8	Bag
9	Ankle boot

[4]:
```
class_names = ['T-shirt/top', 'Trouser', 'Pullover', 'Dress', 'Coat',
               'Sandal', 'Shirt', 'Sneaker', 'Bag', 'Ankle boot' ]
```

1.3 Exploratory data analysis

[5]:
```
num_train_examples = metadata.splits['train'].num_examples
num_test_examples = metadata.splits['test'].num_examples
print("Number of training examples: {}".format(num_train_examples))
print("Number of test examples:     {}".format(num_test_examples))
```

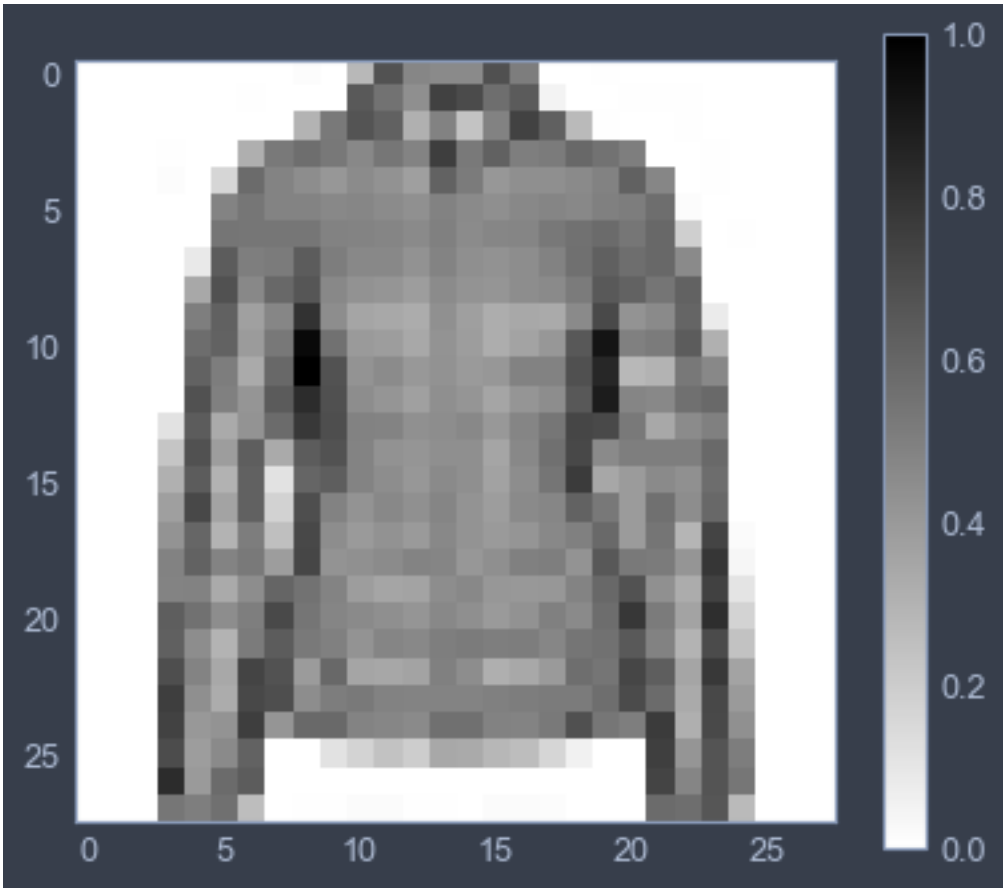
```
Number of training examples: 60000
Number of test examples:     10000
```

[6]:
```
def normalize(images, labels):
    images = tf.cast(images, tf.float32)
    images /= 255
    return images, labels

train_dataset = train_dataset.map(normalize)
test_dataset = test_dataset.map(normalize)
```

[7]:
```
for image, label in test_dataset.take(1):
    break
image = image.numpy().reshape((28, 28))

plt.figure()
plt.imshow(image, cmap=plt.cm.binary)
plt.colorbar()
plt.grid(False)
plt.show()
```



[8]:
```
plt.figure(figsize=(10, 10))
i = 0
for (image, label) in test_dataset.take(25):
    image = image.numpy().reshape((28, 28))
    plt.subplot(5, 5, i+1)
    plt.xticks([])
    plt.yticks([])
    plt.grid(False)
    plt.imshow(image, cmap=plt.cm.binary)
    plt.xlabel(class_names[label])
    i += 1

plt.show()
```

1.4 Building the model

This model consists of the following layers:

1. Conv2D layer with 32 units of (3, 3) filters
2. MaxPooling2D layer of size (2, 2) with strides=2
3. Conv2D layer with 64 units of (3, 3) filters
4. MaxPooling2D layer of size (2, 2) with strides=2
5. Flatten layer
6. Dense layer of 128 neurons with ReLU activation
7. Dense layer of 10 neurons with softmax activation

[9]:
```
model = tf.keras.Sequential([
    tf.keras.layers.Conv2D(32, (3, 3), padding='same', activation=tf.nn.relu,
                           input_shape=(28, 28, 1)),
    tf.keras.layers.MaxPooling2D((2,2), strides=2),
    tf.keras.layers.Conv2D(64, (3, 3), padding='same', activation=tf.nn.relu,
                           input_shape=(28, 28, 1)),
    tf.keras.layers.MaxPooling2D((2, 2), strides=2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(128, activation=tf.nn.relu),
    tf.keras.layers.Dense(10, activation=tf.nn.softmax)
])

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

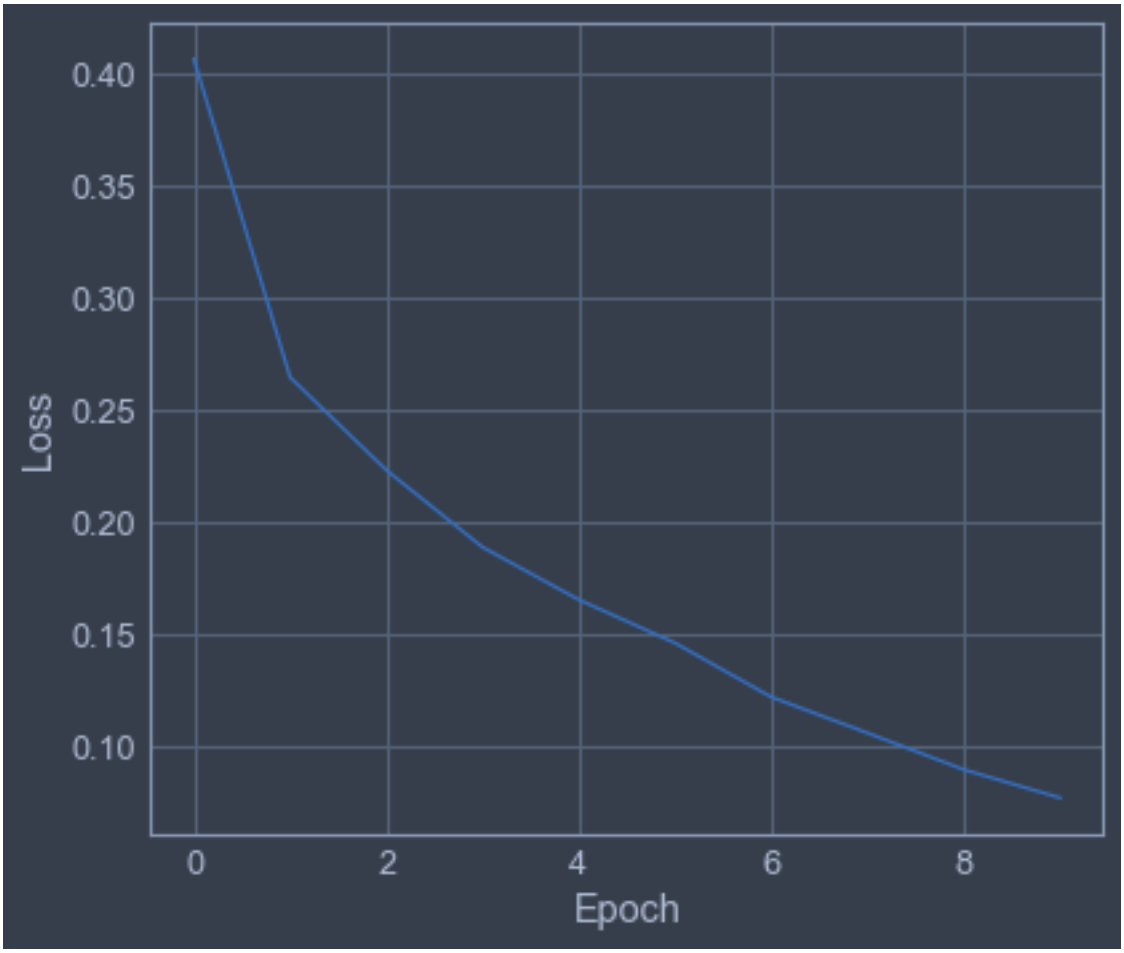
[10]:
```
BATCH_SIZE = 32
train_dataset = train_dataset.repeat().shuffle(num_train_examples).
 ↪batch(BATCH_SIZE)
test_dataset = test_dataset.batch(BATCH_SIZE)
```

[11]:
```
history = model.fit(train_dataset, epochs=10, steps_per_epoch=math.
 ↪ceil(num_train_examples/BATCH_SIZE))
```

```
Epoch 1/10
1875/1875 [==============================] - 32s 11ms/step - loss: 0.4067 -
accuracy: 0.8532
Epoch 2/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.2645 -
accuracy: 0.9040
Epoch 3/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.2230 -
accuracy: 0.9179
Epoch 4/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.1885 -
accuracy: 0.9302
Epoch 5/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.1651 -
accuracy: 0.9386
Epoch 6/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.1457 -
accuracy: 0.9468
Epoch 7/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.1216 -
accuracy: 0.9550
Epoch 8/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.1055 -
accuracy: 0.9606
```

```
Epoch 9/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.0891 -
accuracy: 0.9671
Epoch 10/10
1875/1875 [==============================] - 21s 11ms/step - loss: 0.0765 -
accuracy: 0.9715
```

[12]:
```
plt.plot(history.history['loss'])
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.show()
```



[13]:
```
train_loss, train_accuracy = model.evaluate(train_dataset, steps=math.
 ↪ceil(num_train_examples/BATCH_SIZE), verbose=0)
test_loss, test_accuracy = model.evaluate(test_dataset, steps=math.
 ↪ceil(num_test_examples/BATCH_SIZE), verbose=0)
print("Accuracy on the train set: {:.2f}%".format(train_accuracy * 100))
print("Accuracy on the test set: {:.2f}%".format(test_accuracy * 100))
```

```
Accuracy on the train set: 98.06%
Accuracy on the test set: 91.71%
```