Fashion-MNIST Project

Preparation

In [5]:
```
# PyTorch Modules

from torch.utils.data import Dataset, DataLoader

from torchvision import transforms
import torch
import torch.nn as nn
import torchvision.transforms as transforms
import torchvision.datasets as dsets
torch.manual_seed(0)
```

In [2]:
```
# Other non-PyTorch Modules

from matplotlib.pyplot import imshow
import matplotlib.pylab as plt

from PIL import Image
```

In [3]:
```
def show_data(data_sample):
    plt.imshow(data_sample[0].numpy().reshape(IMAGE_SIZE, IMAGE_SIZE), cmap='gray')
    plt.title('y = '+ str(data_sample[1].item()))
```

---

1. Create a Dataset Class ¶

In this section, you will load a Dataset object and transform the dataset. U

- `Resize` to resize the image.

- `ToTensor` to concert the image to a tensor.

Use the compose function ot compse the

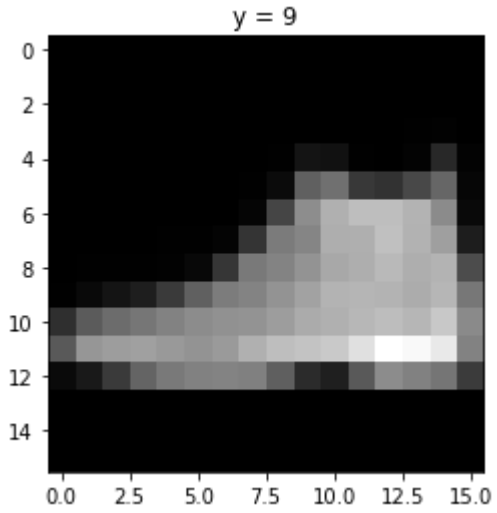
In [6]:
```
IMAGE_SIZE = 16

transforms.Resize((IMAGE_SIZE, IMAGE_SIZE)),
transforms.ToTensor()#
composed = transforms.Compose([transforms.Resize((IMAGE_SIZE, IMAGE_SIZE)), transforms.ToTensor()])
```

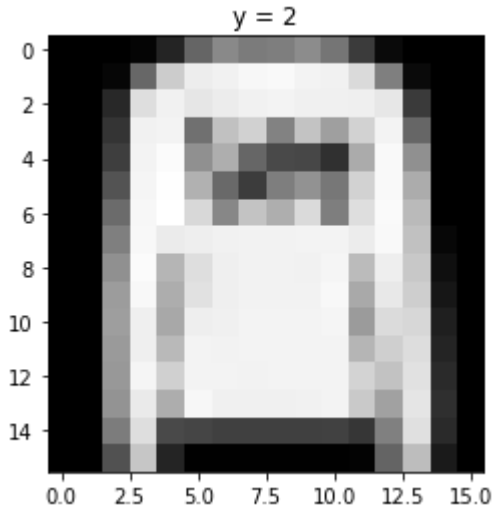
Create two dataset objects for the Fashion MNIST dataset. One for training data called `dataset_train` and one for validation data `dataset_val` .

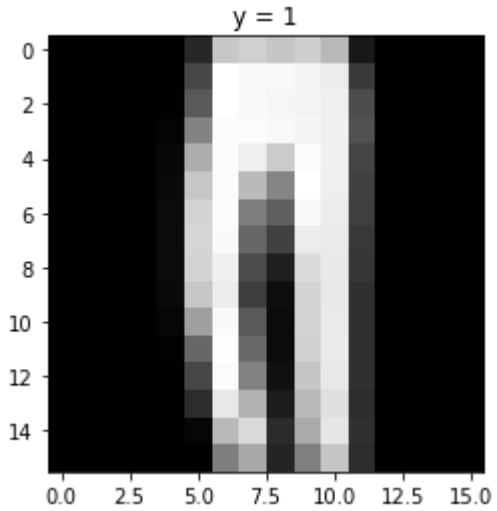
In [5]:
```

dataset_train=dsets.FashionMNIST(root= '.fashion/data', train=True, transform=composed,  download=True)
dataset_val=dsets.FashionMNIST(root= '.fashion/data', train=False, transform=composed, download=True)

```

```
Downloading http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-images-idx3-ubyte.gz (http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-images-idx3-ubyte.gz)
Downloading http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-labels-idx1-ubyte.gz (http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-labels-idx1-ubyte.gz)
Downloading http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-images-idx3-ubyte.gz (http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-images-idx3-ubyte.gz)
Downloading http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-labels-idx1-ubyte.gz (http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-labels-idx1-ubyte.gz)
Processing...
Done!
```

In [6]:
```
for n,data_sample in enumerate(dataset_val):

    show_data(data_sample)
    plt.show()
    if n==2:
        break
```




y = 2
0
2
4
6
8
10
12
14
0.0
2.5
5.0
7.5
10.0
12.5
15.0


y = 1
0
2
4
6
8
10
12
14
0.0
2.5
5.0
7.5
10.0
12.5
15.0

2. Create a Convolutional Neural Network class

Constructor using Batch Norm

In [7]:
```
class CNN_batch(nn.Module):

    # Contructor
    def __init__(self, out_1=16, out_2=32,number_of_classes=10):
        super(CNN_batch, self).__init__()
        self.cnn1 = nn.Conv2d(in_channels=1, out_channels=out_1, kernel_size=5, padding=2)
        self.conv1_bn = nn.BatchNorm2d(out_1)

        self.maxpool1=nn.MaxPool2d(kernel_size=2)

        self.cnn2 = nn.Conv2d(in_channels=out_1, out_channels=out_2, kernel_size=5, stride=1, padding=2)
        self.conv2_bn = nn.BatchNorm2d(out_2)

        self.maxpool2=nn.MaxPool2d(kernel_size=2)
        self.fc1 = nn.Linear(out_2 * 4 * 4, number_of_classes)
        self.bn_fc1 = nn.BatchNorm1d(10)

    # Prediction
    def forward(self, x):
        x = self.cnn1(x)
        x=self.conv1_bn(x)
        x = torch.relu(x)
        x = self.maxpool1(x)
        x = self.cnn2(x)
        x=self.conv2_bn(x)
        x = torch.relu(x)
        x = self.maxpool2(x)
        x = x.view(x.size(0), -1)
        x = self.fc1(x)
        x=self.bn_fc1(x)
        return x
```

Constructor for regular Convolutional Neural Network

In [8]:
```
class CNN(nn.Module):

    # Contructor
    def __init__(self, out_1=16, out_2=32,number_of_classes=10):
        super(CNN, self).__init__()
        self.cnn1 = nn.Conv2d(in_channels=1, out_channels=out_1, kernel_size=5, padding=2)
        self.maxpool1=nn.MaxPool2d(kernel_size=2)

        self.cnn2 = nn.Conv2d(in_channels=out_1, out_channels=out_2, kernel_size=5, stride=1, padding=2)
        self.maxpool2=nn.MaxPool2d(kernel_size=2)
        self.fc1 = nn.Linear(out_2 * 4 * 4, number_of_classes)

    # Prediction
    def forward(self, x):
        x = self.cnn1(x)
        x = torch.relu(x)
        x = self.maxpool1(x)
        x = self.cnn2(x)
        x = torch.relu(x)
        x = self.maxpool2(x)
        x = x.view(x.size(0), -1)
        x = self.fc1(x)
        return x
```

train loader and validation loader

In [9]:
```
train_loader = torch.utils.data.DataLoader(dataset=dataset_train, batch_size=100 )
test_loader = torch.utils.data.DataLoader(dataset=dataset_val, batch_size=100 )
```

Convolutional Neural Network object

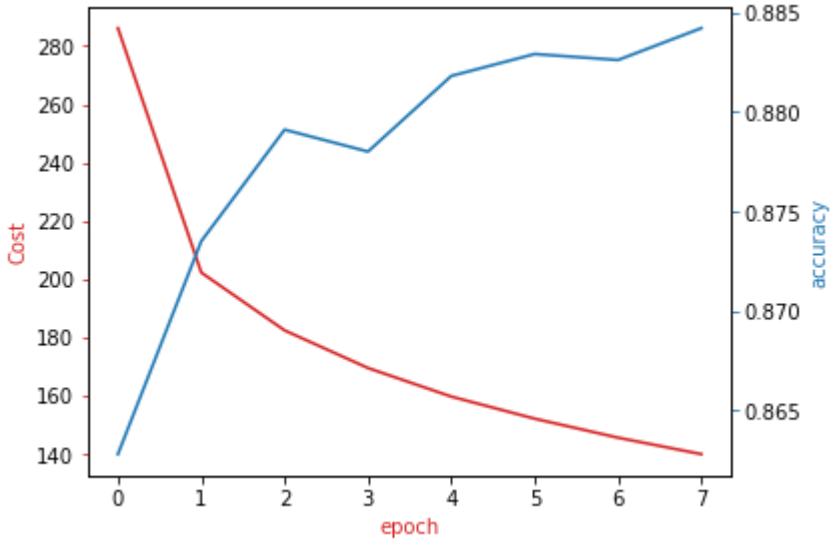
In [12]:
```
#model = CNN(out_1=16, out_2=32,number_of_classes=10)
model =CNN_batch(out_1=16, out_2=32,number_of_classes=10)
```

Code used to train the model

In [13]:
```
import time
start_time = time.time()

cost_list=[]
accuracy_list=[]
N_test=len(dataset_val)
learning_rate =0.1
optimizer = torch.optim.SGD(model.parameters(), lr = learning_rate, momentum=0.3)
criterion = nn.CrossEntropyLoss()
n_epochs=8
for epoch in range(n_epochs):
    cost=0
    model.train()
    for x, y in train_loader:
        optimizer.zero_grad()
        z = model(x)
        loss = criterion(z, y)
        loss.backward()
        optimizer.step()
        cost+=loss.item()
    correct=0
    #perform a prediction on the validation  data
    model.eval()
    for x_test, y_test in test_loader:
        z = model(x_test)
        _, yhat = torch.max(z.data, 1)
        correct += (yhat == y_test).sum().item()
    accuracy = correct / N_test
    accuracy_list.append(accuracy)
    cost_list.append(cost)
```

To plot the Cost and accuracy for each epoch for the training and testing data, respectively.

In [14]:
```
fig, ax1 = plt.subplots()
color = 'tab:red'
ax1.plot(cost_list, color=color)
ax1.set_xlabel('epoch', color=color)
ax1.set_ylabel('Cost', color=color)
ax1.tick_params(axis='y', color=color)

ax2 = ax1.twinx()
color = 'tab:blue'
ax2.set_ylabel('accuracy', color=color)
ax2.set_xlabel('epoch', color=color)
ax2.plot( accuracy_list, color=color)
ax2.tick_params(axis='y', color=color)
fig.tight_layout()
```



dataset: https://github.com/zalandoresearch/fashion-mnist (https://github.com/zalandoresearch/fashion-mnist)