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(http://cocl.us/pytorch_link_top)

Neural Networks More Hidden Neutrons

In [ ]:

```
#by Christopher Harrison
```

Objective

- How to create complex Neural Network in pytorch.

Table of Contents

Estimated Time Needed: **25 min**

Preparation

We'll need to import the following libraries for this lab.

In [1]:

```
import torch
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import torch.nn as nn
import torch.nn.functional as F
from torch.utils.data import Dataset, DataLoader
```

Define the plotting functions.

In [2]:

```
def get_hist(model,data_set):
    activations=model.activation(data_set.x)
    for i,activation in enumerate(activations):
        plt.hist(activation.numpy(),4,density=True)
        plt.title("Activation layer " + str(i+1))
        plt.xlabel("Activation")
        plt.xlabel("Activation")
        plt.legend()
        plt.show()
```

In [3]:

```
def PlotStuff(X,Y,model=None,leg=False):

    plt.plot(X[Y==0].numpy(),Y[Y==0].numpy(),'or',label='training points y=0 ' )
    plt.plot(X[Y==1].numpy(),Y[Y==1].numpy(),'ob',label='training points y=1 ' )

    if model!=None:
        plt.plot(X.numpy(),model(X).detach().numpy(),label='neral network ')

    plt.legend()
    plt.show()
```

Get Our Data

Define the class to get our dataset.

In [4]:

```
class Data(Dataset):
    def __init__(self):
        self.x=torch.linspace(-20, 20, 100).view(-1,1)

        self.y=torch.zeros(self.x.shape[0])
        self.y[(self.x[:,0]>-10)& (self.x[:,0]<-5)]=1
        self.y[(self.x[:,0]>5)& (self.x[:,0]<10)]=1
        self.y=self.y.view(-1,1)
        self.len=self.x.shape[0]
    def __getitem__(self,index):

        return self.x[index],self.y[index]
    def __len__(self):
        return self.len
```

Define the Neural Network, Optimizer and Train the Model

Define the class for creating our model.

In [5]:

```
class Net(nn.Module):
    def __init__(self,D_in,H,D_out):
        super(Net,self).__init__()
        self.linear1=nn.Linear(D_in,H)
        self.linear2=nn.Linear(H,D_out)


    def forward(self,x):
        x=torch.sigmoid(self.linear1(x))
        x=torch.sigmoid(self.linear2(x))
        return x
```

Create the function to train our model, which accumulate lost for each iteration to obtain the cost.

In [6]:

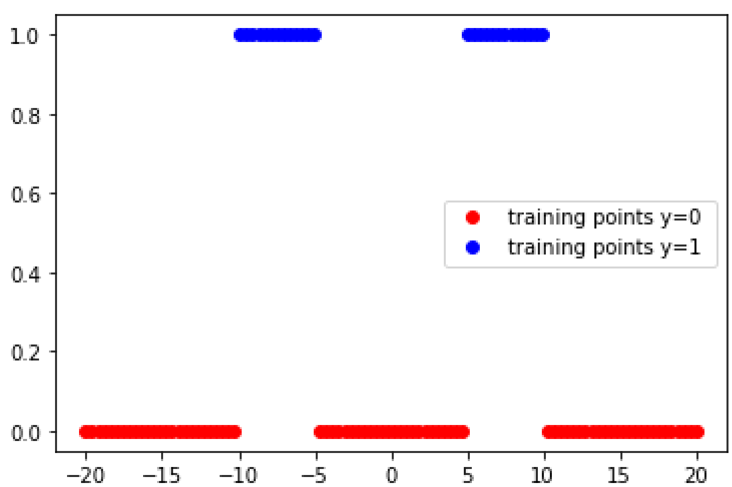
```
def train(data_set,model,criterion, train_loader, optimizer, epochs=5,plot_number=
10):
    cost=[]

    for epoch in range(epochs):
        total=0

        for x,y in train_loader:
            optimizer.zero_grad()

            yhat=model(x)
            loss=criterion(yhat,y)
            optimizer.zero_grad()
            loss.backward()
            optimizer.step()
            total+=loss.item()

        if epoch%plot_number==0:
            PlotStuff(data_set.x,data_set.y,model)

        cost.append(total)
    plt.figure()
    plt.plot(cost)
    plt.xlabel('epoch')
    plt.ylabel('cost')
    plt.show()
    return cost
```

In [7]:

```
data_set=Data()
```

In [8]:

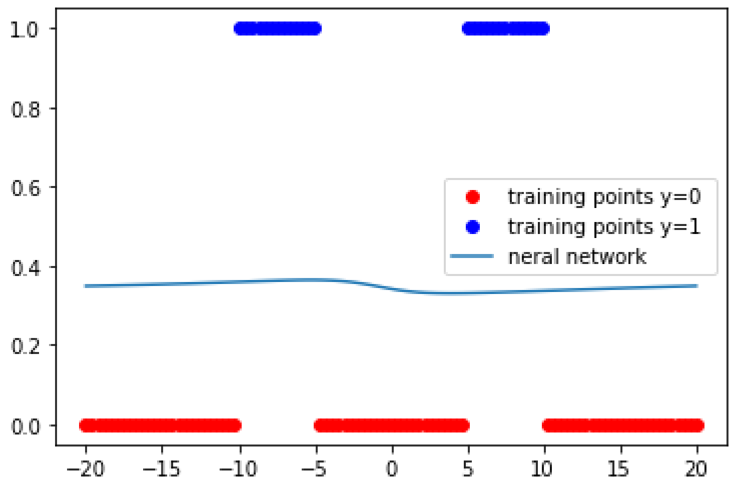
```
PlotStuff(data_set.x,data_set.y,leg=False)
```

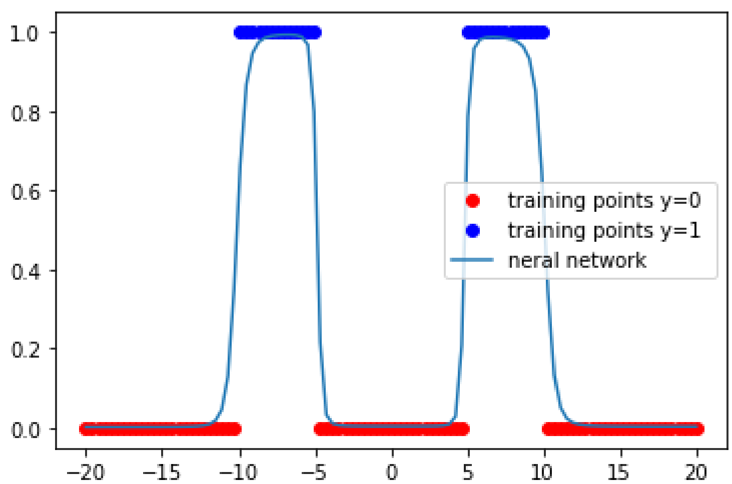


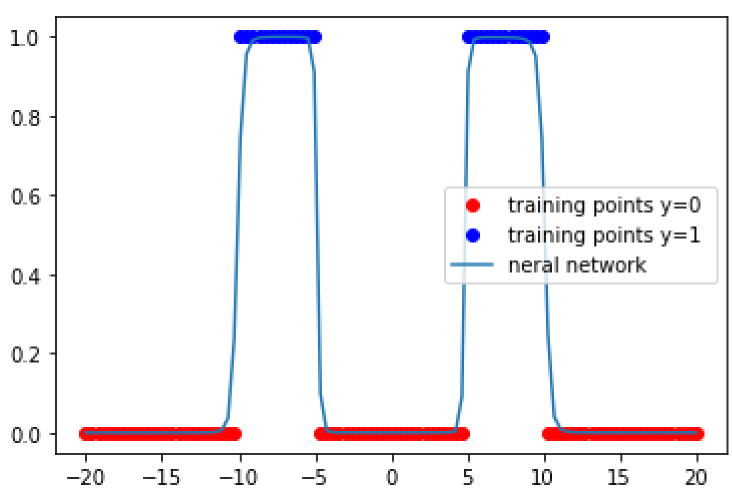
Create our model with 9 neurons in the hidden layer. And then create a BCE loss and an Adam optimizer.

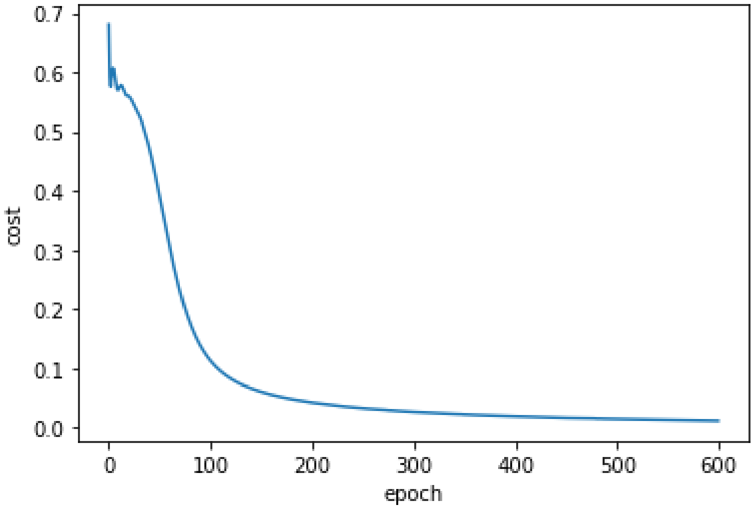
In [9]:

```
torch.manual_seed(0)
model=Net(1,9,1)
learning_rate=0.1
criterion=nn.BCELoss()
optimizer=torch.optim.Adam(model.parameters(), lr=learning_rate)
train_loader=DataLoader(dataset=data_set,batch_size=100)
COST=train(data_set,model,criterion, train_loader, optimizer, epochs=600,plot_numbe
r=200)
```


training points y=0
training points y=1
neral network


training points y=0
training points y=1
neral network


training points y=0
training points y=1
neral network



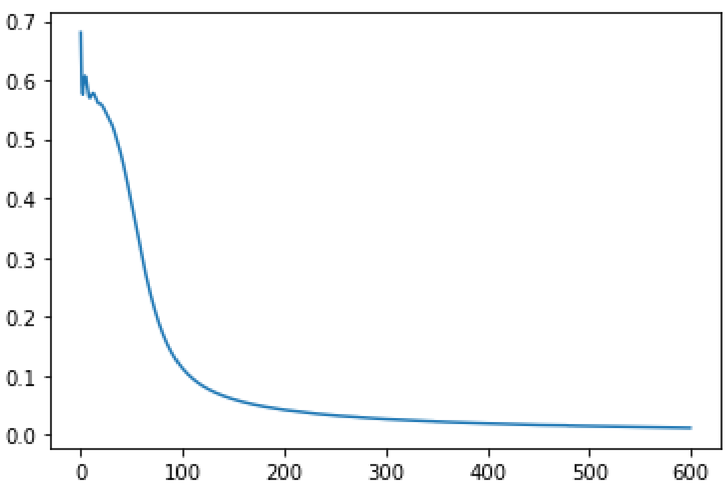
this is for exercises model= torch.nn.Sequential(torch.nn.Linear(1, 6), torch.nn.Sigmoid(), torch.nn.Linear(6,1), torch.nn.Sigmoid())

In [10]:

```
plt.plot(COST)
```

Out[10]:

```
[<matplotlib.lines.Line2D at 0x7f01104b4f28>]
```



About the Authors:

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Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2020-09-23	2.0	Shubham	Migrated Lab to Markdown and added to course repo in GitLab