Machine Learning Project03

October 8, 2019

1 Build a binary classifier based on 3 layers neural network using the human versus horse dataset

[116]:
```
import torch
from torch.utils.data import Dataset, DataLoader
import torchvision.transforms as transforms
from torch.autograd import Variable
import torchvision
import os
import sys

from scipy.special import xlogy

import matplotlib.pyplot as plt
import numpy as np
import time


transform = transforms.Compose([#transforms.Resize((256,256)),
                                transforms.Grayscale(),                 # the␣
 ↪code transforms.Graysclae() is for changing the size [3,100,100] to [1, 100,␣
 ↪100] (notice : [channel, height, width] )
                                transforms.ToTensor(),])


#train_data_path = 'relative path of training data set'
train_data_path = 'C:\\ ␣
 ↪  \\MachineLearningProject\\horse-or-human\\horse-or-human\\train'
trainset = torchvision.datasets.ImageFolder(root=train_data_path,␣
 ↪transform=transform)
# change the valuse of batch_size, num_workers for your program
# if shuffle=True, the data reshuffled at every epoch
trainloader = torch.utils.data.DataLoader(trainset, batch_size=1,␣
 ↪shuffle=False, num_workers=1)
```

```
validation_data_path = 'C:\\ ␣
 ↪  \\MachineLearningProject\\horse-or-human\\horse-or-human\\validation'
valset = torchvision.datasets.ImageFolder(root=validation_data_path,␣
 ↪transform=transform)
# change the valuse of batch_size, num_workers for your program
valloader = torch.utils.data.DataLoader(valset, batch_size=1, shuffle=False,␣
 ↪num_workers=1)
```

[118]:
```
train_labels=np.zeros(1027)
test_labels=np.zeros(256)

train_datas=np.zeros((1027,10000))
test_datas=np.zeros((256,10000))



for epoch in range(1):
    sum=0
    # load training images of the batch size for every iteration
    for i, data in enumerate(trainloader):

        inputs, labels = data
        train_labels[i]=int(labels)
        reinputs=inputs.reshape(10000)
        reinputs=np.array(reinputs)
        train_datas[i]=reinputs

    train_datas=train_datas.T

    for i, data in enumerate(valloader):
        sum+=1
        inputs, labels = data
        test_labels[i]=int(labels)
        reinputs=inputs.reshape(10000)
        reinputs=np.array(reinputs)
        test_datas[i]=reinputs

    test_datas=test_datas.T
```

[119]:
```
def accuracy_func(h_,label):
    label_result=np.zeros(len(h_))
    correct=0
    for i in range(len(label)):
```

```
        if(h_[i]<0.5):
            label_result[i]=0
        elif(h_[i]>=0.5):
            label_result[i]=1

        if(label_result[i]==label[i]):
            correct+=1
    total= correct/len(label)

    return total

np.set_printoptions(threshold=sys.maxsize)
```

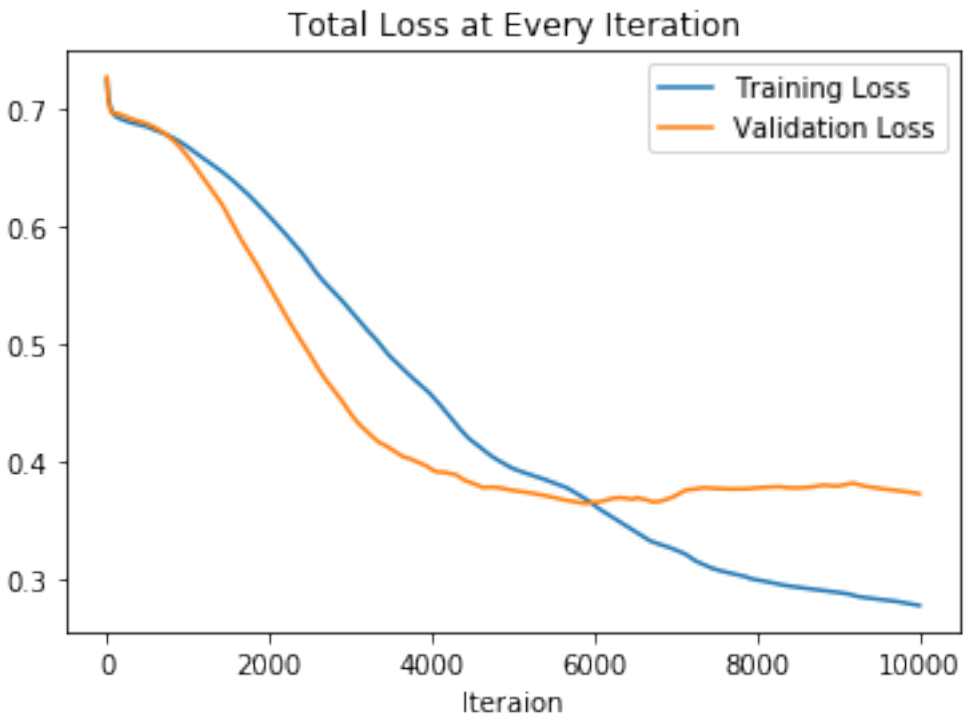
[251]:
```
NUM_EPOCH=10000

total_loss=np.zeros(NUM_EPOCH)
total_loss_test=np.zeros(NUM_EPOCH)

accuracy=np.zeros(NUM_EPOCH)
accuracy_test=np.zeros(NUM_EPOCH)

known_data1=np.random.randn(10000,10)
known_data2=np.random.randn(10,3)
known_data3=np.random.randn(3,1)

b_1=np.random.randn(10,1)
b_2=np.random.randn(3,1)
b_3=np.random.randn(1,1)
```

[252]:
```
l_rate=0.085

delta = 1e-70
for i in range(NUM_EPOCH):
    #Vectorizing Logistic Regression for train_set
    z1=known_data1.T@train_datas+b_1 #10x1027 =a
    A1=1.0/(1+np.exp(-z1))
    z2=known_data2.T@A1 +b_2 #3x1027=b
    A2=1.0/(1+np.exp(-z2))
    z3=known_data3.T@A2+b_3 #1x1027=c
    A3=1.0/(1+np.exp(-z3))


    #Vectorizing Logistic Regression for validation_set
    z1_v=known_data1.T@test_datas+b_1 #10x256=a
    A1_v=1.0/(1+np.exp(-z1_v))
    z2_v=known_data2.T@A1_v+b_2 #3x256=b
    A2_v=1.0/(1+np.exp(-z2_v))
```

```
    z3_v=known_data3.T@A2_v+b_3 #1x256=c
    A3_v=1.0/(1+np.exp(-z3_v))

    j=-(xlogy(train_labels,A3)+xlogy(1-train_labels,1-A3)).sum()/1027
    j_v=-(xlogy(test_labels,A3_v)+xlogy(1-test_labels,1-A3_v)).sum()/256

    L_3=A3-train_labels #1027
    dL_3=(A2@L_3.T)/1027
    known_data3-=l_rate*dL_3
    b3=np.sum(L_3,axis=1,keepdims=True)/1027

    L_3=L_3.reshape(1027,1)
    L_2=known_data3@L_3.T*((1-A2)*A2) #3x1027
    dL_2=(A1@L_2.T)/1027
    known_data2-=l_rate*dL_2
    b2=np.sum(L_2,axis=1,keepdims=True)/1027


    L_1=known_data2@L_2*((1-A1)*A1) #10x1027
    dL_1=(train_datas@L_1.T)/1027
    known_data1-=l_rate*dL_1
    b1=np.sum(L_1,axis=1,keepdims=True)/1027



    total_loss[i]=j
    A3=A3.reshape(1027)
    accuracy[i]=accuracy_func(A3,train_labels)

    A3_v=A3_v.reshape(256)
    total_loss_test[i]=j_v
    accuracy_test[i]=accuracy_func(A3_v,test_labels)
```

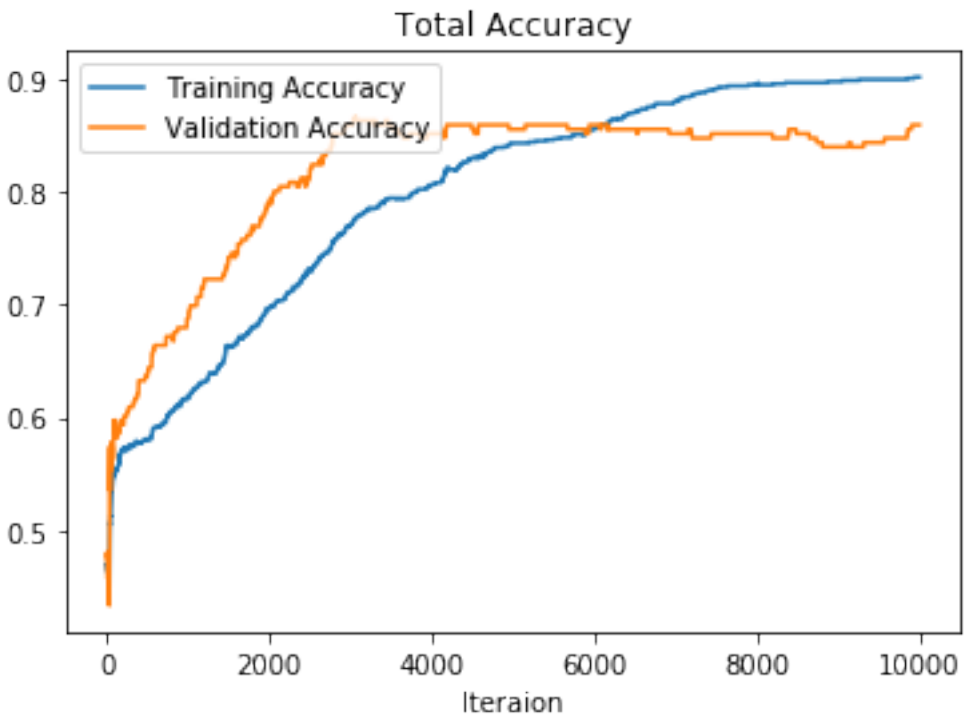
[253]:
```
plt.plot(total_loss,label='Training Loss')
plt.plot(total_loss_test,label='Validation Loss')
plt.legend(loc='upper right')
plt.title("Total Loss at Every Iteration")
plt.xlabel("Iteraion")
```

[253]:
```
Text(0.5, 0, 'Iteraion')
```



[254]:
```
plt.plot(accuracy,label='Training Accuracy')
plt.plot(accuracy_test,label='Validation Accuracy')
plt.legend(loc='upper left')
plt.title("Total Accuracy")
plt.xlabel("Iteraion")
```

[254]:
```
Text(0.5, 0, 'Iteraion')
```


Total Accuracy
Training Accuracy
Validation Accuracy
0.9
0.8
0.7
0.6
0.5
0
2000
4000
6000
8000
10000
Iteraion

[ ]: