Assignment-4
20170937 강제순

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In [1]:
```
'''

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        Assignment 4.

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    '''
    import matplotlib.pyplot as plt
    import math
    import numpy as np
    import random

    import torch
    from torch.utils.data import Dataset, DataLoader
    import torchvision.transforms as transforms

    import torchvision
    import os
```

In [2]:
```
#### Section 1. #### This Section is bringed Data_import_ex.py file.

    # Image Data import & resize

    transform = transforms.Compose([#transforms.Resize((256,256)),
                                    transforms.Grayscale(),                # the code tran
                                    transforms.ToTensor(),])

    #train_data_path = 'relative path of training data set'
    train_data_path = '../data/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=100, shuffle=True, num_
```

```
validation_data_path = '../data/horse-or-human/validation'
valset = torchvision.datasets.ImageFolder(root=validation_data_path, transform=transfo
# change the valuse of batch_size, num_workers for your program
valloader = torch.utils.data.DataLoader(valset, batch_size=100, shuffle=True, num_work

#### Section 1 END ####
```

In [3]:
```
# sigmoid Function.
def sigmoid(z) :
    return 1 / (1 + torch.pow(math.e,-z)+0.000001)

def tanh(z) :
    ret = (2 / (1 + torch.pow(math.e,-2*z) + 0.000001)) - 1
    return ret

def derv_tanh(z) :
    ret = (1 - (tanh(z)**2))
    return ret

def relu(z) :
    ret = z.clone().detach()
    #print(ret)
    tmp = torch.zeros_like(ret)
    ret = torch.where(ret<=0,tmp,ret)
    return ret

def derv_relu(z) :
    ret = z.clone().detach()
    tmp_1 = torch.zeros_like(ret)
    tmp_2 = torch.ones_like(ret)
    ret = torch.where(ret<0,tmp_1,tmp_2)
    #print(ret)
    return ret


def leakly_relu(z) :
    ret = z.clone().detach()
    tmp1 = torch.ones_like(ret)
    ret = torch.where(ret<0,ret*0.01,ret)
    return ret

def derv_leakly_relu(z) :
    ret = z.clone().detach()
    tmp1 = torch.ones_like(ret)
    ret = torch.where(ret<0, tmp1*0.01,tmp1)
```

```
        return ret

    def get_activation(z,type) :
        if (type == 0) :
            return sigmoid(z)
        elif (type == 1) :
            return tanh(z)
        elif (type == 2) :
            return relu(z)
        elif (type == 3) :
            return leakly_relu(z)

        else :
            print("Error, get_activation")
            return 0

    def get_derv_activation(z,type) :
        if (type == 0) :
            return sigmoid(z)*(1-sigmoid(z))
        elif (type == 1) :
            return derv_tanh(z)
        elif (type == 2) :
            return derv_relu(z)
        elif (type == 3) :
            return derv_leakly_relu(z)
        else :
            print("Error, get_derv_activation")
            return 0
```

In [22]:
```
def get_loss(y,a) :
    #print(y,a)
    ret = -(torch.div(y,a+0.000001) - torch.div(1-y,1-a+0.000001))

    return ret

BATCH_SIZE = 100
FEATURE_SIZE = 10000
class ML :
    def __init__(self,act1,act2,act3,L1_size,L2_size,L3_size,lr,min_loss_diff) :
        self.act_type_1 = act1
        self.act_type_2 = act2
        self.act_type_3 = act3
        self.l1_size = L1_size
        self.l2_size = L2_size
        self.l3_size = L3_size
        self.feature_size = 10000
        self.epoch = 0
        self.lr = lr
```

```
        self.min_loss_diff = min_loss_diff

        self.init_weights()

        print("ML Object initialized")
        self.iter = 0

        self.val_acc_log = []
        self.val_loss_log = []
        self.train_acc_log = []
        self.train_loss_log = []
        self.epoch_log = []
        self.val_acc_log.append(0)
        self.val_loss_log.append(0)
        self.train_acc_log.append(0)
        self.train_loss_log.append(0)
        self.epoch_log.append(0)

    def init_weights(self) :
        self.w_1 = torch.FloatTensor(self.l1_size,self.feature_size).uniform_(-1,1)
        self.b_1 = torch.FloatTensor(1,self.l1_size).uniform_(-1,1)

        #torch.FloatTensor(a, b).uniform_(r1, r2)

        self.w_2 = torch.FloatTensor(self.l2_size,self.l1_size).uniform_(-1,1)
        self.b_2 = torch.FloatTensor(1,self.l2_size).uniform_(-1,1)

        self.w_3 = torch.FloatTensor(self.l3_size,self.l2_size).uniform_(-1,1)
        self.b_3 = torch.FloatTensor(1,self.l3_size).uniform_(-1,1)




    def training(self) :

        epoch = 0
        for epoch in range(0,1000000):
            train_acc_log_tmp = []
            train_loss_log_tmp = []
            val_acc_log_tmp = []
            val_loss_log_tmp = []


        # load training images of the batch size for every iteration
            for i, data in enumerate(trainloader):

                # inputs is the images
                # labels is the class of the image
```

```
        inputs, labels = data
        inputs, labels = inputs.float() , labels.float()
        # if you don't change the image size, it will be [batch_size, 1, 100,

        # if labels is horse it returns tensor[0,0,0] else it returns tensor[

        self.t_data_batch = torch.squeeze(torch.FloatTensor(data[0]),3)

        self.t_data_batch = self.t_data_batch.view(len(data[0]),FEATURE_SIZE)
        self.z_1 = torch.matmul(self.t_data_batch,self.w_1.T) + self.b_1
        #print(self.z_1)
        self.a_1 = get_activation(self.z_1,self.act_type_1)
        #print(self.a_1)

        self.z_2 = torch.matmul(self.a_1,self.w_2.T) + self.b_2

        self.a_2 = get_activation(self.z_2,self.act_type_2) # 1027 x 50

        self.z_3 = torch.matmul(self.a_2,self.w_3.T) + self.b_3
        #print(self.z_3)
        self.a_3 = get_activation(self.z_3,self.act_type_3) # 1027 x 1

        #print(self.a_3)
        self.t_yh_batch = data[1].float().unsqueeze(1)

        #print(self.a_3,self.t_yh_batch)
        acc = self.get_acc(self.a_3,self.t_yh_batch)
        loss = np.array(get_loss(self.t_yh_batch, self.a_3)).mean()

        train_acc_log_tmp.append(acc)
        train_loss_log_tmp.append(loss)

        self.update_weights(self.t_yh_batch,self.a_3)



train_acc = np.array(train_acc_log_tmp).mean()
train_loss = np.array(train_loss_log_tmp).mean()

print("epoch : %s, loss : %s, tra_acc : %s"%(epoch,train_loss,train_acc))



# load validation images of the batch size for every iteration
for i, data in enumerate(valloader):

    # inputs is the image
    # labels is the class of the image
```

```
                inputs, labels = data
                inputs, labels = inputs.float() , labels.float()
                # if you don't change the image size, it will be [batch_size, 1, 100,


                # if labels is horse it returns tensor[0,0,0] else it returns tensor[

                self.v_data_batch = torch.squeeze(torch.FloatTensor(data[0]),3)

                self.v_data_batch = self.v_data_batch.view(len(data[0]),FEATURE_SIZE)

                self.z_1 = torch.matmul(self.v_data_batch,self.w_1.T) + self.b_1

                self.a_1 = get_activation(self.z_1,self.act_type_1)
                #print(self.a_1)

                self.z_2 = torch.matmul(self.a_1,self.w_2.T) + self.b_2
                self.a_2 = get_activation(self.z_2,self.act_type_2) # 1027 x 50

                self.z_3 = torch.matmul(self.a_2,self.w_3.T) + self.b_3
                self.a_3 = get_activation(self.z_3,self.act_type_3) # 1027 x 1

                self.v_yh_batch = data[1].float().unsqueeze(1)
                acc = self.get_acc(self.a_3,self.v_yh_batch)


                loss = np.array(get_loss(self.v_yh_batch, self.a_3)).mean()
                val_acc_log_tmp.append(acc)
                val_loss_log_tmp.append(loss)
            val_acc = np.array(val_acc_log_tmp).mean()
            val_loss = np.array(val_loss_log_tmp).mean()

            print("epoch : %s, loss : %s, val_acc : %s"%(epoch,val_loss,val_acc))

            self.train_acc_log.append(train_acc)
            self.train_loss_log.append(train_loss)
            self.val_acc_log.append(val_acc)
            self.val_loss_log.append(val_loss)
            self.epoch_log.append(epoch)
            epoch += 1

            tmp_idx = len(self.train_loss_log)-1
            if ( abs(self.train_loss_log[tmp_idx]-self.train_loss_log[tmp_idx-1]) < s
                print("Learning is terminated.")
                break


    def update_weights(self,t_y,a_3) :
```

```
        error_wb3 = -(torch.div(t_y,a_3+ 0.00011) - torch.div(1.0-t_y,1.0-a_3+ 0.0000
        d_z_3 = error_wb3*get_derv_activation(self.z_3,self.act_type_3) #
        d_w_3 = torch.matmul(d_z_3.T,self.a_2)
        d_b_3 = torch.sum(d_z_3, dim=0, keepdim=True) / self.a_2.shape[0] # mean

        #########

        error_wb2 = torch.matmul(d_z_3,self.w_3)

        d_z_2 = error_wb2*get_derv_activation(self.z_2,self.act_type_2)

        d_w_2 = torch.matmul(d_z_2.T,self.a_1)
        d_b_2 = torch.sum(d_z_2, dim=0,keepdims=True) / self.a_1.shape[0]


        error_wb1 = torch.matmul(d_z_2,self.w_2)
        d_z_1 = error_wb1*get_derv_activation(self.z_1,self.act_type_1)
        d_w_1 = torch.matmul(d_z_1.T,self.t_data_batch)
        d_b_1 = torch.sum(d_z_1, dim=0,keepdims=True) / self.t_data_batch.shape[0]


        self.w_3 += -self.lr*d_w_3
        self.b_3 += -self.lr*d_b_3

        self.w_2 += -self.lr*d_w_2
        self.b_2 += -self.lr*d_b_2
        self.w_1 += -self.lr*d_w_1
        self.b_1 += -self.lr*d_b_1
        #print(b_3,b_2,b_1)

    def get_acc(self,yhat,y) :
        count = 0

        for a,b in zip(yhat,y) :
            if a >= 0.5 :
                if b == 1 :
                    count+=1
            else :
                if b == 0:
                    count +=1

        return count / len(yhat)

    def show_loss(self) :
        #print(self.train_loss_log)
        #print(self.val_loss_log)
        #print(self.epoch_log)
```

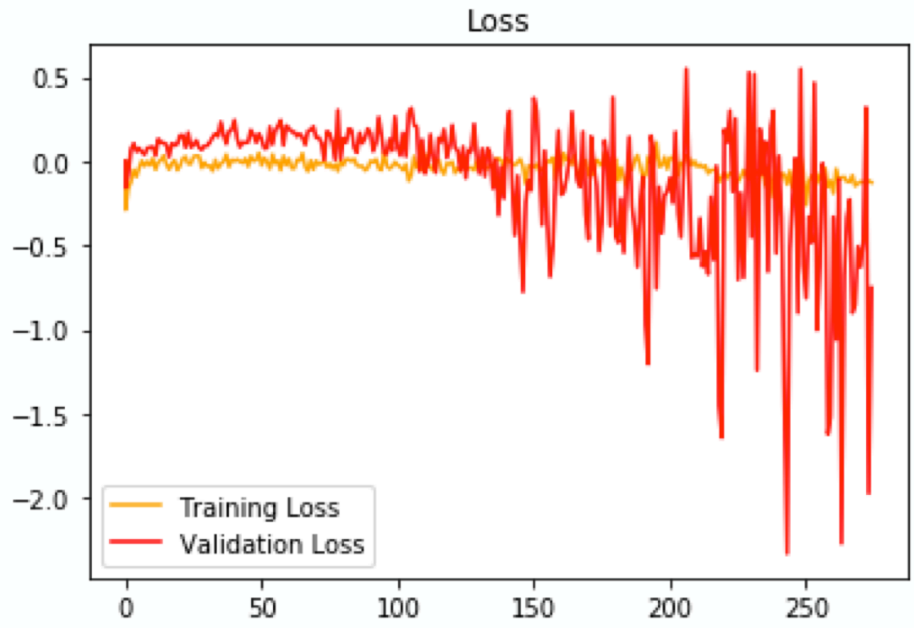
```
            tmp_1 = torch.tensor(self.train_loss_log)
            tmp_2 = torch.tensor(self.epoch_log)

            t1 = plt.plot(self.epoch_log,self.train_loss_log, color='orange',label='Traini
            t2 = plt.plot(self.epoch_log,self.val_loss_log, color= 'red',label='Validatio
            plt.title("Loss")
            plt.legend(['Training Loss','Validation Loss'])
            plt.show()
        def show_acc(self) :
            t1 = plt.plot(self.epoch_log,self.train_acc_log, color='orange',label='Traini
            t2 = plt.plot(self.epoch_log,self.val_acc_log, color= 'red',label='Validation
            plt.title("Accuracy")
            plt.legend(['Training Acc','Validation Acc'])
            plt.show()
```

In [33]:
```
activation_type = 0 # 0 = sigmoid
learningRate = 0.001
min_loss_diff = 0.00001
machine = ML(0,0,0,10,5,1,learningRate,min_loss_diff)
```

```
ML Object initialized
```

In [35]:
```
machine.show_loss()
```



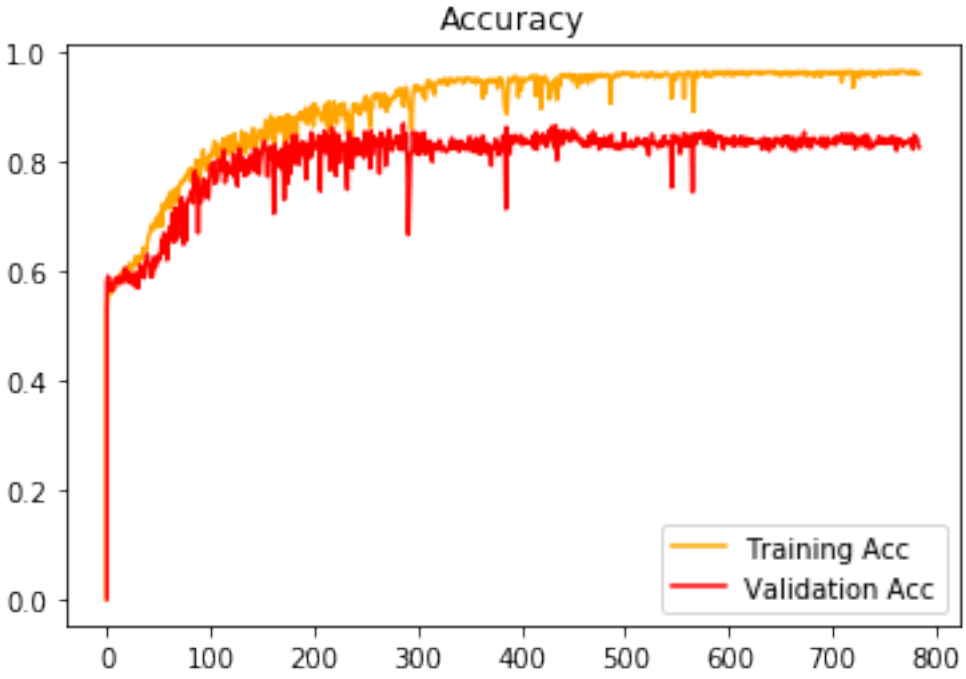
	Accuracy	Loss
Train_set	0.9445454545454546	-0.12590533
Validation_set	0.8138095238095238	-0.75043446

```
In [39]: #1,1,0 means tanh, tanh, sigmoid
         machine = ML(1,1,0,10,5,1,learningRate,min_loss_diff)

ML Object initialized
```

In [41]: machine.show_loss()

In [42]: machine.show_acc()



	Accuracy	Loss
Train_set	0.9614478114478114	0.018247241
Validation_set	0.8266666666666667	0.16419935