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Practical no 6

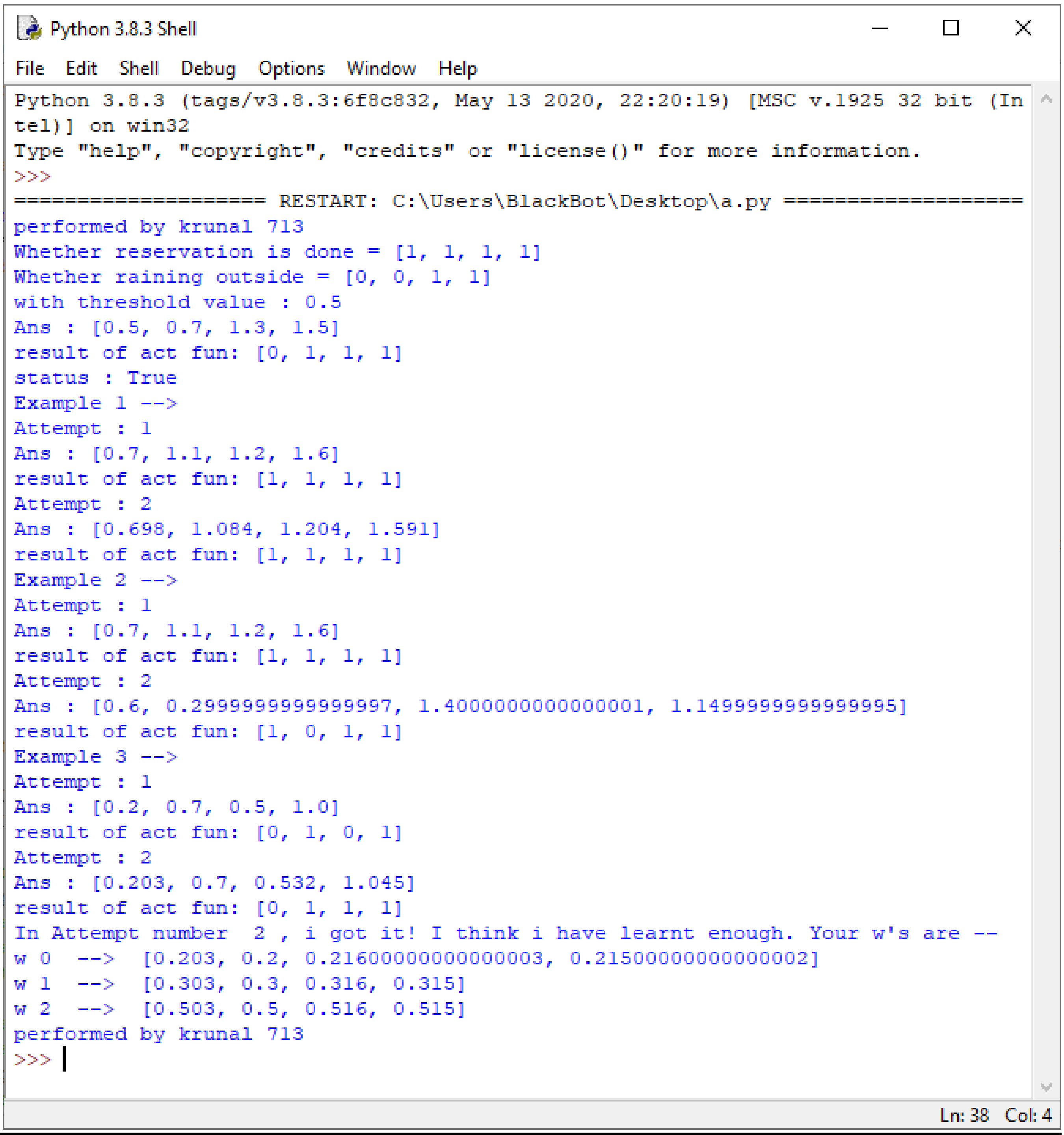
AIM: Implement feed forward back propagation neural network learning algorithm for the restaurant waiting problem.

CODE:

```
class Perceptron : # With 2 inputs and 1 output
    def __init__(self, a,b, c, tval):
        self.x = a # input vector
        self.result = b # activation result
        self.cresult = c # summation result
        self.threshold = tval # threshold value used by activation function
        self.w = []
    def h(self, tw): # calculating summation(hypothesis function)
        hresult= []
        for i in range(0 , len(self.result)):
            hresult.append(0)
            #print("index - ", i, ";", hresult)
            for j in range(0,len(tw)):
                #print("i=",i, ",j=",j)
                hresult[i] = hresult[i] + ( tw[j][i]*self.x[j][i] )
        return hresult
    def checkthreshold(self, hresult):  # applying activation function on summation result using
threshold value
        #flag = True
        actfun =[]
        for i in range(0 , len(self.result)) :
            if (hresult[i] <= self.threshold ):
                actfun.append(0)
            else :
                actfun.append( 1)
        print("Ans :", hresult)
        print("result of act fun:", actfun)

        for i in range(0 , len(self.x)) :
            if (actfun[i] != self.result[i]) :
                return False
        return True

    def training(self, tw, alpha): #passing w vector and alpha value
        i=1
        while i<=2 : # Max 100 attempts
                print("Attempt :", i)
                hresult = self.h(tw)
                if(self.checkthreshold(hresult)) :  #if training result matches the test result
                    self.w = tw
                    print("In Attempt number ", i,  ", i got it! I think i have learnt enough. Your w's are --" )
                    for x in range(0,len(self.w)):
                        print("w", x, " --> ", self.w[x])
                    break

                i = i +1
                # Changing values of w to reduce error/loss using batch gradient descent learning rule
given on page 721 eqn 18.6
```

```
                for j in range(0,len(self.result)) :
                    for k in range(0, len(tw)):
                        sum = 0
                        for n in range(0, len(tw)):
                            sum = sum + (self.cresult[j] - hresult[j]) *self.x[n][j]
                        tw[k][j] = tw[k][j] + alpha*sum


        if(i>=100):
            print("I am exhausted, tried 100 iterations! plz change something else...")
a = [ [1,1,1,1], [0,0,1,1] , [0,1,0,1] ] # x vector, x0 is dummy
b = [0,1,1,1] # result of activation function
c = [0.5, 0.7, 1.3, 1.5] # sample h values
print("performed by krunal 713")
p = Perceptron(a,b,c, 0.5) # threshold = 0.5
print("Whether reservation is done =", p.x[0])
print("Whether raining outside =", p.x[1])
print("with threshold value :", p.threshold)
r =  p.h([ [0.5,0.5,0.5,0.5], [0.8, 0.8, 0.8, 0.8], [0.2, 0.2, 0.2, 0.2]])
print("status :", p.checkthreshold(r))
print("Example 1 -->") #with alpha as 0.01, you will not get result
p.training( [ [0.7,0.7,0.7,0.7], [0.5, 0.5, 0.5, 0.5], [0.4, 0.4, 0.4, 0.4]], 0.01)
print("Example 2 -->")  #with alpha as 0.5, you will not get result
p.training( [ [0.7,0.7,0.7,0.7], [0.5, 0.5, 0.5, 0.5], [0.4, 0.4, 0.4, 0.4]], 0.5)
print("Example 3 -->")
p.training( [ [0.2,0.2,0.2,0.2], [0.3, 0.3, 0.3, 0.3], [0.5, 0.5, 0.5, 0.5]], 0.01)
print("performed by krunal 713")
```

OUTPUT :



```
Python 3.8.3 (tags/v3.8.3:6f8c832, May 13 2020, 22:20:19) [MSC v.1925 32 bit (In
tel)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
==================== RESTART: C:\Users\BlackBot\Desktop\a.py ===================
performed by krunal 713
Whether reservation is done = [1, 1, 1, 1]
Whether raining outside = [0, 0, 1, 1]
with threshold value : 0.5
Ans : [0.5, 0.7, 1.3, 1.5]
result of act fun: [0, 1, 1, 1]
status : True
Example 1 -->
Attempt : 1
Ans : [0.7, 1.1, 1.2, 1.6]
result of act fun: [1, 1, 1, 1]
Attempt : 2
Ans : [0.698, 1.084, 1.204, 1.591]
result of act fun: [1, 1, 1, 1]
Example 2 -->
Attempt : 1
Ans : [0.7, 1.1, 1.2, 1.6]
result of act fun: [1, 1, 1, 1]
Attempt : 2
Ans : [0.6, 0.2999999999999997, 1.4000000000000001, 1.1499999999999995]
result of act fun: [1, 0, 1, 1]
Example 3 -->
Attempt : 1
Ans : [0.2, 0.7, 0.5, 1.0]
result of act fun: [0, 1, 0, 1]
Attempt : 2
Ans : [0.203, 0.7, 0.532, 1.045]
result of act fun: [0, 1, 1, 1]
In Attempt number  2 , i got it! I think i have learnt enough. Your w's are --
w 0  -->  [0.203, 0.2, 0.21600000000000003, 0.21500000000000002]
w 1  -->  [0.303, 0.3, 0.316, 0.315]
w 2  -->  [0.503, 0.5, 0.516, 0.515]
performed by krunal 713
>>> 
```