TRIBHUVAN UNIVERSITY

Sagarmatha College of Science & Technology

Lab-Report On: Neural Network

Lab-Report No.: 02

Date: 2077-08-02

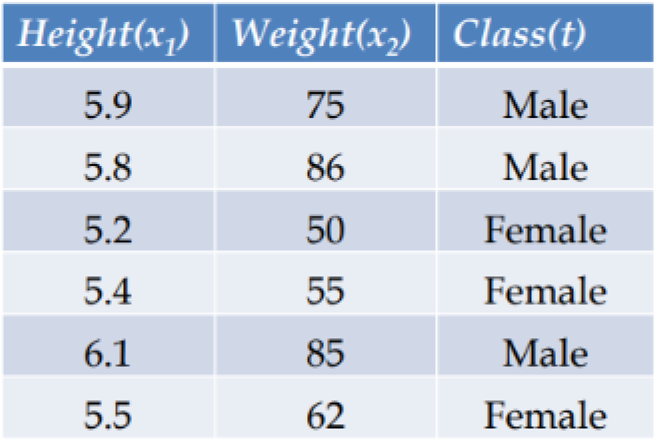
SUBMITTED BY	**SUBMITTED TO**
Name: Ramesh Neupane	*CSIT Department*
Roll no.: 37	

OBJECTIVE

To implement Perceptron Learning Algorithm

LAB QUESTIONS

i) Train AND Gate Using Perceptron Learning Algorithm
ii) Train perceptron using given training set and predict class for the input (6,82) and (5.3,52)



Height(x_1)	*Weight(x_2)*	*Class(t)*
5.9	75	Male
5.8	86	Male
5.2	50	Female
5.4	55	Female
6.1	85	Male
5.5	62	Female

SOURCE CODE AND OUTPUT

i)

```
import numpy as np

b = 0.0
alpha = 1

def train_perceptron(w, x, t):
    global b
    for i in range(len(x)):
        v = sum(w * x[i]) + b
        y = hard_limiter(v)
        dw = alpha * (t[i] - y) * x[i]
        w = np.add(w, dw)
        db = alpha * (t[i] - y)
        b += db
    return w
```

```
def predict_perceptron(w, x):
    z = w * x
    v = sum(z) + b
    y = hard_limiter(v)
    return y

def hard_limiter(v):
    if v > 0:
        return 1
    elif v < 0:
        return -1
    else:
        return 0

trainx = np.array([[-1,-1], [-1, 1], [1, -1], [1, 1]])
trainy = np.array([-1, -1, -1, 1])
testx = np.array([1, 1])
wt = np.array([0.0, 0.0])
print("Training")
print("+++++++++")
for i in range(1, 5):
    print(f"Epoch #{i}")
    wt = train_perceptron(wt, trainx, trainy)
    print(f"Weights after epoch {i}: {wt}")
    print(f"Bias: {b}")

print("*****Testing*****")
y = predict_perceptron(wt, testx)
print(f"Test data: {testx}")
print(f"Output: {y}")
```

Output:

```
Training
+++++++++
Epoch #1
Weights after epoch 1: [1. 1.]
Bias: -1.0
Epoch #2
Weights after epoch 2: [1. 1.]
Bias: -1.0
Epoch #3
Weights after epoch 3: [1. 1.]
Bias: -1.0
Epoch #4
Weights after epoch 4: [1. 1.]
```

```
Bias: -1.0
*****Testing*****
Test data: [1 1]
Output: 1
```

ii)

```
import numpy as np
from sklearn.preprocessing import MinMaxScaler

bias = 0.0
alpha = 1
# Neuron for the calculation
def train_perceptron(tx, wt, t):
    global bias
    for i in range(len(tx)):
        n = sum(wt * tx[i]) + bias
        y = hard_limiter(n)
        wt = np.add(wt, alpha * (t[i] - y) * tx[i])
        bias += alpha * (t[i] - y)
    return wt

# Output for the test data
def predict_class(x, w):
    n = sum(w * x) + bias
    y = hard_limiter(n)
    return y

# Hard limiter activatin function
def hard_limiter(n):
    if n > 0:
        return 1
    elif n < 0:
        return -1
    else:
        return 0
# Raw input heights and weights into trainx
trainx = [[5.9, 75], [5.8, 86], [5.2, 50], [5.4, 55], [6.1, 85], [5.5, 62]]
# Output class 1 for MALE and -1 for FEMALE
trainy = [1, 1, -1, -1, 1, -1]
# Changing trainx and trainy into np.array
trainx = np.array(trainx)
trainy = np.array(trainy)
```

```
weights = np.array([0.0, 0.0])
# normalizing input data
minmax = MinMaxScaler()
trainx = minmax.fit_transform(trainx)
print("******Training******")
for i in range(5):
    print(f"Epoch #{i}")
    weights = train_perceptron(trainx, weights, trainy)
    print(f"Weights after epoch {i}: {weights}")
    print(f"Bias: {bias}")
print("\n******Testing******")
print("Enter test data:")
testx = []
for i in range(len(weights)):
    e = float(input())
    testx.append(e)
testx = np.array([testx])
testx = minmax.transform(testx)
testx = testx.flatten()
output = predict_class(testx, weights)
if output == 1:
    print("Predicted class: MALE")
else:
    print("Predicted class: FEMALE")
```

Output:

```
******Training******
Epoch #0
Weights after epoch 0: [0.77777778 0.69444444]
Bias: -1.0
Epoch #1
Weights after epoch 1: [0.77777778 0.69444444]
Bias: -1.0
Epoch #2
Weights after epoch 2: [0.77777778 0.69444444]
Bias: -1.0
Epoch #3
Weights after epoch 3: [0.77777778 0.69444444]
Bias: -1.0
Epoch #4
Weights after epoch 4: [0.77777778 0.69444444]
Bias: -1.0
```

```
******Testing******
i)      Enter test data:
        6
        82
        Predicted class: MALE
ii)     Enter test data:

        5.3

        52

        Predicted class: FEMALE
```

CONCLUSION

Hence, we are able to implement Perceptron Learning Algorithm to predict the class for the test data.