

Perceptron Simulation

In [1]:

```
import pprint as pp
import json
```

In [2]:

```
def actual_output_fn(input, current_weight, threshold):
    weighted_sum = 0
    for i in range(len(input)):
        weighted_sum += input[i] * current_weight[i]
    if weighted_sum < threshold: return 0
    else: return 1

def new_weight_fn(current_weight, learning_coefficient, target_output, actual_output,
input):
    size = len(current_weight)
    new_weight = [0]*size
    for i in range(size):
        new_weight[i] = current_weight[i] + learning_coefficient * (target_output - ac
tual_output) * input[i]
    return new_weight

def weight_change_fn(current_weight, updated_weight):
    size = len(current_weight)
    weight_change = [0]*size
    for i in range(size):
        weight_change[i] = updated_weight[i] - current_weight[i]
    return weight_change

def perceptron_simulation(data):
    current_weight = data["original_weight"]
    size = len(data["input"])
    actual_output = [0]*size
    flag = 1
    epoque = 0
    while(flag == 1):
```

```

    epoque += 1

    print("\nEpoque", epoque,": ")

    for i in range(size):

        actual_output[i] = actual_output_fn(data["input"][i], current_weight, data
["threshold"])

        updated_weight = new_weight_fn(current_weight, data["learning_coefficient"
], data["target_output"][i], actual_output[i], data["input"][i])

    print("""
        target_output: %s
        actual_output: %s
        current_weight: %s
        weight_change: %s
        current_weight: %s
    """) %(
        data["target_output"][i],
        actual_output[i],
        current_weight,
        weight_change_fn(current_weight, updated_weight),
        updated_weight
    )

    current_weight = updated_weight

flag = 0
for i in range(size):
    if data["target_output"][i]^actual_output[i] == 1:
        flag = 1
        break

```

In [3]:

```

#Training data and Initial parameters
with open("data_or.json") as file: data_or = json.load(file)
with open("data_nor.json") as file: data_nor = json.load(file)
with open("data_3.json") as file: data_3 = json.load(file)
pp.pprint(data_or); pp.pprint(data_nor); pp.pprint(data_3)

```

```

{'input': [[0, 0], [0, 1], [1, 0], [1, 1]],
'learning_coefficient': 0.7,
'original_weight': [0.9, 0.8],
'target_output': [0, 1, 1, 1],
'threshold': 3.1}

```

```
{'input': [[0, 0], [0, 1], [1, 0], [1, 1]],
'learning_coefficient': 0.7,
'original_weight': [0.9, 0.8],
'target_output': [1, 0, 0, 0],
'threshold': -1.5}
{'input': [[0, 0, 0],
[0, 0, 1],
[0, 1, 0],
[1, 1, 1],
[1, 0, 0],
[1, 0, 1],
[1, 1, 0],
[1, 1, 1]],
'learning_coefficient': 0.7,
'original_weight': [0.5, 0.2, 0.6],
'target_output': [0, 0, 1, 1, 0, 0, 1, 1],
'threshold': 2.5}
```

In [4]:

```
perceptron_simulation(data_or)
```

Epoque 1 :

```
target_output: 0
actual_output: 0
current_weight: [0.9, 0.8]
weight_change: [0.0, 0.0]
current_weight: [0.9, 0.8]
```

```
target_output: 1
actual_output: 0
current_weight: [0.9, 0.8]
weight_change: [0.0, 0.7]
current_weight: [0.9, 1.5]
```

```
target_output: 1
actual_output: 0
current_weight: [0.9, 1.5]
weight_change: [0.7000000000000001, 0.0]
current_weight: [1.6, 1.5]
```

```
target_output: 1
actual_output: 1
current_weight: [1.6, 1.5]
weight_change: [0.0, 0.0]
current_weight: [1.6, 1.5]
```

Epoque 2 :

```
target_output: 0
actual_output: 0
current_weight: [1.6, 1.5]
weight_change: [0.0, 0.0]
current_weight: [1.6, 1.5]
```

```
target_output: 1
```

```
actual_output: 0
current_weight: [1.6, 1.5]
weight_change: [0.0, 0.7000000000000002]
current_weight: [1.6, 2.2]
```

```
target_output: 1
actual_output: 0
current_weight: [1.6, 2.2]
weight_change: [0.6999999999999997, 0.0]
current_weight: [2.3, 2.2]
```

```
target_output: 1
actual_output: 1
current_weight: [2.3, 2.2]
weight_change: [0.0, 0.0]
current_weight: [2.3, 2.2]
```

Epoque 3 :

```
target_output: 0
actual_output: 0
current_weight: [2.3, 2.2]
weight_change: [0.0, 0.0]
current_weight: [2.3, 2.2]
```

```
target_output: 1
actual_output: 0
current_weight: [2.3, 2.2]
weight_change: [0.0, 0.7000000000000002]
current_weight: [2.3, 2.9000000000000004]
```

```
target_output: 1
actual_output: 0
current_weight: [2.3, 2.9000000000000004]
weight_change: [0.7000000000000002, 0.0]
current_weight: [3.0, 2.9000000000000004]
```

```
target_output: 1
actual_output: 1
current_weight: [3.0, 2.9000000000000004]
weight_change: [0.0, 0.0]
current_weight: [3.0, 2.9000000000000004]
```

Epoque 4 :

```
target_output: 0
actual_output: 0
current_weight: [3.0, 2.9000000000000004]
weight_change: [0.0, 0.0]
current_weight: [3.0, 2.9000000000000004]
```

```
target_output: 1
actual_output: 0
current_weight: [3.0, 2.9000000000000004]
weight_change: [0.0, 0.7000000000000002]
```

```
current_weight: [3.0, 3.6000000000000005]
```

```
target_output: 1  
actual_output: 0  
current_weight: [3.0, 3.6000000000000005]  
weight_change: [0.7000000000000002, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

```
target_output: 1  
actual_output: 1  
current_weight: [3.7, 3.6000000000000005]  
weight_change: [0.0, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

Epoque 5 :

```
target_output: 0  
actual_output: 0  
current_weight: [3.7, 3.6000000000000005]  
weight_change: [0.0, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

```
target_output: 1  
actual_output: 1  
current_weight: [3.7, 3.6000000000000005]  
weight_change: [0.0, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

```
target_output: 1  
actual_output: 1  
current_weight: [3.7, 3.6000000000000005]  
weight_change: [0.0, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

```
target_output: 1  
actual_output: 1  
current_weight: [3.7, 3.6000000000000005]  
weight_change: [0.0, 0.0]  
current_weight: [3.7, 3.6000000000000005]
```

In [5]:

```
perceptron_simulation(data_nor)
```

Epoque 1 :

```
target_output: 1  
actual_output: 1  
current_weight: [0.9, 0.8]  
weight_change: [0.0, 0.0]  
current_weight: [0.9, 0.8]
```

```
target_output: 0  
actual_output: 1
```

```
current_weight: [0.9, 0.8]
weight_change: [0.0, -0.7]
current_weight: [0.9, 0.10000000000000009]

target_output: 0
actual_output: 1
current_weight: [0.9, 0.10000000000000009]
weight_change: [-0.7, 0.0]
current_weight: [0.20000000000000007, 0.10000000000000009]

target_output: 0
actual_output: 1
current_weight: [0.20000000000000007, 0.10000000000000009]
weight_change: [-0.7, -0.7]
current_weight: [-0.4999999999999999, -0.5999999999999999]
```

Epoque 2 :

```
target_output: 1
actual_output: 1
current_weight: [-0.4999999999999999, -0.5999999999999999]
weight_change: [0.0, 0.0]
current_weight: [-0.4999999999999999, -0.5999999999999999]

target_output: 0
actual_output: 1
current_weight: [-0.4999999999999999, -0.5999999999999999]
weight_change: [0.0, -0.7]
current_weight: [-0.4999999999999999, -1.2999999999999998]

target_output: 0
actual_output: 1
current_weight: [-0.4999999999999999, -1.2999999999999998]
weight_change: [-0.6999999999999998, 0.0]
current_weight: [-1.1999999999999997, -1.2999999999999998]

target_output: 0
actual_output: 0
current_weight: [-1.1999999999999997, -1.2999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.1999999999999997, -1.2999999999999998]
```

Epoque 3 :

```
target_output: 1
actual_output: 1
current_weight: [-1.1999999999999997, -1.2999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.1999999999999997, -1.2999999999999998]

target_output: 0
actual_output: 1
current_weight: [-1.1999999999999997, -1.2999999999999998]
weight_change: [0.0, -0.7]
current_weight: [-1.1999999999999997, -1.9999999999999998]
```

```
target_output: 0
actual_output: 1
current_weight: [-1.1999999999999997, -1.9999999999999998]
weight_change: [-0.7, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

```
target_output: 0
actual_output: 0
current_weight: [-1.8999999999999997, -1.9999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

Epoque 4 :

```
target_output: 1
actual_output: 1
current_weight: [-1.8999999999999997, -1.9999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

```
target_output: 0
actual_output: 0
current_weight: [-1.8999999999999997, -1.9999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

```
target_output: 0
actual_output: 0
current_weight: [-1.8999999999999997, -1.9999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

```
target_output: 0
actual_output: 0
current_weight: [-1.8999999999999997, -1.9999999999999998]
weight_change: [0.0, 0.0]
current_weight: [-1.8999999999999997, -1.9999999999999998]
```

In [6]:

```
perceptron_simulation(data_3)
```

Epoque 1 :

```
target_output: 0
actual_output: 0
current_weight: [0.5, 0.2, 0.6]
weight_change: [0.0, 0.0, 0.0]
current_weight: [0.5, 0.2, 0.6]
```

```
target_output: 0
actual_output: 0
current_weight: [0.5, 0.2, 0.6]
```

```
weight_change: [0.0, 0.0, 0.0]
current_weight: [0.5, 0.2, 0.6]

target_output: 1
actual_output: 0
current_weight: [0.5, 0.2, 0.6]
weight_change: [0.0, 0.7, 0.0]
current_weight: [0.5, 0.8999999999999999, 0.6]

target_output: 1
actual_output: 0
current_weight: [0.5, 0.8999999999999999, 0.6]
weight_change: [0.7, 0.7, 0.6999999999999998]
current_weight: [1.2, 1.5999999999999999, 1.2999999999999998]

target_output: 0
actual_output: 0
current_weight: [1.2, 1.5999999999999999, 1.2999999999999998]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 1.5999999999999999, 1.2999999999999998]

target_output: 0
actual_output: 1
current_weight: [1.2, 1.5999999999999999, 1.2999999999999998]
weight_change: [-0.7, 0.0, -0.7]
current_weight: [0.5, 1.5999999999999999, 0.5999999999999999]

target_output: 1
actual_output: 0
current_weight: [0.5, 1.5999999999999999, 0.5999999999999999]
weight_change: [0.7, 0.7, 0.0]
current_weight: [1.2, 2.3, 0.5999999999999999]

target_output: 1
actual_output: 1
current_weight: [1.2, 2.3, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 2.3, 0.5999999999999999]
```

Epoque 2 :

```
target_output: 0
actual_output: 0
current_weight: [1.2, 2.3, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 2.3, 0.5999999999999999]

target_output: 0
actual_output: 0
current_weight: [1.2, 2.3, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 2.3, 0.5999999999999999]

target_output: 1
```



```
actual_output: 0
current_weight: [1.2, 2.3, 0.5999999999999999]
weight_change: [0.0, 0.7000000000000002, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

Epoque 3 :

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 0
actual_output: 0
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

```
target_output: 1
actual_output: 1
current_weight: [1.2, 3.0, 0.5999999999999999]
weight_change: [0.0, 0.0, 0.0]
current_weight: [1.2, 3.0, 0.5999999999999999]
```

END.¶