McCulloch Pitts Neuron Model

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2012030

CSE

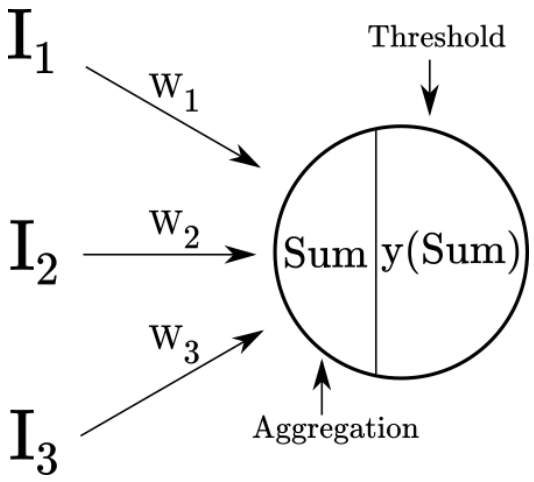
Introduction:

McCulloch and Pitts developed a mathematical formulation know as linear threshold gate, which describes the activity of a single neuron with two states, firing or not-firing. In its simplest form, the mathematical formulation is as follows:

$$Sum = \sum_{i=1}^{N} I_i W_i$$

$$y(Sum) = \begin{cases} 1, & if\ Sum \geq T \\ 0, & Otherwise \end{cases}$$

Where $I_1, I_2, I_3 \ldots I_N$ are binary input values $\epsilon(0,1)$; $W_1, W_2, W_3 \ldots W_N$ are weights associated with each input $\epsilon(-1,1)$; Sum is the weighted sum of inputs; and T is a predefined threshold value for the neuron activation (i.e., firing)



Code Implementation:

The complete code can be found here.

We use python along with numpy to code this neuron.

1. We import numpy

```
import numpy as np
```

2. We make a Neuron Class and add the necessary functions:

```
class Neuron:
   def __init__(self, weights):
      self.weights = weights
      n = len(weights)
      self.threshold = np.dot(np.ones(n), weights)

   def feedforward(self, inputs):
      total = np.dot(self.weights, inputs)
      return 1 if total >= self.threshold else 0
```

3. We finally write the main function to get user input and calculate the AND operation between inputs

```
num_of_inputs = int(input("Enter number of inputs: "))
weights = np.ones(num_of_inputs)
neuron = Neuron(weights)

print("Enter the inputs (each in a newline) in the form of 1 or 0:")
lst=[]
i=0
while(i<num_of_inputs):
   ele = int(input())
   if ele not in [1,0]:
      print("Please enter 1 or 0")
      continue
   lst.append(ele)
   i+=1
inputs=np.array(lst)
print("The AND operation on the following inputs is: ")
print(neuron.feedforward(inputs))
```

Usage:

```
 python .\01_mcculloch_pitts_neuron.py
 Enter number of inputs:
3                                                                                Ent
er the inputs (each in a newline) in the form of 1 or
0:
1
0
1
The AND operation on the following inputs is:
0
```