## **Perceptron Learning - Why it works?**

What is the intuition behind the Perceptron learning algorithm

1. W = [w1, w2, … wn]
2. X = [x1, x2, … xn]
3. Cos 𝜃 = w.x/||w||x||, here the numerator can be replaced with wixi
   1. The denominator is always positive
   2. Therefore Cos 𝜃 ∝ wixi
   3. As 𝜃 ranges from 0 to 180o, cos 𝜃 ranges from 1 to -1
   4. If cos𝜃 > 0, it is an acute angle
   5. If cos𝜃 < 0, it is an obtuse angle
4. For x ∈ P, if w.x < 0, then it means that the angle(𝛂) between this x and the current w is greater than 90o, but we want 𝛂 < 90o)
   1. What happens to the new angle 𝛂new when wnew = w + x
   2. Cos𝛂new ∝ wnewTx
   3. ∝ (w+x)Tx
   4. ∝wTx + xTx(always +ve)
   5. ∝cos𝛂 + xTx(some +ve value)
   6. This means that the cosine is going to increase, which leads to decrease of 𝛂
5. For x ∈ N, if w.x > 0, then it means that the angle(𝛂) between this x and the current w is less than 90o, but we want 𝛂 > 90o)
   1. What happens to the new angle 𝛂new when wnew = w - x
   2. Cos𝛂new ∝ wnewTx
   3. ∝ (w-x)Tx
   4. ∝wTx - xTx(always +ve)
   5. ∝cos𝛂 - xTx(some +ve value)
   6. This means that the cosine is going to decrease, which leads to increase of 𝛂