Perceptron Solution by M22AI601

1q> Perceptron:

1. In how many steps perception learning algorithm will converge.

A> The Perceptron algorithm converged in 6 steps

Epoch 1: Sample 1: x=[1. 1.], y=1, y_hat=2.0, Correct
Epoch 1: Sample 2: x=[-1. -1.], y=-1, y_hat=-2.0, Correct
Epoch 1: Sample 3: x=[0. 0.5], y=-1, y_hat=0.5, Incorrect, Update w=[1. 0.5], b=-1
Epoch 1: Sample 4: x=[0.1 0.5], y=-1, y_hat=-0.65, Correct
Epoch 1: Sample 5: x=[0.2 0.2], y=1, y_hat=-0.7, Incorrect, Update w=[1.2 0.7], b=0
Epoch 1: Sample 6: x=[0.9 0.5], y=1, y_hat=1.4300000000000002, Correct
Epoch 2: Sample 1: x=[1. 1.], y=1, y_hat=1.9, Correct
Epoch 2: Sample 2: x=[-1. -1.], y=-1, y_hat=-1.9, Correct
Epoch 2: Sample 3: x=[0. 0.5], y=-1, y_hat=0.35, Incorrect, Update w=[1.2 0.2], b=-1
Epoch 2: Sample 4: x=[0.1 0.5], y=-1, y_hat=-0.78, Correct
Epoch 2: Sample 5: x=[0.2 0.2], y=1, y_hat=-0.72, Incorrect, Update w=[1.4 0.4], b=0
Epoch 2: Sample 6: x=[0.9 0.5], y=1, y_hat=1.46, Correct
Epoch 3: Sample 1: x=[1. 1.], y=1, y_hat=1.7999999999999998, Correct
Epoch 3: Sample 2: x=[-1. -1.], y=-1, y_hat=-1.7999999999999998, Correct
Epoch 3: Sample 3: x=[0. 0.5], y=-1, y_hat=0.19999999999999998, Incorrect, Update w=[1.4 -0.1], b=-1
Epoch 3: Sample 4: x=[0.1 0.5], y=-1, y_hat=-0.91, Correct
Epoch 3: Sample 5: x=[0.2 0.2], y=1, y_hat=-0.74, Incorrect, Update w=[1.6 0.1], b=0
Epoch 3: Sample 6: x=[0.9 0.5], y=1, y_hat=1.49, Correct
Epoch 4: Sample 1: x=[1. 1.], y=1, y_hat=1.6999999999999997, Correct
Epoch 4: Sample 2: x=[-1. -1.], y=-1, y_hat=-1.6999999999999997, Correct
Epoch 4: Sample 3: x=[0. 0.5], y=-1, y_hat=0.04999999999999999, Incorrect, Update w=[1.6 -0.4], b=-1
Epoch 4: Sample 4: x=[0.1 0.5], y=-1, y_hat=-1.04, Correct
Epoch 4: Sample 5: x=[0.2 0.2], y=1, y_hat=-0.76, Incorrect, Update w=[1.8 -0.2], b=0
Epoch 4: Sample 6: x=[0.9 0.5], y=1, y_hat=1.5199999999999998, Correct
Epoch 5: Sample 1: x=[1. 1.], y=1, y_hat=1.5999999999999999, Correct
Epoch 5: Sample 2: x=[-1. -1.], y=-1, y_hat=-1.5999999999999999, Correct
Epoch 5: Sample 3: x=[0. 0.5], y=-1, y_hat=-0.1, Correct
Epoch 5: Sample 4: x=[0.1 0.5], y=-1, y_hat=0.07999999999999999, Incorrect, Update w=[1.7 -0.7], b=-1
Epoch 5: Sample 5: x=[0.2 0.2], y=1, y_hat=-0.8, Incorrect, Update w=[1.9 -0.5], b=0
Epoch 5: Sample 6: x=[0.9 0.5], y=1, y_hat=1.4599999999999997, Correct
Epoch 6: Sample 1: x=[1. 1.], y=1, y_hat=1.3999999999999997, Correct
Epoch 6: Sample 2: x=[-1. -1.], y=-1, y_hat=-1.3999999999999997, Correct
Epoch 6: Sample 3: x=[0. 0.5], y=-1, y_hat=-0.24999999999999997, Correct
Epoch 6: Sample 4: x=[0.1 0.5], y=-1, y_hat=-0.06, Correct
Epoch 6: Sample 5: x=[0.2 0.2], y=1, y_hat=0.27999999999999997, Correct
Epoch 6: Sample 6: x=[0.9 0.5], y=1, y_hat=1.4599999999999997, Correct

2. What will be the final decision boundary? Show step-wise-step update of weight vector using computation as well as hand-drawn plot.

A> The final decision boundary is given by the equation:

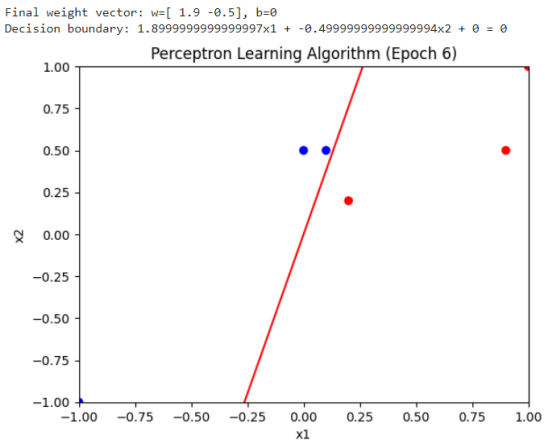
w1x1 + w2x2 + b = 0

where w1 and w2 are the components of the weight vector and b is the bias term.

The final weight vector of the decision boundary is W=(1. 9, -0. 5)

The final Eq. is 1. 9x1+(-0. 5x2)=0

1. 9x1-0. 5x2=0



In The **fig.** we can see that 1. 9x1-0. 5x2=0 line separables the 2 classes correctly