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**Practical 10:** Can you implement XOR gate using a perceptron learning algorithm? Write a code and Justify your answer through reasoning and demonstration.

* **Without using inbuilt module**

import numpy as np  
from matplotlib import pyplot as plt  
  
current = ""  
  
  
def plotGates(X, Y):  
 global current  
 Y = np.array([0, 1, 1, 0])  
 plt.scatter(x=X[:, 0], y=[X[:, 1]], c=Y)  
 # plt.show()  
 n\_samples = X.shape[0]  
 n\_features = X.shape[1]  
 w = np.random.uniform(0, 1, size=n\_features)  
 b = np.random.uniform(0, 1, 1)  
 n\_epoch = int(input(f"Enter the number of epochs for {current} Gate: "))  
 lr = 0.01  
 for e in range(n\_epoch):  
 for s in range(n\_samples):  
 net = np.dot(X[s, :], w) + b  
 if net >= 0:  
 a = 1  
 else:  
 a = 0  
 error = Y[s] - a  
 w = w + lr \* error \* X[s, :]  
 b = b + lr \* error  
 m = -w[0] / w[1]  
 c = -b / w[1]  
 return m, c  
  
  
def plot\_decision\_boundary(X):  
 global current  
 plotDict = {"AND": [0, 0, 0, 1], "OR": [0, 1, 1, 1], "NAND": [1, 1, 1, 0], "NOR": [1, 0, 0, 0], "XOR": [0, 1, 1, 0],  
 "XNOR": [1, 0, 0, 1]}  
 fig, axes = plt.subplots(3, 2, figsize=(10, 10))  
 fig.subplots\_adjust(hspace=0.5)  
 hmm = 0  
 for i in plotDict:  
 current = i  
 m, c = plotGates(X, plotDict[i])  
 for x in np.linspace(np.min(X[:, 0]), np.max(X[:, 0])):  
 y = m \* x + c  
 ax = axes[hmm // 2, hmm % 2]  
 ax.plot(x, y, linestyle="-", color="k", marker=".")  
 ax.scatter(X[:, 0], X[:, 1], c=plotDict[i])  
 ax.set\_title(i)  
 hmm += 1  
 plt.suptitle("Gates using Perceptron Learning")  
 plt.savefig("Gates using Perceptron Learning")  
 plt.show()  
  
  
X = np.array([[0, 0], [0, 1], [1, 0], [1, 1]])  
  
plot\_decision\_boundary(X)

* Output:

