In [44]:

```
import numpy as np
import math
from IPython.display import Markdown as md
from math import *
from matplotlib import pyplot as plt
from sklearn.metrics import accuracy_score
```

In [56]:

```
def make_half_moons(n_samples, radius, width, distance):

    """
    The function make_half_moons takes as input:
    n_samples = number of data samples to be generated
    radius = central radius of the half-moon
    width = width of the half-moon
    distance = distance between the two half-moons

    and returns as output the dataset generated and shuffled
    data_set = the shuffled and combined dataset with 3 rows (as x_cord, y_cord
               and labels) and n_samples columns
    """

    # Initialise dummy variables
    num_rows = 3
    num_cols = n_samples
    r = radius
    w = width
    d = distance
    n = [0 for i in range(n_samples)]




    # Check for boundary conditions
    if(r < w/2):
        print("\nError: Radius should atleast be larger than half the width.")

    if(num_cols%2 != 0):
        print("\nError: Number of samples should be even.")
        num_cols -= 1

    # Create random 2D array of floats between 0.0 and 1.0
    a = np.random.rand(num_rows, num_cols//2)

    # Define rad for first half of records
    rad = (r - w/2) + w*a[0][:]

    # Define theta for second half of records
    theta = np.pi*a[1][:]

    # Create data-set
    # First half-moon data
    x1 = np.multiply(rad, np.cos(theta))
    y1 = np.multiply(rad, np.sin(theta))
    label1 = 1*np.ones((1, len(x1)), dtype=int)
    label1 = np.hstack(label1)
   # print(label1)

    # Second half-moon data
    x2 = np.multiply(rad, np.cos(-theta)) + r
    y2 = np.multiply(rad, np.sin(-theta)) - d
    label2 = 0*np.ones((1, len(x2)), dtype=int)
    label2 = np.hstack(label2)
   # print(label2)

    # Create dataset by combining all values of x's and y's and
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# labels, and shuffling them randomly.
x = np.concatenate((x1, x2))
y = np.concatenate((y1, y2))
labels = np.concatenate((label1, label2))
#print(x)
#print(x1)

def sigmoid(b):
    return 1 / (1 + math.exp(-b))
sigmoid_v = np.vectorize(sigmoid)









# Create coordinate-type dataset from individual values
# so that we have a dataset of type Xi = [[x, y], label]
X = np.zeros((len(x), 2))



k = 0
for i, j in zip(x, y):
    X[k][0] = i
    X[k][1] = j

    k += 1


data_set = [X, labels]
#print(label1)


# Plot a half-moon graph for given dataset
plt.plot(x1, y1, "r.", x2, y2, "b.")
plt.show()


#int(data_set)
#print(x1)
# print(y1)
#print("printing labels")
#print(labels[0])
alpha=0.01

weights = np.zeros((9,n_samples+1), dtype=int)        #initializing weights


actual_result = 0
l = 0

for i in range (n_samples):                         # training the data


    actual_result = weights[0][l]*X[i][0] + weights[0][l+1]*X[i][1]
    #actual_result = np.dot(weights[0][k],X[i])
  # print(sigmoid_v(actual_result))
  #  print(sigmoid(actual_result))
```

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        #print(actual_result)
        actual_result = sigmoid_v(actual_result)
        #print(actual_result)

       # print(label1[i])

        if actual_result > 0.5:
            fx = 1
           # print("greater than 0.5")
        if actual_result <= 0.5:
            fx = 0
            #print("less than 0.5")


        if fx != labels[i]:
            error = labels[i] - fx
            weights[0][l] = weights[0][l] + error*X[i][0]
            weights[0][l+1] = weights[0][l+1] + error*X[i][1]

            #print(weights[:])
            #print (labels)

            print("learning")
        else:
            if fx == labels[i]:
                weights[0][l] = weights[0][l]
                weights[0][l+1] = weights[0][l+1]
                print("no error")
        l +=1

    l = 0
    for i in range (n_samples):                          # testing the data


        actual_result = weights[0][l]*X[i][0] + weights[0][l+1]*X[i][1]
        actual_result = sigmoid_v(actual_result)
        if actual_result > 0.5:
            fx = 1
           # print("greater than 0.5")
        if actual_result <= 0.5:
            fx = 0
            #print("less than 0.5")
        l+=1



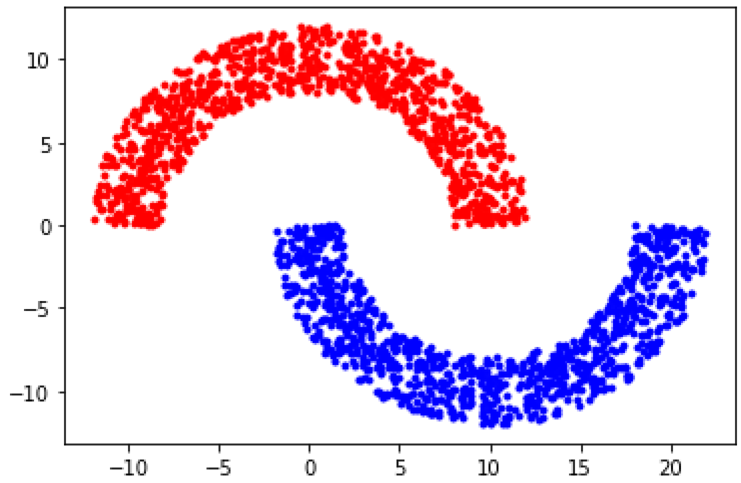
        n[i]=fx #storing value of fx in list


    acc = accuracy_score(labels[:],n[:])
    print ("Accuracy",+accuracy_score(labels[:],n[:])) #finding accuracy
    print('\033[1m',  (accuracy_score(labels[:],n[:]) *100),'%' , '\033[0m')


    #return data_set



make_half_moons(2000, 10, 4, 0)
```

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In [ ]:

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