Homework 02

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1 Solution to Problem 2.1(a)

The equation to find the sample size, N, with a complexity of $M = 1$ is $\epsilon(M, N, \delta) = \sqrt{\frac{1}{2N}\ln(\frac{2(1)}{.03})} \leq .05$.

$$= \frac{1}{2N}\ln(\frac{2(1)}{.03}) \leq .0025 \quad (1)$$
$$= \ln(\frac{2}{.03}) \leq .005N \quad (2)$$
$$= \frac{\ln(\frac{2}{.03})}{.005} \leq N \quad (3)$$
$$= N \geq 840 \quad (4)$$

2 Solution to Problem 2.1(b)

Simlar to the previous question we use the equation to find the sample size, N, with a complexity of $M = 100$ this time.

$$\epsilon(M, N, \delta) = \sqrt{\frac{1}{2N}\ln(\frac{2(100)}{.03})} \leq .05 \quad (5)$$
$$= \frac{1}{2N}\ln(\frac{2(100)}{.03}) \leq .0025 \quad (6)$$
$$= \ln(\frac{200}{.03}) \leq .005N \quad (7)$$
$$= \frac{\ln(\frac{200}{.03})}{.005} \leq N \quad (8)$$
$$= N \geq 1761 \quad (9)$$

3 Solution to Problem 2.1(c)

Simlar to the previous question we use the equation to find the sample size, N, with a complexity of $M = 10000$ this time.

$$\epsilon(M, N, \delta) = \sqrt{\frac{1}{2N}\ln(\frac{2(10000)}{.03})} \leq .05 \quad (10)$$
$$= \frac{1}{2N}\ln(\frac{20000}{.03}) \leq .0025 \quad (11)$$
$$= \ln(\frac{20000}{.03}) \leq .005N \quad (12)$$
$$= \frac{\ln(\frac{20000}{.03})}{.005} \leq N \quad (13)$$
$$= N \geq 2683 \quad (14)$$

4 Solution to Problem 2.11(N=100)

To find the the outside error we use the equation $E_{out}(g) \leq E_{in}(g) + \frac{8}{N}\ln(\frac{m_H(2N)}{\delta})$. Plugging our given values we get $E_{out}(g) \leq E_{in}(g) + \frac{8}{100}\ln(\frac{4(200+1)}{.1}) = E_{in}(g) + 0.719$

5 Solution to Problem 2.11(N=10000)

Similar to the last problem, to find the the outside error we use the equation $E_{out}(g) \leq E_{in}(g) + \frac{8}{N}\ln(\frac{m_H(2N)}{\delta})$. Plugging our given values we get $E_{out}(g) \leq E_{in}(g) + \frac{8}{10000}\ln(\frac{4(20000+1)}{.1}) = E_{in}(g) + 0.011$

6 Solution to Problem 2.12

To find the sample size, N, with the given information we use the equation $N \geq \frac{8}{\epsilon^2}\ln(\frac{4((2N)^{d_{vc}}+1)}{\delta})$. Plugging in our given values we get:

$$N \geq \frac{8}{.05^2}\ln(\frac{4((2N)^1 0+1)}{.05}) = 3200N \geq \ln(\frac{4((2N)^1 0+1)}{.05}) \tag{15}$$

$$= N \geq 452957 \tag{16}$$

7 Solution to Problem 3.1

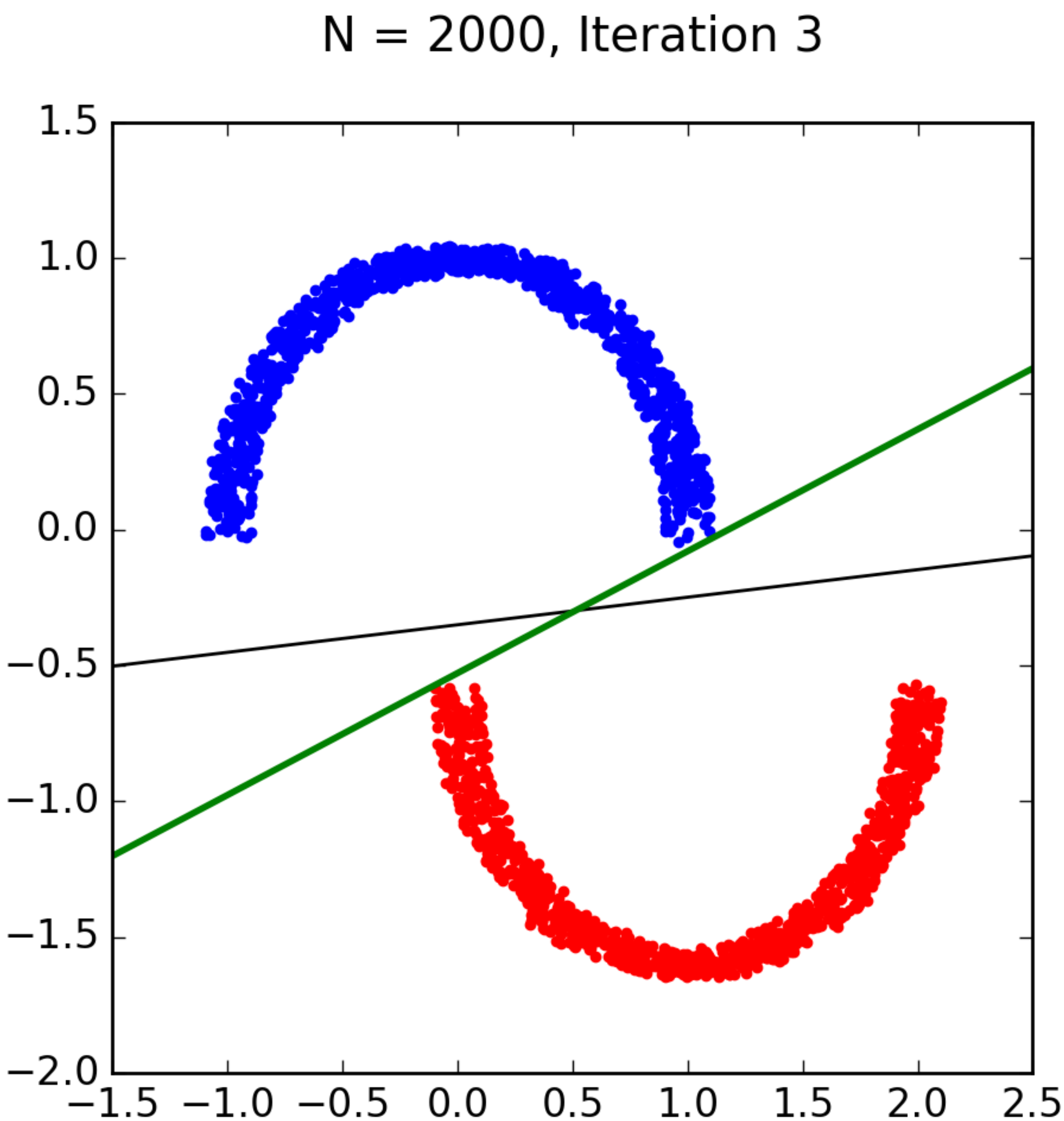

Figure 1: 3.1

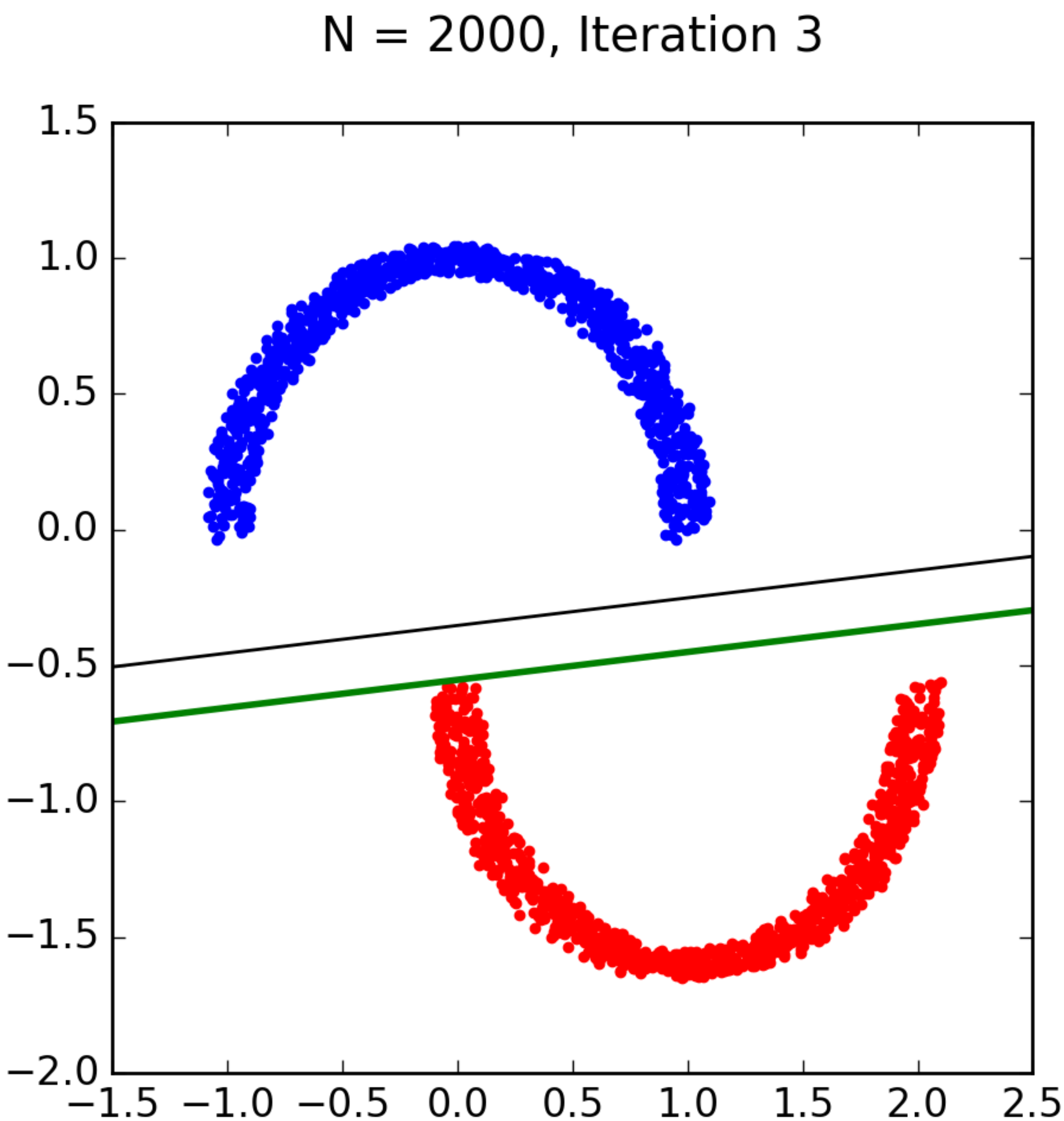

Figure 2: 3.1