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section # 17

Assignment 03

a// Joint Probability Distribution Table :

$P(A, B, C) = 0.2$

$P(\neg A, B, C) = 0.05$

$P(\neg A, \cancel{A}\, \neg B, C) = 0.35$

$P(\neg A, \neg B, \neg C) = 0.05$

$P(A, \neg B, C) = 0.15$

$P(A, \neg B, \neg C) = 0.05$

$P(A, B, \neg C) = 0.1$

$P(\neg A, B, \neg C) = 0.05$

We know,

$P(A) = P(A,B,C) + P(A,\neg B, C) + P(A, \neg B, \neg C) + P(A, B, \neg C)$

$0.5 = 0.2 + 0.15 + 0.05 + P(A, B, \neg C)$

$\therefore P(A, B, \neg C) = 0.1$

$P(\neg A, \neg B, \neg C) = 1 - (0.2 + 0.05 + 0.35 + 0.15 + 0.05 + 0.1 + 0.05)$

$= 0.05$

b// $\cancel{P(B)}$ $P(\neg B) = 1 - (P(A,B,C) + P(\neg A, B, C) + P(\neg A, B, \neg C) + P(A, B, \neg C)$

$= 1 - (0.2 + 0.05 + 0.05 + 0.1) = 0.6$

c)

$$P(A \mid \neg B, C) = \frac{P(A, \neg B, C)}{P(\neg B, C)}$$

$$= \frac{0.15}{0.5} = 0.30$$

$P(\neg B, C)$

$= P(A, \neg B, C) + P(\neg A, \neg B, C)$

$= 0.5$

$$P(\neg A \mid B, \neg C) = \frac{P(\neg A, B, \neg C)}{P(B, \neg C)}$$

$$= \frac{0.05}{0.15}$$

$= 0.33$

$P(B, \neg C)$

$= P(A, B, \neg C) + P(\neg A, B, \neg C)$

$= 0.1 + 0.05$

$= 0.15$

d)

$P(A) = 0.5$ $\quad P(B) = 1 - 0.6 = 0.4$ $\quad P(C) = 1 - 0.25 = 0.75$

If independent

$$P(A, B, C) = P(A) \times P(B) \times P(C)$$

$$= 0.5 \times 0.4 \times 0.75 = 0.15$$

But from Table $P(A, B, C) = 0.2$

$\therefore$ so not Independent.

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Ans to the ques 2

Let: Disease $= D$, Positive Result $= +$

$P(D) = \frac{1}{1000} = 0.001$

$P(\neg D) = 1 - 0.001 = 0.999$

$\therefore P(+|\neg D) = 0.01 \quad \therefore P(-|\neg D) = 1 - 0.01 = 0.99$

$\therefore P(-|D) = 0.03$

$\therefore P(+|D) = 1 - 0.03$
$= 0.97$

a) $P(D|+) = \frac{P(+|D) \times P(D)}{P(+)}$

$= \frac{0.97 \times 0.001}{0.01096}$

$P(D|+) = 0.0885$
$\simeq 8.85\%$

$P(+) = P(D)\,P(+|D) + P(\neg D)\,P(+|\neg D)$
$= (0.001 \times 0.97) + (0.999 \times 0.01)$
$= 0.01096$

b) $P(D)' = 0.0885 \quad P(\neg D)' = 1 - 0.0885$
$= 0.9115$

$P(+)' = 0.0885 \times 0.97 + 0.9115 \times 0.01$
$= 0.09496$

$P(D|+)' = \frac{P(+|D) \times P(D)'}{P(+)'} = \frac{0.97 \times 0.0885}{0.09496}$

$= 0.9040$
$= 90.40\%$

Ans to the ques 3

a|| D_1

x	y
8	1.2
9	1.3
10	1.5
12	1.8
15	2.3

$\theta_0 = 0$

$\theta_1 = 1$

$\cancel{h(\theta)}\ h_\theta(x) = \theta_0 + \theta_1 x$

$$\theta_1 = \theta_1 - \eta \sum_{i=1}^{n} \left(h_\theta(x)^i - y^{(i)} \right) x^{(i)}$$

t=1

$$\theta_1 = 1 - \frac{100}{100 \times 10 \times 1} \left[(1 \times 8 - 1.2)8 + (1 \times 9 - 1.3)9 + (1 \times 10 - 1.5)10 + (1 \times 12 - 1.8)12 + (1 \times 15 - 2.3)15 \right]$$

$= -51.16$

$$\theta_0 = 1 - \frac{100}{100 \times 10 \times 1} \left[(1 \times 8 - 1.2) + (1 \times 9 - 1.3) + (10 - 1.5) + (1 \times 12 - 1.8) + (1 \times 15 - 2.3) \right]$$

$= -4.59$

t=2 $\theta_0 = -4.59$ $\theta_1 = -51.16$

$$\theta_0 = -4.59 - \frac{100}{100 \times 100 \times 2} \left[\{(-4.59 - 51.16 \times 8) - 1.2\} + \{(-4.59 - 51.16 \times 9) - 1.3\} + \{(-4.59 - 51.16 \times 10) - 1.5\} + \{(-4.59 - 51.16 \times 12) - 1.8\} + \{(-4.59 - 51.16 \times 15) - 2.3\} \right]$$

$= \cancel{-2793.63}$

$= 23.3469$

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$-h_\theta(x^i)$

$$\theta_1 = -51.16 - \frac{100}{100\times 10\times 2}\Big[\{(-4.59-51.16\times 8)-1.2\}8 +$$
$$\{(-4.59-51.16\times 9)-1.3\}9 +$$
$$\{(-4.59-51.16\times 10)-1.5\}10 +$$
$$\{(-4.59-51.16\times 12)-1.8\}12 +$$
$$\{(-4.59-51.16\times 15)-2.3\}15\Big]$$

$$= \cancel{-31752.50}$$
$$= 266.365$$

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b) logistic $\quad h_\theta(x) = g(\theta^T x) = \frac{1}{e^{-\theta x}+1}$ $\quad \Big\| \quad \theta_0 = 0,\ \theta_1 = 1$

$$z = \theta_0 + \theta_1 x$$

$\cancel{E_1 =}$

$$\theta_0 = \theta_0 + \eta \sum_{i=1}^{n} \left(y^i - h_\theta(x^i)\right)$$

X	y
10	1
13	1
5	0
15	1
7	0

$$\theta_0 = 0 + \frac{1}{10\times 1}\Big[\left(1 - \frac{1}{1+e^{-1\times 10}}\right) +$$
$$\left(1 - \frac{1}{1+e^{-(13)}}\right) +$$
$$\left(0 - \frac{1}{1+e^{-5}}\right) +$$
$$\left(1 - \frac{1}{1+e^{-15}}\right) +$$
$$\left(0 - \frac{1}{1+e^{-7}}\right)$$

$$= \cancel{-0.0398}$$
$$-0.1992$$

$$\theta_1 = \theta_1 + \eta \sum_{i=1}^{n} \left(y^i - h_\theta (x^i)\right) x^i$$

$$\theta_1 = 1 + \frac{1}{10}\Bigg[\left(1 - \frac{1}{1+e^{-10}}\right)10 + \left(1 - \frac{1}{1+e^{-13}}\right)13 + \left(0 - \frac{1}{1+e^{-5}}\right)5 + \left(1 - \frac{1}{1+e^{-15}}\right)15 + \left(0 - \frac{1}{1+e^{-7}}\right)7\Bigg]$$

$$= 0.\cancel{7608}1959$$

$\cancel{t=2}$

$$\theta_0 = -\overset{0.1992}{\cancel{0.0398}} \qquad \theta_1 = \overset{0.1959}{\cancel{0.7608}}$$

$$\theta_0 = -\overset{0.1992}{\cancel{0.03}} + \frac{1}{10 \times 2}\Bigg[\left(1 - \frac{1}{1+e^{\overset{\cancel{0.03 - 0.7608}\times 10}{0.1992 - 0.1959}}}\right) + \left(1 - \frac{1}{1+e^{\overset{\cancel{0.03 - 0.7608}\times 13}{0.1992 - 0.1959}}}\right) + \left(0 - \frac{1}{1+e^{\overset{\cancel{0.03 - 0.7608}\times 5}{0.1992 - 0.1959}}}\right) + \left(1 - \frac{1}{1+e^{\overset{\cancel{0.03 - 0.7608}\times 15}{0.1992 - 0.1959}}}\right) + \left(0 - \frac{1}{1+e^{\overset{\cancel{0.03 - 0.7608}\times 7}{0.1992 - 0.1959}}}\right)$$

$$= \cancel{-0.0437} \quad -0.1753$$

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$$\theta_1 = \theta_1 + \eta \sum_{i=1}^{n} \left(y^i - h_\theta(\theta^T x)\, x^i\right)$$

$$= 0.1959 + \frac{1}{2\times10}\Bigg[\left(1 - \frac{1}{1+e^{0.1992 - .1959\times10}}\right)10 +$$

$$\left(1 - \frac{1}{1+e^{.1992 - .1959\times13}}\right)13 +$$

$$\left(0 - \frac{1}{1+e^{.1992 - .1959\times5}}\right)5 +$$

$$\left(1 - \frac{1}{1+e^{.1992 - .1959\times15}}\right)15 +$$

$$\left(0 - \frac{1}{1+e^{.1992 - .1959\times7}}\right)7$$

$$= 0.1358$$