Page No.
Date : / /201

Bayesian Learning

1. $P(\text{Manchester wins}) = 0.7$
$P(\text{" loss}) = 0.3$

$P(\text{Packed Pub} \mid \text{wins}) = 0.9$
$P(\text{——} \mid \text{loss}) = 0.6$

$$P(\text{win} \mid \text{Packed Pub}) = \frac{P(PP \mid w) \times P(w)}{P(PP)}$$

$$= \frac{0.9 \times 0.7}{0.9 \times 0.7 + 0.3 \times 0.6}$$

$$= \frac{0.63}{0.63 + 0.18} = \frac{0.63}{0.81}$$

2. $P(wf) = 0.3$
~~$P(die \mid f) = 0.8$~~
$P(die \mid Recive) = 0.1$
$P(die \mid not\ recieve) = 0.8$

$$P(\text{wforgot} \mid die) = \frac{P(die \mid NR) \times P(f)}{P(dead)}$$

$$= \frac{0.8 \times 0.3}{0.8 \times 0.3 + 0.1 \times 0.7} = 0.77.$$

(5.) $P(gold) = 0.1$

$P(coal) = 0.3$

$P(none) = 0.6$

$P(+ve \mid gold) = 0.8$

$P(+ve \mid coal) = 0.4$

$P(+ve \mid none) = 0.2$

$$P(gold \mid +ve) = \frac{P(+ve \mid gold)\, P(gold)}{P(+ve)}$$

$$= \frac{0.8 \times 0.1}{0.8 \times 0.1 + 0.4 \times 0.3 + 0.2 \times 0.6}$$

$$= 0.25$$

(4) (i) $$P(M \mid +ve) = \frac{P(+ve \mid M)\, P(M)}{P(+ve)}$$

$$= \frac{0.05 \times 0.05}{0.95 \times 0.05 + 0.3 \times 0.95}$$

$$= 0.1428.$$

(i) $P(M \mid +ve, -ve) = \frac{P[+ve \mid D] \times P[D]}{P(+ve, -ve)}$

$= \frac{P(+ve \mid M)\, P(-ve \mid M)\, P(M)}{P(+ve)\, P(-ve)}$

$= \frac{0.05 \times 0.05 \times 0.95}{P(+ve)\,(1 - P(+ve))}$

$= \frac{0.002375}{0.0675 \times 0.3325} = 0.017.$

(5) $P(\text{Rain}) = 0.8$

$P(\text{No Rain}) = 0.2$

$P(+ve \mid \text{Rain}) = 0.75$

$P(-ve \mid \text{Rain}) = 0.25$

$P(+ve \mid \text{No Rain}) = 0.15$

$P(-ve \mid \text{No } ,,) = 0.85$

$P(R \mid -ve) = \frac{P(-ve \mid R)\, P(R)}{P(-ve)}$

$= \frac{0.25 \times 0.8}{P(R)\, P(-ve \mid R) + P(R) + P(N \mid R)}$

$= \frac{0.2}{0.2 + 0.85 \times 0.2}$

$= 0.5405$

(Q) (i) Bhic konjuniya = C

$P(C) = 0.0001$
$P(C') = 0.999$
$P(Pain / C) = 0.64$
$P(Pain / C') = 0.6$
$P(pos / C) = 0.99$
$P(pos / C') = 0.04$

$$P(C \mid pos.pain) = \frac{P(Pos|C)\,P(Pain)\,P(C)}{P(Pos|C)\,P(Pain|C)\,P(C) + P(pos|C')\,P(Pain|C') \times P(C')}$$

$$= \frac{0.99 \times 0.64 \times 0.0001}{0.99 \times 0.64 \times 0.0001 + 0.04 \times 0.6 \times 0.999}$$

$$= \frac{0.0000633.6}{0.2406} = 0.00263$$

(ii) $P(D \mid Pos.Pain) =$ ~~P(Pos~~

$$\frac{P(pos|C)^2\,P(Pain|C)\,P(C)}{[P(pos|C)^2\,P(Pain|C)\,P(C) + P(pos|C')^2\,P(Pain|C')\,P(C')]}$$

Page No.
Date : / /201

$$\frac{(0.99)^2 + 0.64 \times 0.0001}{0.00006273 + 0.0009522} = 0.0613$$

(11) Yes Repeating may improve.

(7) Hand set = old

time ≥ 2.5, Age ≤ 5.5

clumping = Yes

$P(C = Yes) = 5/10$ $P(C = No) = 5/10$

$P(H = old \mid C = Yes) = 2/5$

$P(H = old \mid C = Yes) = 2/5$	$P(T \geq 2.5 \mid C = No) = 3/5$
$P(H = old \mid C = No) = 0$	$P(A \leq 55 \mid C = Yes) = 2/5$
$P(T \geq 2.5 \mid C = Yes) = 2/5$	$P(A \leq 55 \mid C = No) = 3/5$

$= P(H = old \mid C = Yes) \times P(T \geq 2.5 \mid C = Yes) \times P(A \leq 55 \mid C = Yes) \times P(C = Yes)$

$= \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{5}{10} = \frac{4}{125}$

8 $N(x, \mu, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$

$\bar{x} = 3.87, \quad \bar{y} = 5.25$

$(x-\bar{x})^2$	$(y-\bar{y})^2$
1.51	0.56
14.97	3.08
0.75	0.56
0.01	0.06
0.23	3.08
0.75	1.56
3.42	0.56
17.05	18.66
46.70	27.48

$\sigma_x = \sqrt{\frac{46.70}{8}} = 2.41$

$\sigma_y = \sqrt{\frac{27.48}{8}} = 1.85$

$(\sigma_x)^2 = 5.84 \qquad (\sigma_y)^2 = 3.43$

Page No.
Date : / /201

$$N(x=7, \mu, \sigma) = \frac{1}{\sqrt{2\pi}(2.4)} e^{\frac{-(7-5.25)^2}{2(2.4)^2}}$$

$$N(Y=4, \mu, \sigma) = \frac{1}{\sqrt{2\pi}(1.85)} e^{\frac{-(4-3.25)^2}{2(1.85)^2}}$$

$$= 0.172$$

$$P\left(\frac{+ve}{x=7, y=4}\right) = P\left(\frac{x=7, y=4}{P(+ve)}\right) \times P(+ve)$$

$$= \frac{P(x=7)\, P(y=4) \times P(+ve)}{P(+ve)}$$

$$= 0.07 \times 0.172 = 0.01204.$$