Shivang Ahuja

Exercise Sheet on Bayesian Learning

1) Probablity of MU winning $= P(MU) = 0.7$

Prob. of Crowd at Pub given MU win
$= P(C/MU) = 0.9$

Prob of Crowd at Pub given MU loose
$= P(C/\neg MU) = 0.6$

to find $P(MU/C)$

$$= \frac{P(C/MU)\,P(MU)}{P(C)}$$

$$= \frac{0.9 \times 0.7}{0.9 \times 0.7 + 0.6 \times 0.3} = \frac{0.63}{0.81} = \underline{\underline{0.77}}$$

There is a probablity of $\underline{\underline{77\%}}$ that MU won the match

It can be assumed that they won

2) Probab. that She will give the pill
$= P(g) = 0.7$

not give pill $= P(\neg g) = 0.3$

prob that the man die given he recieves a pill
$= P(D/g) = 0.1$

if not recieve pill $\Rightarrow P(D/\neg g) = 0.8$

to find

$$P(\neg g / D) = \frac{P(D/\neg g)\ P(\neg g)}{P(D)}$$

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

$$= \frac{0.24}{0.31} = \underline{\underline{0.7741}}$$

their are 77.41 % chances that the Nurse forget to give pill.

37) Prob to find gold = $P(g) = 0.1$
" " " Coal = $P(c) = 0.3$
" " " None = $P(n) = 0.6$

prob of test given gold = $P(T=p/g) = 0.8$
" " " " Coal = $P(T=p/c) = 0.4$
" " " " None = $P(T=p/n) = 0.2$

given result is positive find $P(g/T=p)$

$$P(g/T=p) = \frac{P(T=p/g) * P(g)}{P(T=p)}$$

$$= \frac{0.8 \times 0.1}{0.8 \times 0.1 + 0.4 \times 0.3 + 0.2 \times 0.6} = \frac{0.08}{0.32} = \underline{0.25}$$

5) Prob. of rain in UK = $P(R) = 0.8$

$P(\neg R) = 0.2$

given $P(T=p / R) = 0.75 \Rightarrow P(T=N/R) = 0.15$

$P(T=p / \neg R) = 0.15 \Rightarrow P(T=N/\neg R) = 0.75$

to find $P(\neg R / T=N)$

$$= \frac{0.75 \times 0.2}{0.75 \times 0.2 + 0.15 \times 0.8}$$

$$= \frac{0.15}{0.27} = 0.5555$$

ther are 55.55% Chances that it will not Rain

6) $P(C) = 0.0001$

Prob of joint pain given Chickungunya $P(J/C) = 64\% = 0.64$

& $P(J/\neg C) = 0.6$

$P(T=P / C) = 0.99$ | $P(T=P / \neg C) = 0.04$

~~To find~~ $\cancel{P(C / T=P) = \frac{P(T=P/C)\,P(C)}{P(T=P/C)\,P(J/C)}}$

PTO

1) $P(C \mid T=P, J) = \dfrac{P(T=P, J \mid C)\, P(C)}{P(T=P, J)}$

$= \dfrac{P(T=P \mid C)\, P(J \mid C)\, P(C)}{P(T=P, J \mid C)\, P(C) + P(T=P, J \mid \neg C)\, P(\neg C)}$

$= \dfrac{0.99 \times 0.64 \times 0.0001}{0.0001 \times 0.99 \times 0.64 + 0.9999 \times 0.04 \times 0.6}$

$= \dfrac{0.00006336}{0.02406096} = \underline{\underline{0.0026}}$

There is very less prob. that Fred has the disease.

2) For $P(C \mid T_1=P, T_2=P, J)$

$= \dfrac{0.99 \times 0.64 \times 0.0026}{0.0026 \times 0.99 \times 0.64 + 0.9974 \times 0.04 \times 0.6}$

$= \dfrac{0.00164736}{0.02558496} = \underline{\underline{0.0643}}$

7) Prob of Churning

$\Rightarrow P(C) = \frac{5}{10} = 0.5$ | $P(\neg C) = 0.5$

Now

$P(\text{new}/C) = 3/5 = 0.6$ $\quad$ $P(\text{new}/\neg C) = 1$

$P(>2.5/C) = 2/5$ $\quad$ $P([1,2.5]/C) = 1/5$

$P(>2.5/\neg C) = 3/5$ $\quad$ $P([1,2.5]/\neg C) = 2/5$

$P(<1/C) = 2/5$ $\quad$ $P(<1/\neg C) = 0$

$P(>55/C) = 3/5$ $\quad$ $P(>55/\neg C) = 2/5$

$P(\leq 55/C) = 2/5$ $\quad$ $P(\leq 55/\neg C) = 3/5$

now

let $X = \text{old}, >2.5 \ \leq 55 \ \& \ C$

$\Rightarrow P(X|C) = 0.4 \times 0.4 \times 0.4 = 0.064$

~~8)~~ $\mu_{(x,+)} = 4.25$ $\mu_{(x,-)} = 7.5$

$\sigma_{(x,+)} = 0.957$ $\sigma_{(x,-)} = 3.109$

$\mu_{(y,+)} = 6$ $\mu_{(y,-)} = 4.5$

$\sigma_{(y,+)} = 0.816$ $\sigma_{(y,-)} = 2.645$

Using Gaussian Density function

$$P(x=7/+) = \frac{1}{\sqrt{2\pi}(0.957)} e^{-\frac{(7-4.25)^2}{2(0.957)^2}}$$

$$= 0.0084$$

$$P(y=4/+) = 0.0381$$

now $P(x=7, y=4/+) = 0.0084 \times 0.0381$

$$= 0.00032$$

the prob. is very less