(3) Let I with $i \in \{0, 1\}$ be the random variable.

$$\left\{ \begin{array}{l} \text{intruder} = 1 \\ \text{not intruder} = 0 \end{array} \right\}$$

be the alarm indicating variable.

Alarm will be raised if an intruder is identified with probability.

$$P(A=1 \mid I=1) = \underline{0.98}$$

and non-intruder probability $P(A=1 \mid I=0) = \underline{0.001}$

implies error factor.

Some one to be intruder. $\underline{P(I=1) = 0.00001}$

Q - what is the probability that an alarm is raised when person is actually intruder?

Sol -

$$P(I=1 \mid A=1) = \frac{P(A=1 \mid I=1)\, P(I=1)}{P(A=1)}$$

$$= \frac{P(A=1 \mid I=1)\, P(I=1)}{P(A=1 \mid I=1)\, P(I=1) + P(A=1 \mid I=0)\, P(I=0)}$$

$$= \frac{\cancel{0.98 \times 0.00001}}{\cancel{0.98 \times 0.00001} +}$$

i.e

~~Intruder Identified X Is Intruder~~

~~Intruder Identified X Is Intruder~~ X ~~error~~ 0.~~001~~ X

$$= \frac{0.98 \times 0.00001}{0.98 \times 0.00001 + 0.001 \times (1 - 0.00001)}$$

$$\approx \frac{0.00001}{0.001} = \boxed{0.01}$$

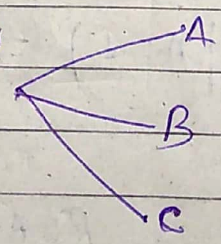
If he arrested as a intruder
he is still most likely not a intruder
with 99% of probability

formula

$$\frac{\text{Intruder} \times \text{Someone to be Intruder}}{\text{Intruder} \times \text{Someone to be Intruder} \times \text{Not Intruder} + (1 - \text{error})}$$

(5)

Question solves
either of type



Probabilities of A ; B ~~and~~ or C
30%, 20%, 50%.

During preparation, the student
solved 9 of 10 problems of
type A.

2 of 10 of type B, 6 of 10 of type C

i.e solve;

9 of 10 ⟶ A
2 of 10 ⟶ B
6 of 10 ⟶ C

Q probability that the student will solve the problem of exam?

$$P(\text{solved}) = P(\text{solved}|A)\ P(A) + P(\text{solved}|B)\ P(B) + P(\text{solved}|C)\ P(C)$$

$$= \left(\frac{9}{10} \cdot 30\%\right) + \left(\frac{2}{10} \cdot 20\%\right) + \frac{6}{10} \cdot 50\%$$

$$= \frac{27}{100} + \frac{4}{100} + \frac{30}{100}$$

$$= \frac{61}{100} = \boxed{0.61}$$

Total probability

Q what is the probability that it was of type A?

$$P(A|\text{solved}) = \frac{P(\text{solved}|A)\ P(A)}{P(\text{solved})} = \frac{\frac{9}{10} \cdot 30\%}{61/100}$$

$$= \frac{27/100}{61/100} = \frac{27}{61} = \boxed{0.442}$$

(6) created bins of time frame of 5 min each.

In each time frame of 5 min, there may be a customer moving into the bank with 5% probability or there is no customer

If a customer is detected by CCTV with probability 90%.

If no customer, camera false false photography with probability of 10%.

Q How many customers enter the bank on average day (10 hours)?

~~Sol~~— consideration —
average day = 10 hours

There are $10 \times \boxed{12} = 120$ five minute period per day

$1 hr = 60$ min
$1 hr = 12 \times$ 5 min frame

In each period there is a probability of 5% for an customer to enter the bank
so,
average number of person is
$120 \times 5\% = \boxed{6}$

Q How many false photograph (if no customer) and how many missed photograph (if customer but no photograph) are there on average per day?

- on average there is no person $(120 - 6)$ of five-minute period

false probability is 10%.

so, $(120 - 6) \times 10\% = 11.4$

false photograph

on average there a 6 person, each of has probability of 1% of getting missed $(\underline{100 - 99\%})$

Thus number of missed photograph

$6 \times 1\% = 6 \times 0.01 = \boxed{0.06}$

Q If there is a photography, probability that there is indeed a customer?

$P(\text{person} \mid \text{photograph}) =$

$$\frac{P(\text{person} \mid \text{photo}) \; P(\text{person})}{P(\text{person})}$$

$$= \frac{P(\text{person} \mid \text{photo})\ P(\text{person})}{P(\text{person} \mid \text{photo})\,P(\text{person}) + P(\text{person} \mid \text{no photo})\ P(\text{No person})}$$

$$= \frac{0.99 \times 0.05}{0.99 \times 0.05 + 0.1 \cdot (1 - 0.05)}$$

$$= \frac{0.05}{0.05 + 0.1} = \boxed{0.333}$$

Ex-

Instance	classification	A1	A2
1	+	T	T
2	+	T	T
3	−	T	F
4	+	F	F
5	−	F	T
6	−	F	T

(a) what is the entropy of this collection of training.

(b) what is the information gain (G) of A2.

formulas

$$\text{Entropy}(S) = \sum_{i=1}^{c} -p_i \log_2 p_i$$

S → sample set

- Entropy(S) measures the impurity of S & defined as –
- c is the number of class labels
- p refers to the proportion of values falling into the ith level.

$$\text{Information Gain}(S, A) = \text{Entropy}(S_{bs}) - \text{Entropy}(S_{as})$$

Individual Entropy sum

$$\text{Entropy}(S_{as}) = \sum_{i=1}^{n} w_i \, \text{Entropy}(p_i)$$

w_i → weight

① original dataset

Sol –

+	→	3	$p_i = 3/6$	$= 0.5$
–	→	3	$p_i = 3/6$	$= 0.5$
		count		

Total $\text{Entropy}(S_{bs}) = -p_i \log_2 p_i$

$= 0.5 + 0.5 = 1$

② Splitted dataset

True (a_1)	+	–	Total
count	2	1	3
p_i	0.667	0.33	
$-p_i \log_2 p_i$	0.39	0.529	= 0.917

$\text{Entropy}(a_{1\,as}) = 0.917 \approx 0.92$

False (a_1)	+	–	Total
count	1	2	3
p_i	0.33	0.667	
$-p_i \log_2 p_i$	0.53	0.39	= 0.917

$\text{Entropy}(a_{1\,as}) = 0.917 \approx 0.92$

Splitted entropy

$$\text{Entropy}(S_{a1}) = \sum_{i=1}^{n} w_i \text{ Entropy}(P_i)$$

$$= 3/6 * 0.923 + 3/6 * 0.923$$

$$= 0.923$$

Info. gain $= 1 - 0.923$
$= \underline{0.077}$

~~False~~ True (a_2)	+	-	Total
count	2	2	4
P_i	0.5	0.5	
$-P_i \log_2 P_i$	0.5	0.5	~~2~~ 1

false (a_2)	+	-	Total
count	1	1	2
P_i	0.5	0.5	
$-P_i \log_2 P_i$	0.5	0.5	1

Splitted entropy

$$\text{Entropy}(S_{a1}) = \sum_{i=1}^{2} w_i \text{ Entropy}(P_i)$$

$$= 4/6 * 1 + 2/6 * 1$$

$$= 6/6 = 1$$

$Gh = 1 - 1 = 0$

$A_2 \; Gh = \underline{0}$

$\boxed{A1} \rightarrow \boxed{A2}$

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