AI Assignment

Page:
Date: / /

Question:1

(a) Comparing Sampling strategies:-

→ Direct Sampling:-

↳ Drawn sample from probability distribution.

* Strength:-
  - Simple and efficiently works for known distributions.
  - Easy for calculation in small and low Dimension data.

* Weakness:-
  - Does not works well for complex Calculation (distribution) ~~ad~~ and higher dimensions data.

→ Rejection Sampling:-

↳ Sample accepts based on a probability criteria,

* Strength:-
  - Use for unnormalized distributed data.
  - Approximate complex distribution if good proposal (sample) chosen.

* weakness:-
  - unefficient when multiple samples are rejected.
  - Carefully choose sample (proposal) distribution

→ Gibbs Sampling:-
↳ Iterate Samples from Conditional distribution of variables.

* Strength:-
↳ handles high Dimensional distribution
↳ Very helpfull only if Conditional distribution easy to compute.

* weakness.
↳ Slow convergence for poorly chosen value.
↳ Assume conditional independent among other variables.

(b) $P(L/T) = 0.400$ — Given
L- Leisure, T- Train

$n = 100$ sample ~~people~~.
$N_t = 30$ trains } Given

$N_{L/T} = P(L/T) * N_t$

⇒ 0.400×30.
⇒ 12 train's traveller

a → air ; b → business

(c) Given data :- $\begin{cases} P(a) = 0.8 \\ P(b/a) = 0.2 \end{cases}$

↳ $P(a \cap b) = P(a) \times P(b/a)$ → by bay's theorem.

$= 0.8 \times 0.2$

$\boxed{= 0.16}$

(d) Effect of sample size on Direct Sampling :-

Accuracy :-

↳ Large sample sizes reduce bias

↳ Estimate converge to true probabilities.

↳ Laws of large no. applies.

Precision :-

↳ Standard error decrease with $\sqrt{n}$.

↳ interval of confidence became narrow.

↳ More reliable probability estimates.

Implication of Datasets :-

↳ More sample needed for rare events.

↳ Better estimation of conditional probabilities

↳ Improved reliability of novel pattern analysis.

Page:
Date: / /

Q.2 (a) Identify variables and write statements-

b = read book ; j = Access journals ; c = participate in book club

1. $P(b \cup j) = 0.91$
2. $P(j|b) = 0.4$
3. $P(b \cap \bar{j}) = 0.6$
4. $P(c|b) = 320$
5. $P(j \cap \neg b) = 0.227$
6. $P(\bar{b} \cap \bar{j}) = 0.09$
7. $P(j/\bar{b}) = 0.916$
8. $P(c \cap j) = 0.088$
9. $P(c \cup j) = 0.631$
10. $P(j|c) = 0.4$
11. $P(j) = 0.5$

(b) non-negative :- $0 \leq p(a) \leq 1$ all events 'a'.
Normalize :- The sum of all possible outcomes must 1.

$\rightarrow P(b \cup j) = P(b) + P(j) - P(b \cap j)$

$P(b \cap j) = P(b) + P(j) - P(b \cup j)$

$= P(b) + 0.5 - 0.91$

$P(b) \cdot P(j/b) = P(b) - 0.91 + 0.5$

$P(b) \cdot (0.4) = P(b) - 0.91 + 0.5$

$P(b) = \frac{0.41}{0.6}$

$P(b) = \boxed{0.683}$

(c)

B	J	C	P(B, J, C)
0	0	0	0.09
0	0	1	~~0.00~~ 0.163
0	1	0	~~0.187~~
0	1	1	~~0.288~~ 0.04
1	0	0	~~0.41~~ 0.279
1	0	1	~~0.072~~ 0.131
1	1	0	~~0.012~~ 0.225
1	1	1	0.088

(d) Check conditional independence of joint distribution

↳ check if B & C are conditionally indep- given J :-

$$p(B \cap C / J) = p(B/J) \cdot p(C/J)$$

using Joint distribution:-

$$p(B \cap C \cap J) = p(B/J) \cdot p(C/J) \cdot p(J)$$

from table
we compute $p(C/J) = 0.176$
$p(B/J) = 0.546$
$\cancel{p(J)}$

$$p(B \cap C \cap J) = 0.96 = \boxed{0.176 \times 0.546}$$

Page :
Date: / /

Que 3

(a) Bayesian Inference formulae :-

A – Adversarial perturbation
B – Backdoor attacks
M – misclassify alarm

– A & B are Independent
$$P(A \cap B) = P(A) \times P(B)$$

$$\Rightarrow P(A/M, B) = \frac{P(M/A, B) \times P(A/B)}{P(M/B)}$$

$\Rightarrow$ A independent B $\Rightarrow P(A/B) = P(A)$

So, that :- $P(A/M, B) \neq P(A/M)$

(b) Probability parameters :-
$\Rightarrow$ Prior probabilities :-
$P(A)$ = probability of Adversarial perturbation.
$P(B)$ = probability of Backdoor attacks
$P(C)$ = miss classifier alarm.

– Likelihood :-
$P(M/A)$ = misclassifier given A
$P(M/B)$ = misclassifier given B
$P(M/A, B)$ = misclassifier given A & B.

→ Posterior :-

$P(A/M)$:- A of given M ~~was~~ Misclassified

$P(A/M,B)$ = probability of A given Misclassified & B.

(c)

1. Away effect :-

- When B is observed.
- $P(A/M,B) < P(A/M)$
- This reduction occurs ~~because~~ B provides an alternative of M.

2. Reasoning :-

↳ Misclassified determined by ~~by~~ A or B

↳ If B is their then A is comparatively less.

$$\to P(A/M,B) = \frac{P(M/A,B) \times P(A)}{P(M/B)}$$