

CSE422 Artificial Intelligence

QUIZ 3 Sec-13 [IBU]

NAME:

ID:

Sec:

Total Marks: 15, Duration: 20 Minutes

Scenario

You are developing a machine learning model to predict the likelihood of a student passing, failing, or withdrawing from a course based on the presence of three study habits: “Studying Daily”, “Attending Lectures”, and “Group Study”.

You have the following information:

$$P(\text{Pass}) = 0.6, \quad P(\text{Fail}) = 0.3, \quad P(\text{Withdraw}) = 0.1$$

For each study habit and outcome, the following conditional probabilities are given:

$$\begin{aligned} P(\text{Studying Daily}|\text{Pass}) &= 0.9, & P(\text{Attending Lectures}|\text{Pass}) &= 0.8, & P(\text{Group Study}|\text{Pass}) &= 0.7 \\ P(\text{Studying Daily}|\text{Fail}) &= 0.3, & P(\text{Attending Lectures}|\text{Fail}) &= 0.4, & P(\text{Group Study}|\text{Fail}) &= 0.2 \\ P(\text{Studying Daily}|\text{Withdraw}) &= 0.5, & P(\text{Attending Lectures}|\text{Withdraw}) &= 0.6, & & \\ & & P(\text{Group Study}|\text{Withdraw}) &= 0.4 & & \end{aligned}$$

A student exhibits two study habits: “Studying Daily”, “Attending Lectures”, but does not exhibit “Group Study”. You want to calculate the probability that the student will withdraw from the course.

Questions:

1. What is the assumption of Naive Bayes Classification. [2 Marks]
 2. Compute $P(\text{Studying Daily}, \text{Attending Lectures}, \text{No Group Study})$. [7 Marks]
 3. Using Bayes’ rule and Naive Bayes’ assumption for classification, compute the posterior probability that a student will “Withdraw”, given that they study daily, attend lectures but does not do group study. You may use result from previous answers. [6 Marks]
-

P(studying, Attending lectures, No group st)

$$P(S) P(L) P(\neg GS)$$

$$P(S) = P(\text{study} \cap \text{Pass}) \\ + P(\text{study} \cap \text{Fail}) \\ + P(\text{study} \cap \text{With})$$

$$= P(S|P)P(P) + P(S|F)P(F) \\ + P(S|W)P(W)$$

$$P(L) = P(L \cap P) + P(L \cap F) + P(L \cap W) \\ = P(L|P)P(P) + P(L|F)P(F) + P(L|W)P(W)$$

$$P(\neg GS) = 1 - P(GS)$$

$$= 1 - (P(G|P)P(P) + P(G|F)P(F) \\ + P(G|W)P(W))$$

$$P(S, L, \neg GS) = P(S) P(L) P(\neg GS)$$



$$P(W | S, L, \neg AS) = \frac{P(S, L, \neg AS | W) P(W)}{P(S, L, \neg AS)}$$

Naive Assumption.

$$= \frac{P(S | W) P(L | W) P(\neg AS | W) P(W)}{P(S, L, \neg AS)}$$

$$P(\neg AS | W) = 1 - P(AS | W)$$

Use all this and solve