

Homework # 8

In this LAB, you will practice the Naive bayes and Bayesian network. (this assignment does not require python coding).

1. Consider the data set shown in Table 1 and estimate the following probabilities: (without performing the Laplace smoothing). Show all your work. [12.5pts]
 - a. $P(A = 0 \mid +)$
 - b. $P(A = 0 \mid -)$
 - c. $P(B = 1 \mid +)$
 - d. $P(B = 1 \mid -)$
 - e. $P(C = 0 \mid +)$
 - f. $P(C = 0 \mid -)$

Record	A	B	C	Class
1	0	0	0	+
2	0	0	1	-
3	0	1	1	-
4	0	1	1	-
5	0	0	1	+
6	1	0	1	+
7	1	0	1	-
8	1	0	1	-
9	1	1	1	+
10	1	0	1	+

Table 1

2. Use the estimate of conditional probabilities given in the previous question to predict the class label for a test sample ($A = 0, B = 1, C = 0$) using the Naïve Bayes approach. What is the predicted label for the test sample? Show all your work. [10pts]
3. Consider the data set shown in Table 1 and estimate the following probabilities: (With Laplace smoothing and $\alpha = 2$). Show all your work. [12.5pts]
 - a. $P(A = 0 \mid +)$
 - b. $P(A = 0 \mid -)$
 - c. $P(B = 1 \mid +)$
 - d. $P(B = 1 \mid -)$
 - e. $P(C = 0 \mid +)$
 - f. $P(C = 0 \mid -)$

4. Use the estimate of conditional probabilities given in the previous question to predict the class label for a test sample ($A = 0, B = 1, C = 0$) using the Naïve Bayes approach. What is the predicted label for the test sample? Show all your work. [7.5pts]
5. Compare the label prediction in question 2 and 4. Are the results the same? Which method is better and why? [5pts]
6. Consider the dataset shown in Table 2. Estimate the following conditional probabilities. Show all your work. [12.5pts]
 - a. $P(A = 1 \mid +)$
 - b. $P(A = 1 \mid -)$
 - c. $P(B = 1 \mid +)$
 - d. $P(B = 1 \mid -)$
 - e. $P(C = 1 \mid +)$
 - f. $P(C = 1 \mid -)$

Instance	A	B	C	Class
1	0	0	1	-
2	1	0	1	+
3	0	1	0	-
4	1	0	0	-
5	1	0	1	+
6	0	0	1	+
7	1	1	0	-
8	0	0	0	-
9	0	1	0	+
10	1	1	1	+

Table 2

7. Use the conditional probabilities in the previous question to predict the class label for a test sample ($A = 1, B = 1, C = 1$) using the Naïve Bayes approach. What is the predicted label for the test sample? Show all your work. [10pts]
8. Two events can cause grass to be wet as shown in figure 1: an active sprinkler or rain. Rain has a direct effect on the use of the sprinkler. Using the Bayesian network and given that the grass is wet, find out if it rained or not? Show all your work. [30pts]

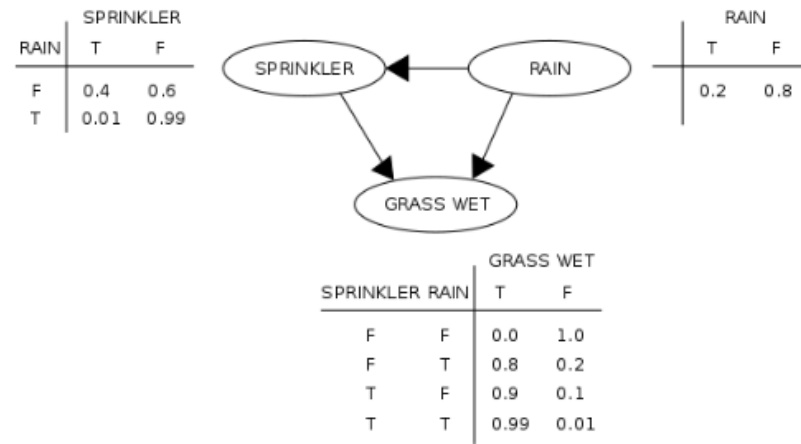


Figure 1

Upload a formal **report (as a single pdf)** through canvas by the due date.