Homework

Bayesian Learning

1. Redo the case study in pp. 63, Chap. 3 Uncertainty management in rule-based systems as follows.

Probability	*Hypothesis*		
	$i = 1$	$i = 2$	$i = 3$
$p(H_i)$	0.40	0.35	0.25
$p(E_1 \mid H_i)$	0.3	0.8	0.5
$p(E_2 \mid H_i)$	0.9	0.0	0.7
$p(E_3 \mid H_i)$	0.6	0.7	0.9

Using the iterative approach to compute the posteriori probabilities as shown in class, asssuming that the evidences appear in the order of E3, E1, and E2. You should illustrate the computation process for $P(h_i|\mathbf{d})$ and $P(X|\mathbf{d})$, the prediction about the next evidence X from the observed value $\mathbf{d}$, such as $P(E1|E3)$ and $P(E2|E3\ E1)$.

2. You are about to developing a decision support system using Bayesian Learning for recommending activities according to weather conditions. Assume that the uncertainties is as follows:

Prior probabilities:	Likelihood
P(swim) = 0.3 P(golf) = 0.25 P(hiking) = 0.45	P(hot | swim) = 0.8 P(sunny | swim) = 0.7 P(dry | swim) = 0.2 P(hot | golf) = 0.4 P(sunny | golf) = 0.9 P(dry | golf) = 0.3 P(hot | hiking) = 0.4 P(unny | hiking) = 0.8 P(dry | hiking) = 0.7

Modify the program cherry-lime.ipynb (https://colab.research.google.com/drive/1FNJ9RQsctrPZgjNIigbW7RkLnlCaQMbx?usp=sharing) to answer the following questions.

(1) After observing the evidences: hot, sunny, dry in order, what activity will be suggested? What will be the next evidence showing up at this time?

(2) Same as (1) but the evidence order is sunny, sunny, sunny, sunny, sunny.

(3) Same as (1) but the evidence order is hot, hot, hot, hot, hot

(4) Same as (1) but the evidence order is dry, dry, dry, dry, dry

(5) Redo (2) thru (4). Plot the corresponding graphs for $P(h_i|\mathbf{d})$ and $P(X|\mathbf{d})$ and discuss some insights you found from this experiment.

Ps. You should provide the colab URL of the program you modified.

3. Regarding to Problem 2:

(1) Redo Problem 2, assuming the three prior hypotheses follow a uniform distribution, i.e., P(swim) == P(swim) == P(swim) == 0.33.

(2) Conduct a comparative analysis of the results using the two different prior probabilities mentioned above by highlighting the insights you identified.