Assignment 1

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Download all python codes from

https://github.com/GauthamBellamkonda/AI1103/tree/main/Assignment1/Codes

and latex codes from

https://github.com/GauthamBellamkonda/AI1103/tree/main/Assignment1

Problem

(Prob 2.3) Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduces the risk of heart attack by 30% and prescription of certain drug reduces its chances by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?

Solution

Let $H \in \{0, 1\}$ denote the random variable of the patient having a heart attack, $A \in \{0, 1\}$ denote the random variable of the patient taking a meditation and yoga course, or the patient taking the drug. ($A = 0$ if the patient took a meditation and yoga course, and $A = 1$ if the patient took the prescription of the drug.)
Given that,

$$\begin{aligned}
\Pr(H = 1) &= 0.4 \\
\Pr(A = 0) &= \Pr(A = 1) \\
\Pr(H = 1|A = 0) &= \Pr(H = 1)\,(1 - 0.30) \\
&= 0.28 \\
\Pr(H = 1|A = 1) &= \Pr(H = 1)\,(1 - 0.25) \\
&= 0.3
\end{aligned}$$

Therefore, by Bayes' Theorem

$$\Pr(A = 0|H = 1) = \frac{\Pr(H = 1|A = 0)\Pr(A = 0)}{\sum_{i=0}^{1} \Pr(H = 1|A = i)\Pr(A = i)}$$

We can cancel $\Pr(A = 1)$ and $\Pr(A = 0)$ from the numerator and denominator as they are given to be equal.

$$\begin{aligned}
\therefore \Pr(A = 0|H = 1) &= \frac{\Pr(H = 1|A = 0)}{\Pr(H = 1|A = 0) + \Pr(H = 1|A = 1)} \\
&= \frac{0.28}{0.28 + 0.3} \\
&= \frac{0.28}{0.58} \\
&= \frac{14}{29} \\
&\approx 0.48275862069
\end{aligned}$$

Therefore, the probability that the patient followed a course of meditation and yoga, given that he suffers a heart attack is 0.48275862069