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 twp 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, $Y \in \{0,1\}$ denote the random variable of the patient taking a meditation and yoga course, and $D \in \{0,1\}$ denote the random variable whether the patient takes the drug.
Given that,

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

Therefore, by Bayes' Theorem

$$\Pr(Y=1|H=1) = \frac{\Pr(H=1|Y=1)\Pr(Y=1)}{\Pr(H=1|Y=1)\Pr(Y=1)+\Pr(H=1|D=1)\Pr(D=1)}$$

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

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

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