Engineering Statistics Lecture IX

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Abstract

HW #1 is due October 1, 2019
HW #2 is due October 10, 2019:

- Section 2.3 #23-37 odd
- Section 2.4 #49-65 odd
- Section 2.5 #73-93 odd

1 Example: Noah again

Spoz Noah works at an electronics store. Let event A be the case in which a customer buys a stylus and B be the case where a customer buys an external drive, such that S is the set of cases wherein a customer buys a laptop. Spoz that $P(A) = \frac{1}{4}$ and $P(B) = \frac{1}{5}$ and that $P(A \cap B) = \frac{1}{10}$.

What is $P(B|A)$?

$$\begin{aligned} P(B|A) &= \frac{P(B \cap A)}{P(A)} \\ &= \frac{.10}{.25} \\ &= 0.4 \\ P(A|B) &= \frac{P(A \cap B)}{P(B)} \\ &= \frac{.10}{.20} \\ &= 0.5 \end{aligned}$$

B is independent from A because $P(A|B) \neq P(A)$.

$$(A\ indep.\ B) \iff P(A|B) = P(A) \tag{1}$$

2 Brian at the ER

Spoz Brian is working the Friday night shift at the ER: Three events: Pediatric, Geriatric, Average-age adults.

$$\begin{aligned} P(Pediatric) &= 0.25 \\ P(Geriatric) &= 0.15 \\ P(Average) &= 0.60 \end{aligned}$$

You might notice that the three events above are the entire sample set and, therefore, definitively mutually exclusive.

Now, B is the event that a patient will return within 3 days:

$$\begin{aligned} P(B|Pediatric) &= 0.10 \\ P(B|Geriatric) &= 0.80 \\ P(B|Average) &= 0.50 \end{aligned}$$

Note that just because the initial given cases were independent does NOT mean that the cases of them being a given for a particular event will add up.

$$\begin{aligned} P(Pediatric|B) &= P(B|Pediatric)\frac{P(Pediatric)}{P(B)} \\ P(Geriatric|B) &= P(B|Geriatric)\frac{P(Geriatric)}{P(B)} \\ P(Average|B) &= P(B|Average)\frac{P(Average)}{P(B)} \end{aligned}$$

$$\begin{aligned} P(B) = & \quad P(B|Pediatric) * P(Pediatric) \\ + & \quad P(B|Geriatric) * P(Geriatric) \\ + & \quad P(B|Average) * P(Average) \\ = & \quad (0.1)(0.25) + (0.80)(0.15) + (0.50)(0.60) \\ = & \quad 0.181 \end{aligned}$$

Therefore,

$$\begin{aligned} P(Pediatric|B) &= 0.10\frac{0.25}{0.181} \\ P(Geriatric|B) &= 0.80\frac{0.15}{0.181} \\ P(Average|B) &= 0.60\frac{0.50}{0.181} \end{aligned}$$

Which doesn't make sense but still makes adequate use of the formulas, so I'm going to leave it here.