Error in heuristics

BMC Beginners I

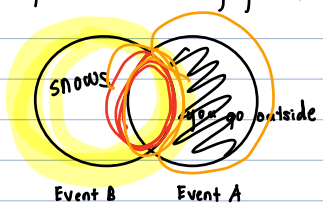
3-8-23

Bayes' Theorem

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})}$$

$\bar{A}$ = Opposite of Event A

"Probability of Event A occurring given Event B occurs"



$P(\text{you go outside} \mid \text{snowing}) = \frac{P(A \cap B)}{P(B)} =$

$P(B) = \frac{100}{365} \approx \frac{1}{4}$

$P(A \cap B) = \frac{50}{365} \approx \frac{1}{8}$

↳ AND

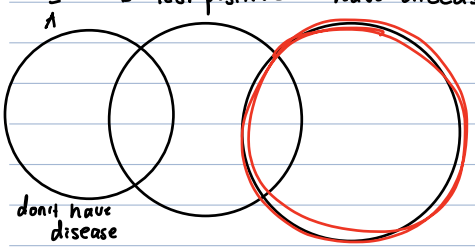
$P(A|B) = \frac{\frac{1}{8}}{\frac{1}{4}} = \frac{1}{2}$

$|$ = Given

$\cap$ = AND

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})}$$

B = test positive A = have disease



$P(B|A) = 98\%$

$P(A) = 10\%$

$P(B|\bar{A}) = P(\text{test positive} \mid \text{don't have disease}) = 25\%$

$P(\bar{A}) = 1 - P(A) = 90\%$

$P(A|B)$

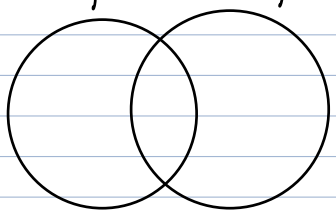
$= P(\text{have disease} \mid \text{test positive}) = \frac{98\%\,(10\%)}{98\%\,(10\%) + 25\%\,(90\%)}$ ← 0.98 (0.1)

$= \boxed{30.3\%}$

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})} = 1$$

Hand sanitizer claims Kills 99%

A: have germs B: Kills germs



$P(B|A) = 99\%$

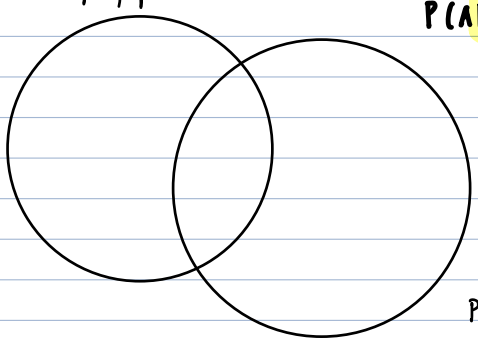
$P(A) = 65\%$

$P(\bar{A}) = 1 - P(A) = 35\%$

$P(B|\bar{A})$

↳ P(Killing germs | don't have germs) = 0

B: play piano A: reminder



$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})}$$

$P(B|A) = 99\%$

$P(A) = 75\%$

$P(\bar{A}) = 1 - P(A) = 25\%$

$P(B|\bar{A}) = 50\%$

$$P(A|B) = \frac{0.99(0.75)}{0.99(0.75) + 0.5(0.25)}$$

$$= 85.59\% \approx 86\%$$