

Practice Problem 4

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February 15, 2024

Problem 1 — Do I believe that a patient with the following symptoms has the flu?
 $\{Y_c, N_r, Mild_h, Y_f, ?_{flu}\}$

Answer

$$P(C | X) = \frac{P(X|C)P(C)}{P(X)}$$

We don't calculate $P(X)$ since it is the same for all cases.

$$P(Y_{flu} | \{Y_c, N_r, Mild_h, Y_f\}) \propto P(Y_c | Y_{flu}) \cdot P(N_r | Y_{flu}) \cdot P(Mild_h | Y_{flu}) \cdot P(Y_f | Y_{flu}) \cdot P(Y_{flu})$$

$$P(Y_c | Y_{flu}) = \frac{3}{5}$$

$$P(N_r | Y_{flu}) = \frac{5}{5}$$

$$P(Mild_h | Y_{flu}) = \frac{2}{5}$$

$$P(Y_f | Y_{flu}) = \frac{4}{5}$$

$$P(Y_{flu}) = \frac{5}{8}$$

Multiplying these together gives us $\frac{3}{5} \cdot \frac{5}{5} \cdot \frac{2}{5} \cdot \frac{4}{5} \cdot \frac{5}{8}$

$$= \frac{3}{25}$$

$$P(N_{flu} | \{Y_c, N_r, Mild_h, Y_f\}) \propto P(Y_c | N_{flu}) \cdot P(N_r | N_{flu}) \cdot P(Mild_h | N_{flu}) \cdot P(Y_f | N_{flu})$$

$$P(Y_c | N_{flu}) = \frac{1}{3}$$

$$P(N_r | N_{flu}) = \frac{2}{3}$$

$$P(Mild_h | N_{flu}) = \frac{1}{3}$$

$$P(Y_f | N_{flu}) = \frac{1}{3}$$

Multiplying these together gives us $\frac{1}{3} \cdot \frac{2}{3} \cdot \frac{1}{3} \cdot \frac{1}{3}$

$$= \frac{2}{81}$$

\therefore , the patient likely has the flu.