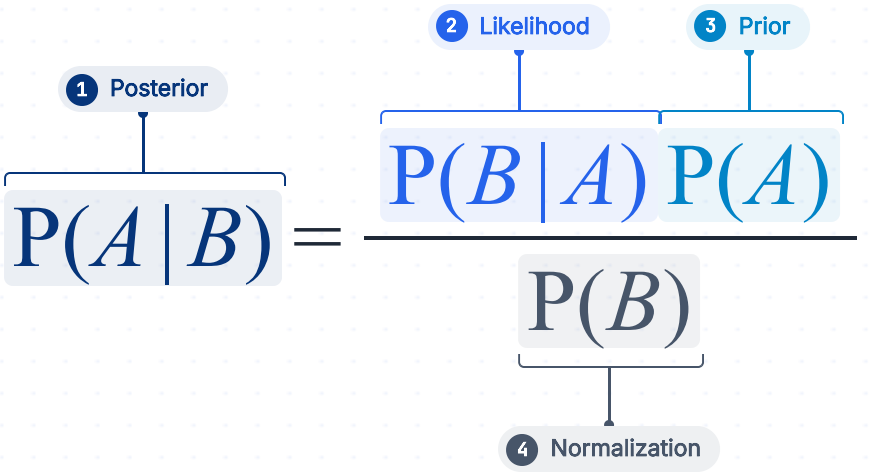
THE FORMULA, PART BY PART

Bayes' theorem

start from the prior, weigh it by how well the observation fits, rescale so everything adds up to 1



1 Posterior $P(A \mid B)$

The output of the formula: the probability of A after the observation B. Example: machine 1 makes 90% of the parts with a 2% defect rate, machine 2 makes 10% with 10%. For a defective part, P(machine 1 | defective) = 0.018 / 0.028 = 9/14 ≈ 0.64.

2 Likelihood $P(B \mid A)$

How compatible the observation B is with A. Comparing likelihoods alone ignores how common each hypothesis is. Example: P(defective | machine 1) = 0.02, lower than machine 2's 0.10, yet machine 1 is still the more likely source.

3 Prior $P(A)$

The starting probability of A, before B is taken into account. The part most often dropped. Example: P(machine 1) = 0.9, and it is this 0.9 that outweighs the lower defect rate.

4 Normalization $P(B)$

The overall probability of B across all hypotheses, found by total probability. Example: P(defective) = 0.9 · 0.02 + 0.1 · 0.10 = 0.018 + 0.010 = 0.028.