

Bayes' Theorem

Mathematics

Turning a prior belief into a posterior one using the evidence.

Bayes turns a prior into a posterior by weighting it with the likelihood of the observed evidence.

$$P(A \mid B) = P(B \mid A) P(A) / P(B)$$

Prior $P(A) = 0.01$

The base rate dominates.

Posterior can stay low

The denominator $P(B)$

Total probability.

$$\sum P(B \mid A_i) P(A_i)$$

Odds form

Often the quicker route.

Prior odds $\times$ likelihood ratio

THE COMMON MISTAKE

✗ **Reading the likelihood as the posterior**

✓ **Weighting the likelihood by the prior**

A signal that is 99% accurate for an event affecting 1 in 10,000 still produces mostly false alarms. The base rate does most of the work.

Posterior is proportional to likelihood times prior. The denominator only normalises, which is why the odds form is often quicker.