

Bayes Theorem: Takeaways

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Concepts

- Independence, dependence, and exclusivity describe the relationship between events (two or more events), and they have different mathematical meanings:

Independence $\implies P(A \cap B) = P(A) \cdot P(B)$

Dependence $\implies P(A \cap B) = P(A) \cdot P(B|A)$

Exclusivity $\implies P(A \cap B) = 0$

- If two events are **exhaustive**, it means they make up the whole sample space Ω .
- **The law of total probability** can be expressed mathematically as:

$$P(A) = P(B_1) \cdot P(A|B_1) + P(B_2) \cdot P(A|B_2) + \dots + P(B_n) \cdot P(A|B_n)$$

- The law of total probability is often written using the summation sign Σ :

$$P(A) = \sum_{i=1}^n P(B_i) \cdot P(A|B_i)$$

- For any events A and B, we can use **Bayes' theorem** to calculate $P(A|B)$:

$$P(A|B) = \frac{P(A) \cdot P(B|A)}{\sum_{i=1}^n P(A_i) \cdot P(B|A_i)}$$

- $P(A|B)$ is the **posterior probability** of A *after* B happens ("posterior" means "after"). $P(A)$ is the **prior probability** of A *before* B happens ("prior" means "before").

Resources

- [An intuitive approach to understanding Bayes' theorem](#)
- [False positives, false negatives, and Bayes' theorem](#)