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
$$\Rightarrow P(A \cap B) = P(A) \cdot P(B)$$

Dependence $\Rightarrow P(A \cap B) = P(A) \cdot P(B \mid A)$
Exclusivity $\Rightarrow P(A \cap B) = 0$

- 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:

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

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

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

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

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

• 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



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