

UNCERTAINTY IN MACHINE LEARNING:

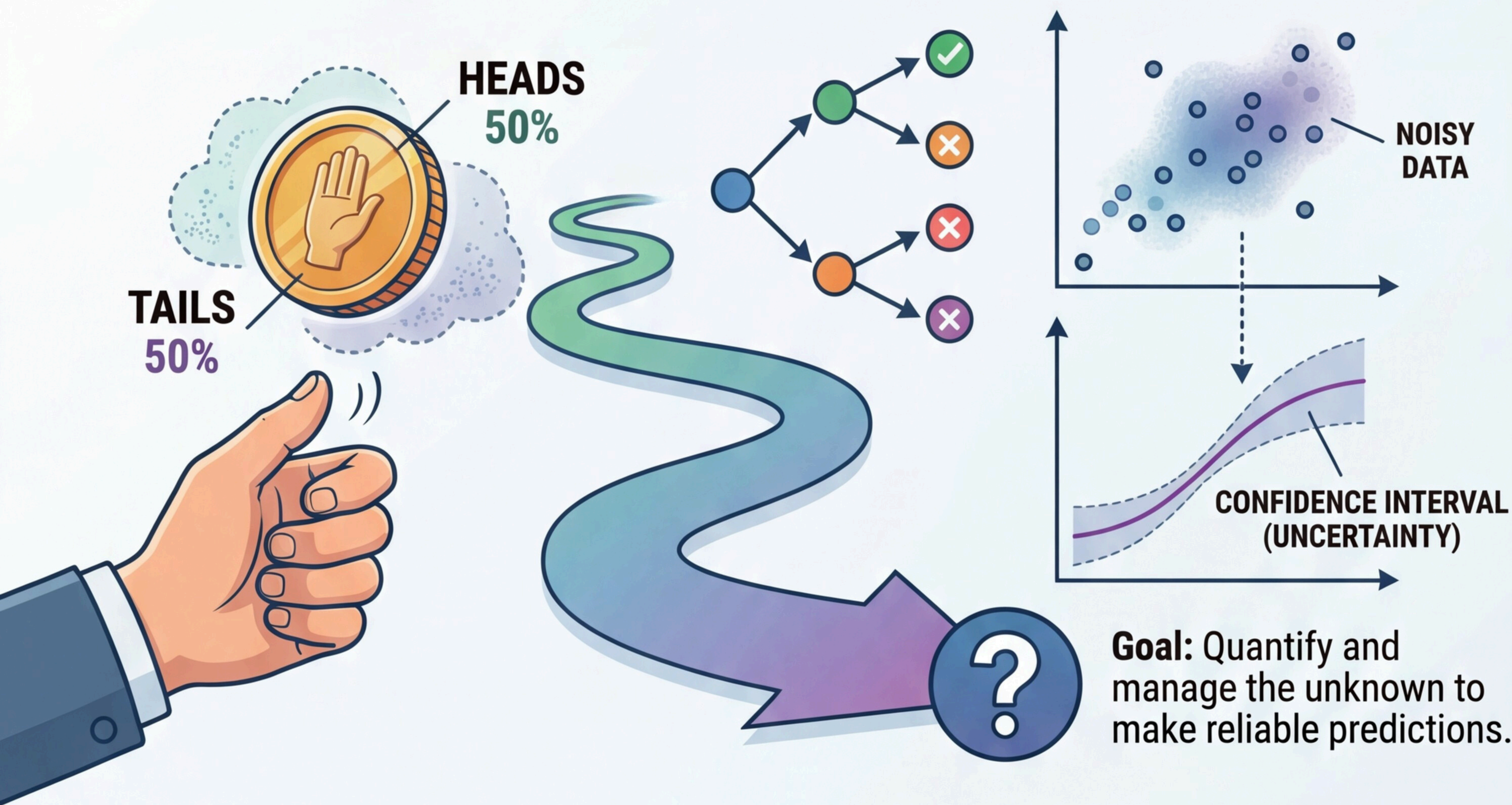
Probability & Noise



WHAT IS UNCERTAINTY?

The lack of certainty or the state of limited knowledge about an outcome, often quantified using probability.

THE ANALOGY: PROBABILITY & THE UNKNOWN



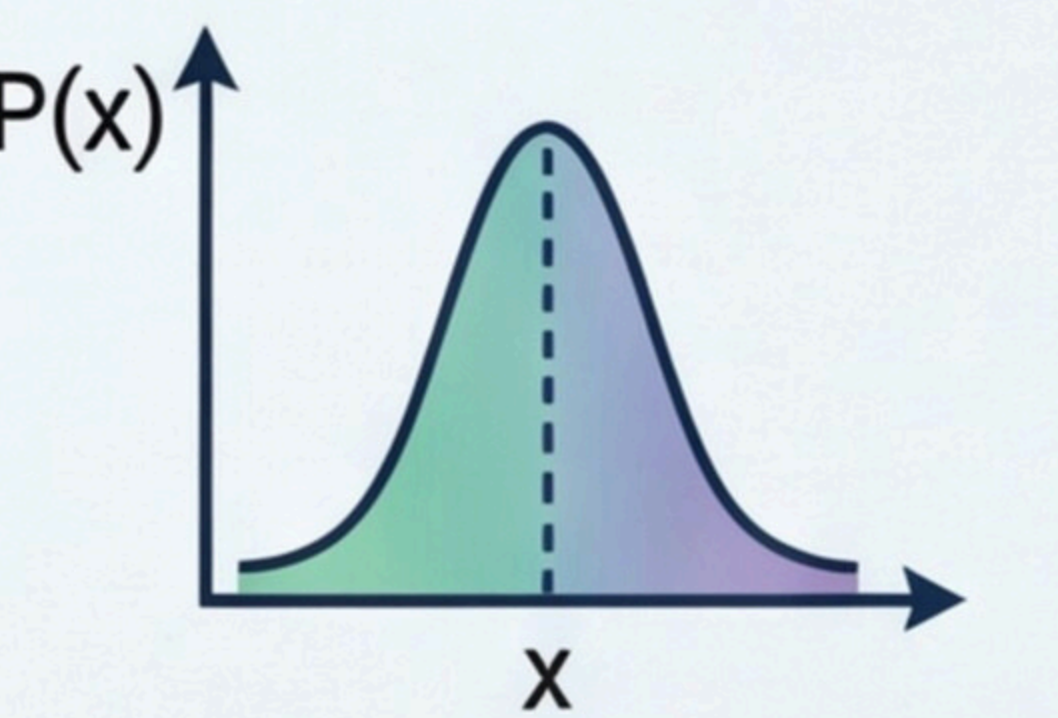
KEY COMPONENTS & TYPES



1. PROBABILITY

A measure of the likelihood of an event occurring.

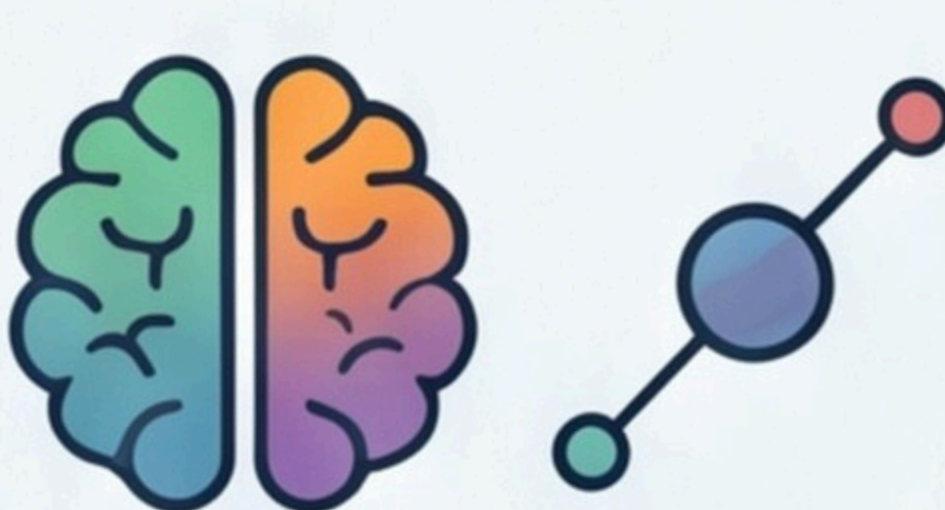
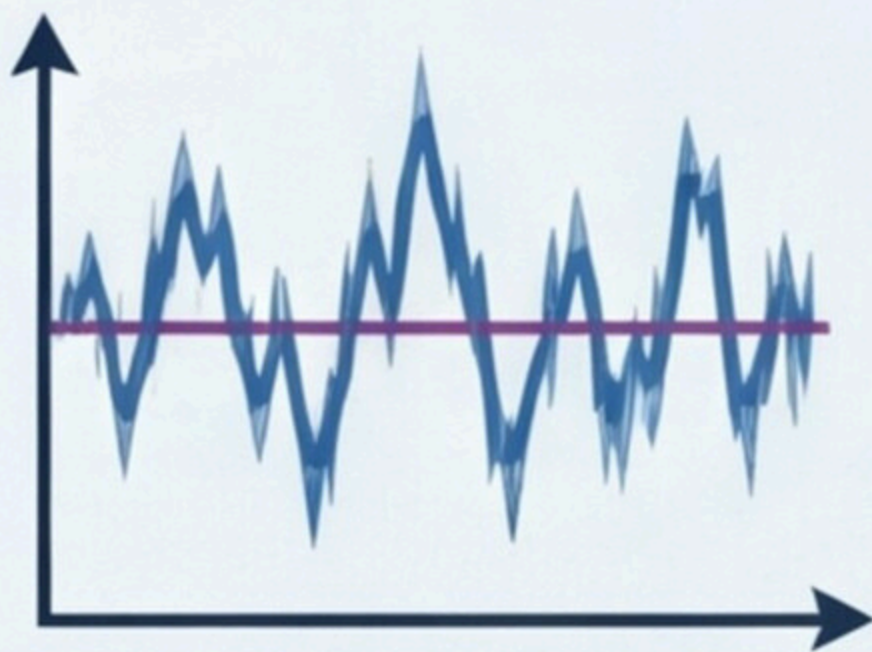
Used to model uncertainty.



2. NOISE

Irrelevant or meaningless data that obscures the true signal.

Can be random or systematic.



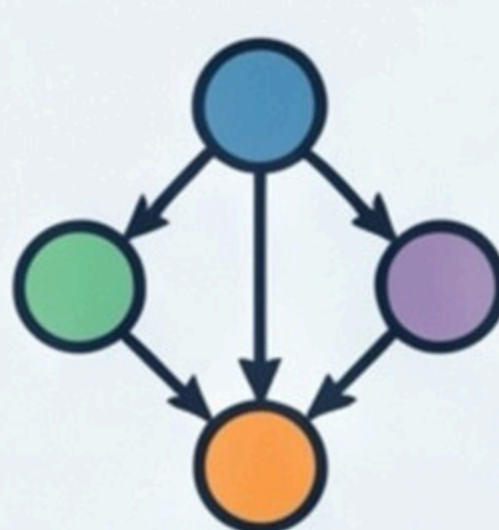
3. TYPES OF UNCERTAINTY

Aleatoric (Data):
Inherent randomness.

Epistemic (Model):
Lack of knowledge.

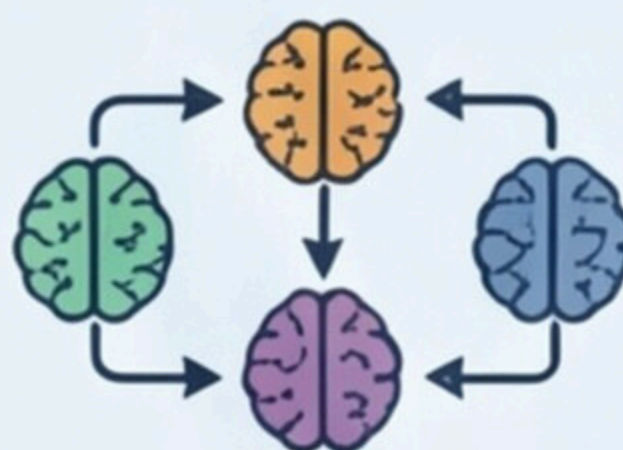
Aleatoric is irreducible, Epistemic can be reduced with more data.

MANAGING UNCERTAINTY



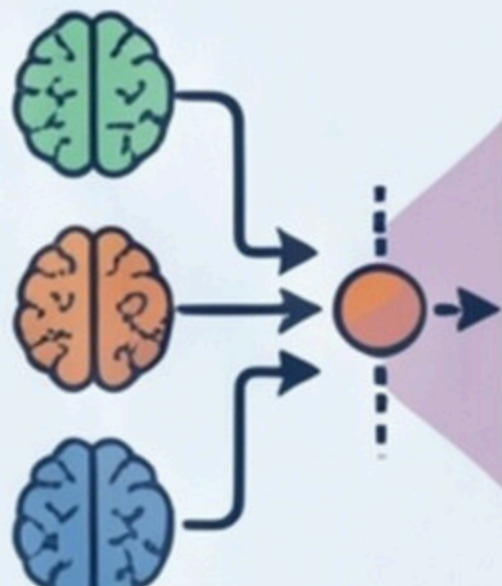
PROBABILISTIC MODELS

Models that output probability distributions instead of single values.



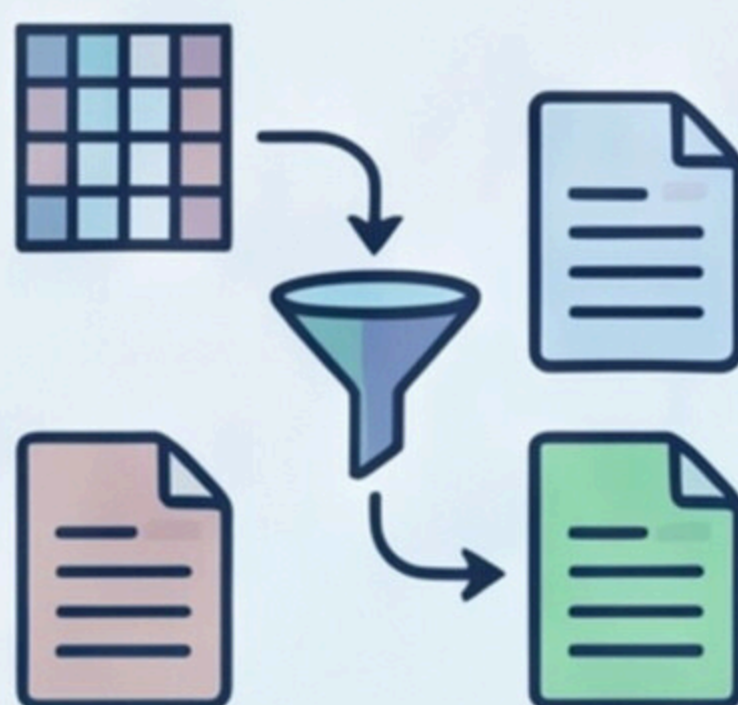
ENSEMBLE METHODS

Combining predictions from multiple models to reduce variance and estimate uncertainty.



DATA CLEANING & VALIDATION

Reducing noise and errors in data to improve model reliability.



KEY TAKEAWAYS

- ✓ Uncertainty is inherent in real-world data and models.
- ✓ Distinguishing between aleatoric and epistemic uncertainty is crucial.
- ✓ Managing uncertainty leads to more robust and trustworthy AI systems.

