

Representing Uncertainty + Probabilistic Learning

R&N Chapter 13
A bit of 20.2

Uncertainty

- Most real-world problems deal with uncertain information
 - Diagnosis: Likely disease given observed symptoms
 - Equipment repair: Likely component failure given sensor reading
 - Help desk: Likely operation based on past operations
 - Cannot be represented by deterministic rules
Headache => Fever

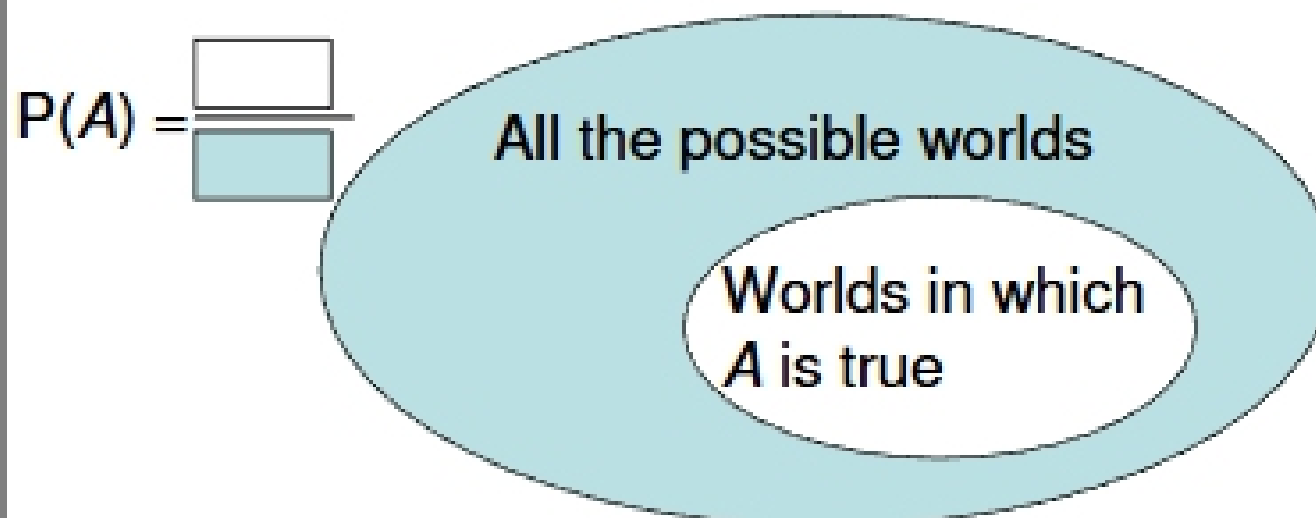
Uncertainty

- Correct framework for representing uncertainty: Probability
- Outline:
 - Review of basic probability tools (much of it well-known, but still important to review)
 - Bayes rule and its use in uncertain reasoning and probabilistic learning

Probability

- $P(A)$ = Probability of event A = percentage of all possible worlds in which A is true.

$$0 \leq P(A) \leq 1$$



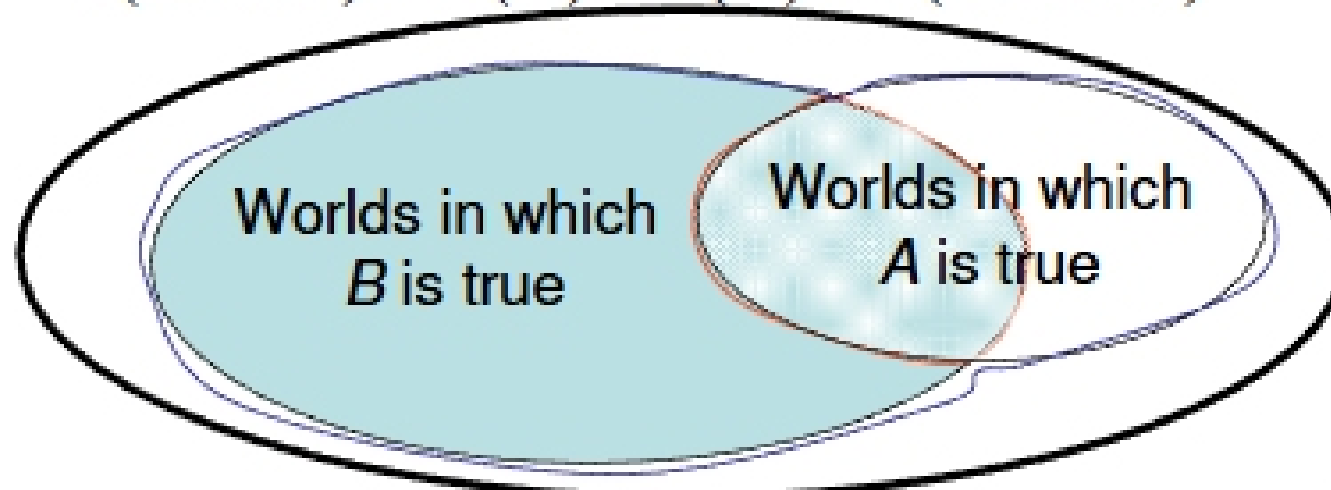
Probability

$$0 \leq P(A) \leq 1$$

$$P(\textit{True}) = 1$$

$$P(\textit{False}) = 0$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$



Probability

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- Other ideas:
 - Fuzzy logic
 - Non-monotonic logic
 - Multi-valued logic
 - Evidence theory (Dempster-Shafer)
- Probability is the only system that is "consistent"