The Role of Logic & Knowledge in AI

Commonsense problem solving, planning, & dialogue require large amounts of factual knowledge:

- Consider “Alicia’s holiday” (previous notes); Randy Bausch’s decision against further chemotherapy
- Story understanding (e.g., why the wolf in LRRH didn’t attack her in the first encounter)
- Truman Everts in Yellowstone; a bear comes to your camp breakfast

How much do you know?

- e.g., you know general facts about most things in a dictionary (say 30,000 X ??)
- general facts about (various kinds of) people
- Specific facts about hundreds of people (including mental aspects), what they do/did ...
  especially about yourself!
- typical situations and patterns of events in the world, ways of achieving goals
- specific facts about history, movies, sports, politics, music, crime, math, science, literature, …
- a doctor might know most of Current Medical Diagnosis and Treatment (& then some!)
- technical stuff, math, CSC, etc., etc.!

We use all this to think about & function in the world!
The road to knowledge & the KA bottleneck

• **Factual knowledge engineering**: e.g., Cyc (Doug Lenat); learn by being told;

• **Rule-based systems**: if-then rule engineering; e.g., John Laird, SOAR;

  NB: symbolic reasoning is also rule-based (patterns-to-patterns):

  Given: [[fact1] OR [fact2]], (not [fact2])
  Conclude: [fact1]

  Given: Bird(x)
  Conclude: Flies(x)

• **Neobehaviorism** (subsumption architecture); e.g., Rodney Brooks – Roomba, PackBot (mine detection); BTW, see his “My Dated Predictions” blog

• **Universal ML**: DNNs, e.g., OpenAI’s GPT-3, Markram’s Blue (mouse) Brain, Chris Eliasmith, ...

• **Simulated evolution/ genetic programming**

  - *Only the first and second have shown a capacity for competent reasoning and planning.*
  - They are high-level (“deliberate” reasoning) while DNNs model analogical “intuition”.
  - We need to combine higher-level, deliberate methods with intuitive, analogical ones.
  - We need one-shot and few-shot learning methods (here: “1st readers” => learn schemas)

  “Lecture 1” also has comments on (a) declarative “vs” procedural knowledge, and (b) B & L on pro’s of logic; entailment, “knowing”, soundness & completeness.