Artificial Intelligence 1

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Overview

Chapter 1: Summary

- What is "Artificial Intelligence?"
- History of AI = History of Computer Science
- Humans and rationality
- Strong and weak AI hypothesis
- Turing test, the Chinese room, Winograd schemes
- AI has many facets

Chapter 2.1: Summary

- Syntax and semantics of formal logics
- Propositional logic
  - Syntax: signature, $\wedge$, $\vee$, $\neg$
  - Semantics: interpretations, models, satisfaction relation
  - Inference, equivalence
  - Satisfiability, CNF, SAT
- First-order logic
  - Syntax: signature, variables, terms, atoms, $\wedge$, $\vee$, $\neg$, $\forall$, $\exists$
  - Semantics: interpretations, variable assignments, models, satisfaction relation
  - Automatic theorem proving

Chapter 2.2: Summary

- First-order logic and Horn logic
- Prolog programs
  - data base D
  - rule base R
- Prolog interpreter SWI-Prolog
- Lists and list operations
- Cut operator, text output

Chapter 3.1: Summary

- Uninformed Search: we have no further information besides the state transition relation
- General strategy: extend paths incrementally starting from the start node
- Search strategies
  - Depth-first search
  - Breadth-first search
  - Iterative depth-first search
  - Bidirectional search

Chapter 3.2: Summary

- Idea of informed search: “guess well” the next best state
- Use heuristics to evaluate states
  - Admissible heuristics
  - Dominance
- Algorithms
  - Greedy best-first search
  - A*

Chapter 3.3: Summary

- Situation calculus
  - Situations $\neq$ states
  - Fluents: situation-dependent relations
  - Actions: preconditions and effects
- STRIPS
  - Simple planning language
  - Actions are triples (C, D, A)
  - Simple depth-first search algorithm r-strips

Chapter 4.1: Summary

- Default rules of the form

$$\delta = \frac{\phi : \psi_1, \ldots, \psi_n}{\chi}$$

  represent plausible (but not necessarily generally valid) rules
- Extensions: deductively closed, include facts, closed under default application
- Fix point characterisation of extensions
- Computing extensions with process trees
- Normal default theories and semi-monotony

Chapter 4.2: Summary

- extended logic programs contain rules of the form

$$r: \qquad H \leftarrow A_1, \ldots, A_n, \texttt{not}\ B_1, \ldots, \texttt{not}\ B_m.$$

- grounding of first-order rules
- states, closed states
- minimal models of programs without default negation
- Gelfond-Lifschitz-Reduct and answer sets
- Answer sets and default extensions

Chapter 4.3: Summary

- Abstract argumentation frameworks $\mathrm{AF} = (\mathrm{Arg}, \mathrm{R})$
- Conflict-freeness, defense, admissibility
- Characteristic function
- Semantics
  - Preferred semantics
  - Grounded semantics
  - Complete semantics
  - Stable semantics

Chapter 5.1: Summary

- A simple agent model of a reflex-based agent is realisiert through a function $act : P \to A$
- Model-based agent with functions

$$upd : P \times M \to M \qquad act : M \to A$$

- The BDI model: *Beliefs*, *Desires*, *Intentions*
  - Deliberation and means-end reasoning
  - Realised through the functions *brf*, *options*, *filter*, *plan*, *execute*
  - Self-commitment towards intentions and plans