

Artificial Intelligence – Exam 1 Outline – Fall 2019

Introduction

- Definition of AI
- Four approaches to AI
 - Acting humanly
 - Thinking humanly
 - Thinking rationally
 - Acting rationally (approach we'll follow)
- Turing test

Intelligent Agents

- Definition of agent, percept, action, rational agent
- PEAS description of task environment
 - Performance, Environment, Actuators, Sensors
- Task environment properties
 - Fully vs. partially observable
 - Single vs. multi-agent
 - Deterministic vs. stochastic
 - Episodic vs. sequential
 - Static vs. dynamic
 - Discrete vs. continuous
 - Known vs. unknown
- Types of agents
 - Reflex
 - Model-based
 - Goal-based
 - Utility-based
 - Learning: critic, learning element, problem generator
- Wumpus world

Search

- Problem-solving agent
- Five parts of search problem
 - Initial state, actions, transition model, goal test, path (step) cost
 - Examples: vacuum world, 8-puzzle, wumpus world
- State space, search tree, path, frontier
- Tree search vs. graph search
- Performance: completeness, optimality, time and space complexity
- Branching factor
- Uninformed search (know algorithm and performance for each)
 - Breadth-first, Depth-first, Depth-limited, Iterative deepening
- Informed search (know algorithm and performance for each)
 - Greedy best-first, A*, Hill-climbing (stochastic)
- State space properties: plateau, local maximum, global maximum

- Heuristic functions
 - Admissible, dominating
 - Designing good heuristics
 - Heuristics: city-block (Manhattan), straight-line (Euclidean)
- Adversarial search
 - Game tree
 - Minimax (know algorithm and complexity)
 - Alpha-beta pruning (know algorithm)
 - Move ordering
 - Real-time games: cutoff test, state evaluator
 - Stochastic games: chance nodes, ExpectiMinimax
 - Partially-observable games
 - Games: tic-tac-toe, checkers, chess, go, backgammon, poker

Logic

- Knowledge-based agent
- Syntax, semantics, model, entailment, soundness, completeness
- Propositional logic
 - Syntax and semantics
 - Inference, validity, satisfiability
 - Proof by refutation
 - Logical equivalences
 - Inference rules
 - Clause
 - Conversion to CNF
 - Unit and full resolution
 - PL-Resolution (know algorithm, soundness, completeness, time complexity)
 - Frame problem and frame axiom
- Application to Wumpus World