COS470 Final Study Guide

# Part 1: Introduction

* What is AI?
  + Getting computers to do intelligent things
  + Medical diagnostic reasoning, planning, designing… doing the right thing and being rational
* What is AI technique?
  + The method of exploiting knowledge through search, structure of knowledge and abstraction
* **Tractability** – a problem is called intractable if the time required to solve instances of the problem grows exponentially with the size of the instances.
* Ideal agent: responsive, proactive, rational, maximizes utility, autonomous, social
* Properties of Agents: sensors, actuators, knowledge of goal, knowledge of utility, can it change via learning
* Good Agent: rational, does the right thing with the information it has
  + Should be in relation to human goals
  + Some agents know their performance measure
  + Best performance measure: relate to outcome wanted, not how agent behaves
* Rational Agent: For each possible sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built in knowledge the agent has
* Task Environments
  + Properties of world
  + Circumscribed to problem and things affecting solution
  + Domain impacts task environment properties
  + Complexity of environment -> effectively nondeterministic
  + Sensor/actuator noise -> effectively nondeterministic
    - Deterministic
    - Static
    - Episodic
    - Sequential
    - Discreet
    - Continuous
* Types of problems:
  + Classification/Analysis
    - Image recognition
    - Diagnosis
    - Data mining
    - NLP
    - Sentiment analysis
  + Synthesis Construction
    - Automated planning
    - Scheduling
    - Designing buildings, car parts, new drugs
  + Divide and conquer method for decomposable problems into subproblems”
    - P is O(n^2) -> O(m\*2^(n/m))
* Types of agents
  + Reflex Agent – simplest has condition action rules that matches what the world is like now, atemporal, no history (condition action pairs)
  + Model Based Agent – Consider what we’ve done in the past, How the world evolves over time. How actions affect the world
  + Goal based agent – what would happen if I did this, compare alternatives, plan out ahead, search agent
  + Utility based agent – what do I want to happen
  + Learning Agent – learning, how to do things better by how well its doing something.

# Part 2: Search

* State-space search
  + - Modeled with graph, usually digraph
    - Problem = state space + initial state + description of final state
  + State: the configuration of the world
  + State space: collection of all possible states
  + Transitions or links: events or processes in the world, Agent’s, or other Agent’s actions
  + Solution: path from start to goal states.
* Uninformed search
  + Complete? optimal?
  + BFS – complete, optimal as long as cost of edges are equal
  + DFS – complete, not optimal
* Heuristic search & heuristics

– Local & online search

– Constraint-satisfaction

– Neural networks: Searching to create agents (Assignment 3: Neural networks)

– Adversarial search (Assignment 4: α-β Minimax)

# Part 3: Knowledge and its use

– Knowledge representation

– First-order logic and theorem proving (Assignment 5: Resolution theorem proving)

– Rules and rule-based reasoning

– Structured knowledge representation

– Description logics and ontologies

# Part 4: Planning and acting

– Automated planning

– Handling uncertainty

– Decision making with utilities

# Part 5: Machine learning

– Symbolic ML

– Going beyond MLPs (Assignment 6: Convolutional Neural Networks)

– Reinforcement learning

# Part 6: Interacting with others

– Natural language processing

– Multiagent systems

Table

Description automatically generated