

Summary: Applications of AI

Chapter 1: Introduction and Survey

Definition: What is AI?

Examples for application domains and essential properties of AI solutions, AI paradigms of software technology with examples (knowledge-based, distributed).

Architectures XPS, KBS. General goals and methods of AI.

Chapter 2: Logic and Rule-Based Programming

Propositional logic, predicate logic. resolution and unification (purpose, general function and examples, Goal and Limits of Prolog and Classical AI, ~~simple Prolog examples~~, proving power of Prolog (Horn clauses).

Chapter 3: Algorithmic Methods of AI

~~Knowledge-based properties of Prolog~~, constraint satisfaction problem, search graphs and their adjacency definitions (improvement of total solutions, enhancement of partial solutions), application examples (class scheduling, TSP, shortest path problem).
breadth-first search, depth-first-search, best-first-search (with special case Dijkstra).
Informed search strategies, special case A* in detail: examples, comparison to Dijkstra.
Rough knowledge of complexity properties of all methods, general optimisation methods for CSP: backtracking, forward checking, ~~min-conflicts~~, tabu list, ~~simulated annealing~~ (only general principles).

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Chapter 4: Knowledge-Based Systems

4.1: Representation and Classification of Knowledge

Representation of knowledge: logic, functional object-oriented.

Classification of knowledge: 3 dimensions of classification, (with examples), special case fuzzy sets (rough understanding).

Aspects of representing temporal and spatial knowledge.

4.2: Rule-Based Reasoning

General interface of technical diagnosis.

General principle of rule-based diagnosis, distinction between fault tree and decision tree.

Advantages and disadvantages of this reasoning technique.

4.3: Case-Based Reasoning

General principle of case-based diagnosis, distinction in classical AI and neural networks.

Generalising view on arbitrary applications (regression), reasonable application scenarios.

General principle of neural networks, advantages and disadvantages to classical case-based AI.

Advantages and disadvantages of this reasoning technique.

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4.4: Model-Based Reasoning

General principle of model-based diagnosis.

Classic GDE example (adders and multipliers).

Problems arising in practice if only normal behaviour is modeled (3 bulbs example).

Fault models as measure to solve this problem.

~~Elements of component modeling. Behavioural modes, actions, observations, variables, ports.~~

4.5: Concluding Comparison

Classification of problem solving techniques: heuristic, causal, case-based.

~~Data Mining a technique to develop rules in case-based reasoning.~~

Classification of the techniques rule-based, case-based and model-based with respect to depth, general advantages and disadvantages.

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Chapter 5: Ant Algorithms and their Application in Navigation and Logistics

Explaining the function and advantages of probabilistic decision for natural ants.
Architecture and function of the overall system for navigation, structure and use of pheromone tables in detail, ABC method for pheromone updating, advantages and disadvantages with respect to traditional navigation tools / methods.

TSP: Definition and what pheromones denote in the graph.

Logistic variants of TSP: (C)VRP, time windows, ~~methods of updating~~, optimisation criteria.

~~FH Wedel applications of ant algorithms.~~

Lessons learnt: When to use and when not to use ant algorithms.