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: AI Logics

Propositional logic, predicate logic, goal and limits of Prolog and classical AI, understanding simple Prolog examples, proving ability of Prolog (Horn clauses).

Chapter 3: Algorithmic Methods of AI

Knowledge-based properties of Prolog, constraint satisfaction problem, search graphs and their adjacency definitions (enhancement of partial solutions, improvement of global solutions), application examples (simple inequalities, 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).

Summary: Applications of AI

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 (no Allen‘s temporal logic).

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: Model-Based Reasoning

General principle of model-based diagnosis.
Classical 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~~.

Summary: Applications of AI

Terminology of GDE (with examples).
Separation of diagnostic task in base functionality and extended functionality.
Algorithms for base functionality:
Candidate generation: Interface, Network of preferred diagnoses, Updating procedure for new conflicts (on examples).
Optimisation of candidate generation: Elimination of irrelevant conflicts.

Conflict generation: Terminology of TMS, Generalisation to ATMS (with interfaces). Application of ATMS in MDS. Comprehension of the class example. Mechanism of label update.

Interface of ATMS in inference engine: Interaction with value propagation
Components of an ACS system, Classification of the single components to the general knowledge-based architecture..

4.4: Case-Based Reasoning (Machine Learning)

General principle of case-based reasoning, 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 in general.

Neural network technology: Basic technique of the backpropagation algorithm (with examples similar to assignment), perceptron, critique (XOR deficiency), basic structures of Deep Forward Network, Recurrent Neural Network, Deep Convolutional Network, Special Improvement Techniques: Bias Nodes, Dropout, Training Techniques: Cross validation, feature selection.

Data Mining: Cluster detection (definition), k-means method (with easy examples).

Summary: Applications of AI

4.5: Concluding Comparison

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

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.
Application of dynamic routing, difference to static routing. Open- Street Map properties,
TSP: Definitions, difference between pheromones and probabilities, applications in simple graphs (formulae will be given)
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.

Summary: Applications of AI

Chapter 6: Ontology Management

Ontology definition, properties and advantages of XML syntax.
~~Motivation, history and advances of the tourist information system.~~
How to connect a new service provider into an existing information system.
Definition of an added value service, ~~TIS principle of realisation.~~

Motivation and definition of the Semantic Web. Principle of unique understanding of concepts. RDF, RDFS, ~~OWL~~: main features, differences, looking at examples (only passive understanding), Motivation and general principle of markup tools, handling HTML problems, RDFa: General idea

Guideline for exam: Assignment sheet 11.

Chapter 7: Game AI

Difference between turn-based and real-time strategy games.
General principle to compute an optimal strategy in a turn-based game.
Typical tasks in a real-time strategy game.
Problems for path finding in real-time strategy games.

Guideline for exam Assignment sheet 12.