TDT4136 Assignment 1

Fredrik Veidahl Aagaard & Karl Martin Lysø Svendsby

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1 Definitions of AI

- "Computational Intelligence is the study of the design of intelligent agents." (Poole et al., 1998)
- "The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990)
- "The exciting new effort to make computers think ... machines with minds, in the full and literal sense." (Haugeland, 1985)

2 The Turing Test

The Turing test inquiries whether or not a computer is able to exhibit intelligent behavior, similar to that of a human. The test is carried out by having an evaluator examine a natural language conversation between a computer and another human. The evaluator is to decide which of the two parties is the computer, and which is the human. The conversation between the two parties must be in written language such that the computer does not have to mimic human speech.

3 Rational Thinking and Acting Rationally

Rational thinking is the ability to arrive at a sound conclusion using logic. Acting rationally, on the other hand, is the notion of achieving the best expected outcome in a given situation. Rational thinking can be a part of – but is not an absolute condition for – a rational act.

4 Rationality

Rationality is an ideal performance measure; a system is rational if it performs the "correct" action, given a state.

5 Aristotle's Argument

Given a goal, Aristotle argues that an action is justified by a logical connection between the goal and the knowledge of the action's outcome related to that goal. Aristotle suggests a step-wise algorithm for finding the best means to an end. The first researchers implementing this algorithm were Newell and Simon in their General Problem Solver program. The GPS can be used to solve any problem that can be described as a set of well-formed formulas,

6 Robot Crossing the Road

In this task we make the following assumptions:

- Green light means that the robot is legally allowed to cross the road.
- The robot can see the passing car.

a) The robot is rational because it tries to achieve its goal, but is hindered by an unforeseen circumstance.

b) The robot is not rational; while it had green light it also knew that a car was driving on the road, and the best approach would have been to wait for the car to pass by safely.

7 Vacuum Cleaner

1. A simple reflex agent can not be rational in this scenario; if the agent can only perceive the current tile, optimal choices can not be made globally.
2. A reflex agent with state is rational; the agent can store the status of its current tile and when it knows it has visited both tiles, and cleaned them if they are dirty, it does not have to move again.
3. The robot can be rational if it perceives the status of each tile, because it then knows whether it should move or not. The agent function would be: if the current section is dirty: suck and store the tile as clean, If the current tile is clean and the agent has not visited the other tile: move. If both tiles are clean: do nothing.

8 Vacuum Cleaner Environment Properties

- The environment is partially observable: the agent can only perceive the status of the tile it is currently standing on.
- The environment is deterministic: the next state of the environment is only dependent on its current state and the agents chosen action.

- The environment is sequential: the current state is affected by whether the tiles have been previously cleaned by the agent.

9 Agents

a) A simple reflex agent acts only based on the current percept. This agent usually only works when the environment is fully observable. This agent is fast and simple, but has no goal.

a) A model-based reflex agent keep internal model of the environment based on previous percepts. The usage of states makes the agent able to function in partially observed environments. However, (greater) storage is needed, since the agent needs to hold this history in memory. This agent also has no goal.

a) A goal-based agent expands upon the model-based agent with the addition of a goal. This agent chooses the action that gets it closer to the goal state, and is therefore often a more practically oriented agent.

a) A utility-based agent attempts to maximize utility. Instead of just a goal-state, as in c), this agent chooses the action that yields the highest utility. Utility is here some cost function that the agent tries to maximize (or minimize). This agent is even more complex than the goal-based agent, as the utility function in itself might be very complex; maximizing utility might not always be to take the greedy – currently best – option, but might be to search for, and evaluate, multiple steps ahead of the current state.