

## AI2 Module 4

### Tutorial 2

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## 1 Agent Types and their Environments

In the first lecture, we discussed five different agent types: simple reflex agents, model-based reflex agents, goals-based agents, utility-based agents and learning agents. [If you are using R&N 1st edition, note that the notation is slightly different from the above.]

We also distinguished the agents' environments according to some key characteristics. Environments can be fully/partially observable, deterministic/stochastic, episodic/sequential, static/dynamic, discrete/continuous or single/multi agent. [Again, R&N 1st edition notation is slightly different.]

### 1.1 Find Common Sense Agents

Name common-sense examples (e.g. from the animal or plant kingdom) for all agent types mentioned above. In particular, answer the following questions for each agent:

- What is the agent's environment?
- What are its percepts?
- What are its actions?
- What are its possible internal models, if existing?
- What are its goals if it has any?
- What are its utilities, if any?

For each agent, characterise its environment using the characteristics mentioned above and give a short explanation.

### 1.2 The DVD Playing Agent

Let us consider a DVD-player as an agent. The DVD-player can be controlled with buttons on the front panel or via a remote control (which is not a part of the agent itself).

- a) Classify this agent to one of the five agent types.
- b) Answer all five questions from question 1.1. for this agent.

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## 2 The Wumpus World

In lecture 2, we introduced a simple knowledge-based agent in the Wumpus World. The agent can draw inferences from its knowledge base using propositional rules that we presented using schemas.

### 2.1 Propositional Rules

a) Translate the following propositions into propositional logic formulae. You can use schematic representation for similar rules.

- A square cannot contain the wumpus and a pit at the same time.
- A visited square is OK in any possible circumstances.
- There is a stench in the square which contains the wumpus and in each (not diagonally) adjacent square.

### 2.2 Changing Wumpus World

Imagine the Wumpus World with a bomb as an additional hazard and the following rules:

- In the square containing the bomb and in the directly (not diagonally) adjacent squares the agent will perceive a ticking sound.
- The agent causes a premature explosion if it enters a square containing the bomb and therefore dies a sudden but almost painless death.
- The agent can kill the wumpus by shooting a bullet in a square containing a bomb but only if the bomb square is (not diagonally) adjacent to the wumpus square. The nearby explosion will not cause any harm to the agent.

In the following, we assume that the new propositional variables  $NORTH_{i,j}$ ,  $EAST_{i,j}$ ,  $SOUTH_{i,j}$ ,  $WEST_{i,j}$  whose truth-values express whether the agent is heading north, east, south, or west in square  $(i, j)$ . We also assume that the agent shoots a bullet in the direction it is heading if it can infer  $SHOOT$  from its knowledge base.

a) Are the propositional variables used for the standard Wumpus World still sufficient to describe the new world? If not, introduce new variables.

b) Which of the following propositional rule schemas are valid in the new world, which ones are not? If not, write down the revised schema.

- $S_{i,j} \Leftrightarrow (W_{i-1,j} \vee W_{i+1,j} \vee W_{i,j-1} \vee W_{i,j+1})$
- $OK_{i,j} \Leftrightarrow (\neg W_{i,j} \wedge \neg P_{i,j})$

c) Give two non-trivial examples of new propositional rule formulae (or schemas):

- a definition of ticking in terms of bomb locations;
- a rule to prescribe one set of conditions for shooting a bullet.