Lukas Probst
Fabian Ihle

Artificial Intelligence
Assignment 1

13. November 2020

A1	A2	A3	A4	Σ

Task 1 - Properties of agents

i)

This statement is false, the same action might be devastating in another environment, i.e. an taxi driver agent that reaches its target by driving as fast as possible is no problem on a german Autobahn, but will most likely cause an accident in towns. Different environments have different criteria for a satisfactory performance.

ii)

This statement is true, as 'rational' means that it behaves 'as well as possible'. The agent has no other sensors than a temperature sensor, thus it can not draw other factors into weight, like driving at full speed right now. The performance measure in this case would be to lower the temperature, which it fully reaches by turning of the vehicle.

iii)

The agent has won the chess game, which means that he always selected a 'better' action that its opponent, not that he always maximized his performance. The agent could still perform quite bad, if his opponent does even worse. Thus the statement is false. The agent could also have 'always lose' as performance measure thus winning the chess game would be not rational at all.

iv)

This statement is true, in a partially observable environment, a pure reflex agent might never take the 'best' action for behaving rationally, because it does not see everything and can not make assumptions with only simple 'if-then-else' rules and no representation of the full environment.

v)

This statement is true, rational means the agent is trying to improve performance measure using the available perception. In very or completely random environments, where statistics are not applicable, performance measure and the outcome of actions may not be predictable/calculable, therefore rational decisions are not possible for any agent.

Task 2 - Environments for agents

Task Environment	Observable	Deterministic	Static	Discrete	#agents
Snooker	fully	strategic	static	continuous	multi (2)
Sudoku	fully	deterministic	static	discrete	single
Tennis	partially	strategic	dynamic	continuous	multi (2,4)
Baking a cake	partially	stochastic	static	continuous	single

Snooker

By playing snooker, the agents always see the full snooker table, so it is fully observable. The next state fully depends on the current position of the balls and the action the agent makes (hit a specific ball for example) and also the actions the opponent agent did. The environment does not change without making an action by an agent thus it is static. The amount of possible positions of balls is indefinite, balls can be placed everywhere on the snooker table (not just at $x = 1, 2, 3$ and $y = 1, 2, 3$), which makes it continuous. The number of agents is multi, because there are always 2 players playing a game.

Sudoku

A game of sudoku is always fully observable as you see the complete sudoku 'table'. The next state fully depends on the numbers already there and the number inserted, so it is deterministic. Also the environment does not change by itself, same as in 'Snooker'. We now got a finite number of percepts and actions, as a sudoku field is 9x9 and numbers 1-9 can be inserted, thus it is discrete. We only got a single agent, as only one agent solves a sudoku puzzle at a time.

Tennis

A game of tennis is only partially observable, as the player got face another direction and not 'see' the ball at this moment. Depending on the agent it could also be just a camera on top of the whole field and a robot arm, which sees the full field. One could argue that the flight path of the tennis ball is deterministic, but the actions of the opponent are not foreseeable, therefore it is strategic. The environment is dynamic, as there could be a wind suddenly blowing that affects the flight path of the ball. With the same reasoning as for snooker, it is continuous. There are indefinite positions of agents and the ball. There are at least 2 but sometimes 4 agents in a tennis game.

Baking a cake

Allthough the agent most likely will supervise the dough, it can not for example see the inside where an egg yolk could be still in one piece or completely mixed. The same principle applies to stochastic. Of course you could say 'after three times mixing everything up, the

egg yolk will be distributed through the dough', but you can not be 100% sure about that. Also there are many different states of mixing up a cake (air bubbles, state of molecules,...) so it is continuous.

Task 3 - PEAS description

A firefighting robot

Performance measure

fast, secure, fire extinguished, as few persons harmed as possible (not by the agent, but by the fire), finding people, first aid

Environment

Roads, fire station, houses, cars, subways, tunnels, everywhere where fire is to be extinguished

Actuators

water pump, fan to remove smoke, wheels / arms to move and grab stuff

Sensors

smoke sensor, temperature sensor, cameras, engine sensors, distance sensors (ultrasonic), infrared sensors

The task of a firefighting robot would be to extinguish fire, for example at houses or a car accident. By doing so it has to be fast, efficient by extinguishing and don't harm people by doing so. It has to have a wide range of movement and should be able to extinguish the fire with for example water. It needs a variety of sensors to detect smoke, fire and plan its movements. Ultrasonic sensors would fit better for this as infrared would be blocked by smoke.

Online food delivery agent

Performance measure

food delivered on time, food still warm, state of the food, correct order of food delivered

Environment

Roads, driveway of restaurant and target house

Actuators

steering wheel, accelerator, brake, signal, connectivity for signaling arrival via an app

Sensors

cameras, sonar, thermometer, gps

We settled for an agent to drive food from restaurant to a home. Thus it needs to have sensors and actuators for autonomous driving, food monitoring (thermometer) and also something to signal to the customer that the food arrived (mobile data / internet).

A car detector vision system

Performance measure

amount of cars properly detected, time to classify car as car

Environment

Roads, maybe only crossings

Actuators

screen display to show results, interface to read classifications from

Sensors

camera, distance sensors (infrared, ultrasonic)

This describes an agent that is mounted for example at a big crossing and is responsible for detecting the amount of cars in traffic.

Task 4 - Structure of Agents

i)

The function itself is not changed. It still might yield different results as it gets 'faster' values from its environment. For example if the machine (robot arm) of a tennis agent is now twice as fast, it still could pass back the balls, but the actuators might act faster. If the sensors can not keep up with the faster environment, it might act wrongly but the function itself stays the same.

ii)

It's a simple reflex agent, because it only takes the current temperature into consideration. The increased heat may be a direct result of the action, but is not calculated or planned by the agent.

iii)

As the architecture can be displayed as a finite state automaton (FSA) and with n bits one can create 2^n FSA's, the number of agent programs is the same, namely 2^n.

Authors:

Fabian Ihle	fabian.ihle@student.uni-tuebingen.de	4222664
Lukas Probst	lukas.probst@student.uni-tuebingen.de	4232298

Space for comments