COMP310 Tutorial Week 6

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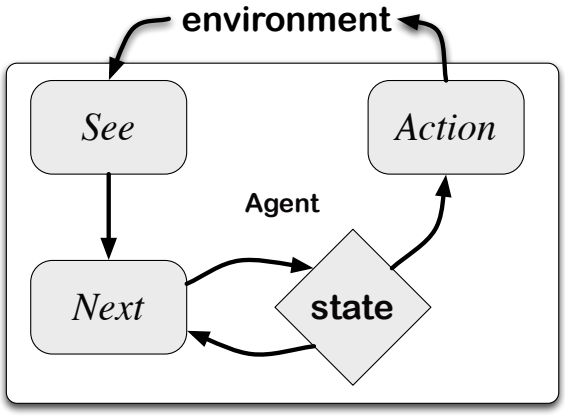
Exercise

The diagram below illustrates a simple model of a deliberative agent and its components.



With reference to the above diagram, explain the purpose/role of the components:

(a) *see* (**3 marks**)

(b) *next* (**3 marks**)

(c) *state* (**3 marks**)

(d) *action* (**3 marks**)

A classical approach to building agents is to view them as a particular type of knowledge-based system based on *symbolic AI*. Given this, a deliberative agent is one that contains an explicitly represented, symbolic model of the world, and that makes decisions via symbolic reasoning.

(e) Describe the transduction problem, and identify which of the functions in the diagram that it relates to. (**3 marks**)

(f) Describe the representation/reasoning problem, and identify which of the functions in the diagram that it relates to. (**3 marks**)

(g) Explain (with notation) the changes you would make to the deliberative agent (above, parts a-d) to enable a *deductive reasoning* agent. (**15 marks**)

Solution

(a) The role is to make an observation of current environment. **[1 mark]**

-or-

The *see* function is responsible for observing the environment E and generating a percept Per that is defined by whatever knowledge representational system is used by the agent. **[2 marks]**

$see : E \rightarrow per$ **[1 mark]**

[MAX **3 marks**]

(b) The next function updates the internal state. **[1 mark]**

The *next* function is responsible for deliberation; i.e. updating the internal knowledge base of the agent based on the current intention I, and a new percept Per.

[2 marks]

$next : I \times Per \rightarrow I$ **[1 mark]**

(MAX **3 marks**)

(c) The state is an internal representation of the internal state. **[1 mark]**

The *state* function is responsible for representing the internal knowledge base of the agent based on the current intention.

[2 marks]

$state : I = \{i_0, i_1, ...\}$ **[1 mark]**

(MAX **3 marks**)

(d) The action function maps states to an action. **[1 mark]**

-or-

The *action* function is responsible for taking a state I and determining an action Ac that moves towards achieving the intention. **[2 mark]**

$Action : I \rightarrow Ac$ **[1 mark]**

(MAX **3 marks**)

(e) The transduction problem relates to the task of converting sensor input - for example proximity data, video, audio or speech, or other data that characterises the environment in which the agent is situated (which could be the real world or an online one) into an accurate, adequate symbolic description, in time for that description to be useful.

[**1 mark** for basic.]

[**2 marks** for detailed]

This relates to the *See* function. **[1 mark]**

(MAX **3 marks**)

(f) The representation/reasoning problem relates to how an agent symbolically represents information about complex real-world entities and processes, and how agents can reason with this information in time for the results to be useful. This includes issues such as knowledge representation, automated reasoning, automatic planning. The underlying problem lies with the complexity of symbol manipulation algorithms. In general many (most) search-based symbol manipulation algorithms of interest are highly intractable, and this it is hard to find compact representations.

[**1 mark** for basic.]

[**2 marks** for detailed]

This mainly relates to the $Next$ function, but could equally be argued to relate to the See function as well, as it relates to the symbolic representation of obersarvations post the transduction process.

[**1 mark**]

[MAX **3 marks**]

(g) For deductive reasoning, we look to prove theorems from a database which represents the internal state of the agent.

[**2 marks**]

For deliberative reasoning, we first must change all functions except *see*.

[**1 mark**]

state: This now becomes a database $\Delta = \delta_0, \delta_1, ...$ which represents the state.

[**1 mark**]

The state can encompass beliefs, desires, intentions.

[**1 mark**]

next: This function now takes a percept and the state of the database, updating the beliefs of the world.

[**1 mark**]

$next : \Delta \times Per \rightarrow \Delta$

[**1 mark**]

Action: The action function now looks for actions that are allowed to be made, given the state of the database.

[**1 mark**]

$action : \Delta \times Ac \rightarrow Ac$

[**1 mark**]

More specifically, given a set of rules ρ, it looks to prove that an action is prescribed.

[**1 mark**]

Algorithm 1 Action Funcion

1: **for** $\alpha \in Ac$ **do**
2: **if** $\Delta \vdash_\rho Do(\alpha)$ **then** return α
3: **for** $\alpha \in Ac$ **do**
4: **if** $\Delta \nvdash_\rho \neg Do(\alpha)$ **then** return α
return null

Algorithm: [**5 mark**] [MAX **15 marks**]