

S-R Agents and Production Systems

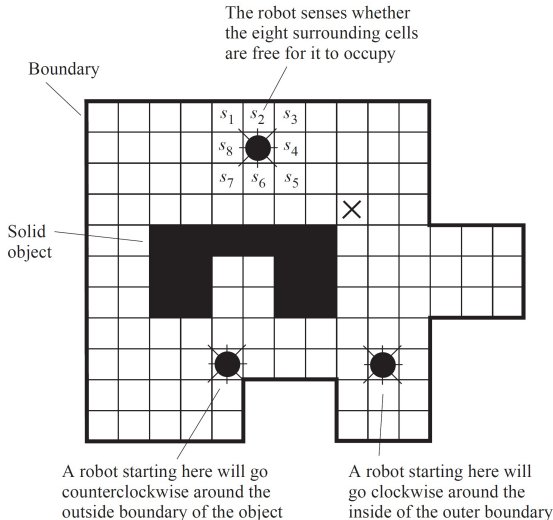
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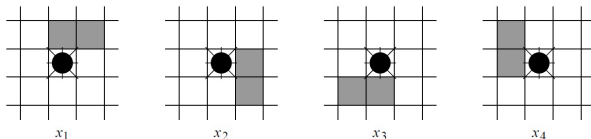
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Stimulus-Response Agents

Recall the boundary-following robot example in the lecture:



Production System



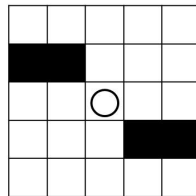
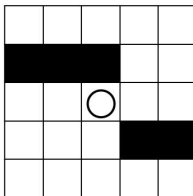
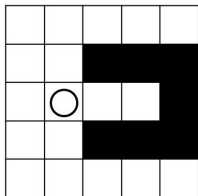
- if $x_4 = 1$ and $x_1 = 0$, then move north;
 - if $x_3 = 1$ and $x_4 = 0$, then move west;
 - if $x_2 = 1$ and $x_3 = 0$, then move south;
 - if $x_1 = 1$ and $x_2 = 0$, then move east;
 - if none of the four features equal to 1, then move north.
- $x_4\bar{x}_1 \rightarrow north$
 - $x_3\bar{x}_4 \rightarrow west$
 - $x_2\bar{x}_3 \rightarrow south$
 - $x_1\bar{x}_2 \rightarrow east$
 - $1 \rightarrow north$

Question

Does this boundary-following program always run correctly?

Tight spaces

Consider the following situations:



Tight spaces

The previous production system will only work under the restriction of “tight space free”. This restriction could be described in different forms:

- Intuitively, the distance between two solid objects should not be less or equal to 1 or
- Within arbitrary 3×3 grid in the map, there is no more than one solid area or
- $\neg(x_4\overline{x_1}x_2\overline{x_3}) \wedge \neg(x_1\overline{x_2}x_3\overline{x_4})$

Behavior of the bf program

Given that there's no “tight space” in the map and the following production system:

- $x_4\overline{x_1} \rightarrow north$
- $x_3\overline{x_4} \rightarrow west$
- $x_2\overline{x_3} \rightarrow south$
- $x_1\overline{x_2} \rightarrow east$
- $1 \rightarrow north$

What's the behavior of it?

- follow the boundary of the map **clockwise** or
- follow the boundary of an inner solid area **counterclockwise**.

Boundary-following program example

Question

Is it possible to write a program which

- either follows the boundary of map **clockwise**
- or follows the boundary of an inner solid area **clockwise**?

Boundary-following program example

Question

Is it possible to write a program which

- either follows the boundary of map **clockwise**
- or follows the boundary of an inner solid area **clockwise**?

It's impossible. In the map on the right, consider the two locations marked by 1 and 2. At the location 1, the agent needs to go left, while at location 2, it needs to go right. But, the information variables the agent can sense in these two situations are the same. That is to say, the agent **can not differentiate** these two different locations which require different actions.

