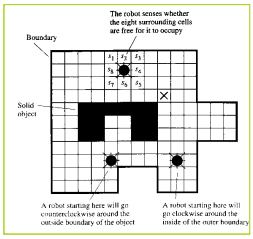
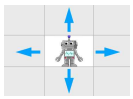
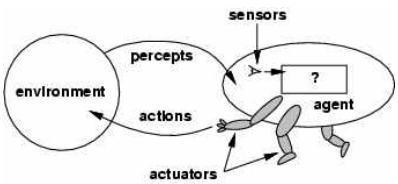
Lab & Homework 2





SR-Agent

- What to do?
  - What is percept, x ?
  - How to choose an action a given x ?



$x \rightarrow f(x) \rightarrow a$

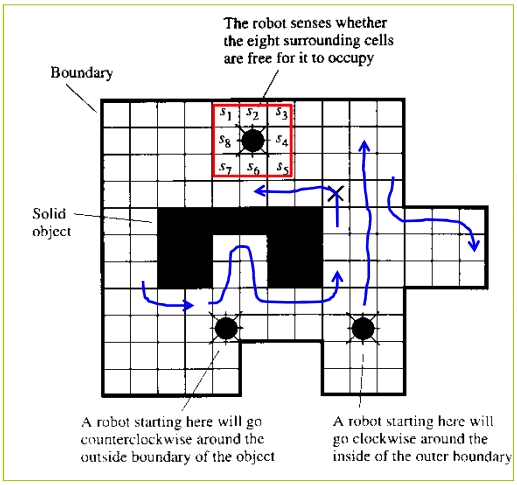
percept agent action

?

BF Robot – Data-Generate + A-Classify

- Boundary Following Robot (BFR) in a Grid World
  - Around any object on the left (왼 쪽에 끼고 이동한다/돈다)
  - Or just go to the North in an empty space (no objects around)
  - There is no end/stop – move forever…
  - There is no narrow gap/path that is 1-cell wide
- Design a navigation control for a BFR
  - Stimulus-Response Agent (SR Agent) type
  - Design a classifier – select an action
  - Generate training data

BFR and a Grid World



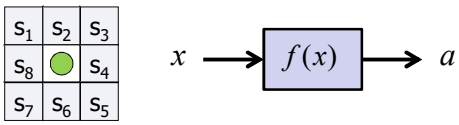
Grid World

```
BD = [ ...
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   1   1   1   1   1   1   0   0   0   0   0   0
    0   0   1   1   0   0   1   1   0   0   0   0   0   0
    0   0   1   1   0   0   1   1   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   0   0   0   0   0   0   0   0   0   1   1   1
    0   0   0   0   0   1   1   1   0   0   0   1   1   1
    0   0   0   0   0   1   1   1   0   0   0   1   1   1 ];
[H W] = size(BD);  % [11 14]

% size(BW) - - -  [13 16]
bot = [3 4];   % = (x, y)
```


Percept X

- Percept:

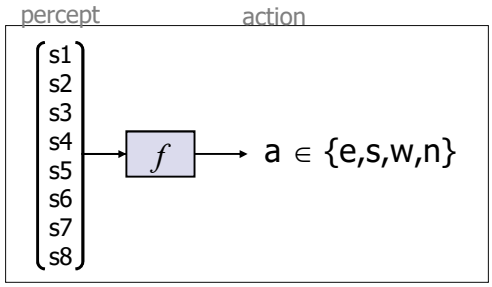


Ex. $S = \{0, 1, 2, \ldots, N\},\ N = 1$ (percept) $\quad A = \{\mathbf{e}, \mathbf{s}, \mathbf{w}, \mathbf{n}\}$ (action)

$\mathbf{x} \in S^p$

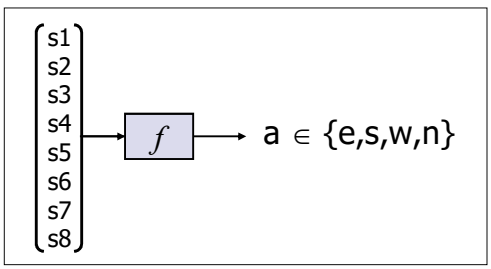
e.g.,
[0 0 0, 0, 1 1 1, 0] → **e**
[1 0 0, 0, 0 0 1, 1] → **s**
[1 1 1, 0, 0 0 0, 0] → **w**
[0 0 1, 1, 1 0 0, 0] → **n**
: :

Map: Percept-to-Action

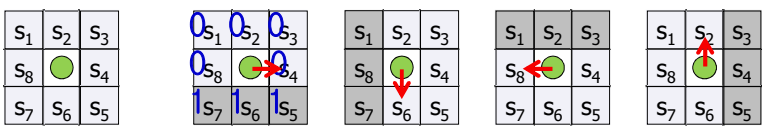


8 sensory elements, so
$s_i \in S$ -> 2^8 different configurations
is *mapped* to one of 4 different actions

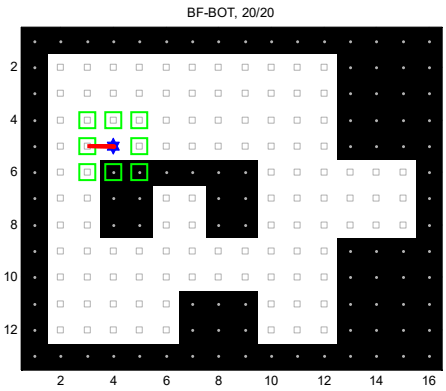
X2A Mapping



[0 0 0, 0, 1 1 1, 0] → **e**
[1 0 0, 0, 0 0 1, 1] → **s**
[1 1 1, 0, 0 0 0, 0] → **w**
[0 0 1, 1, 1 0 0, 0] → **n**
: :



Ex. Go WEST



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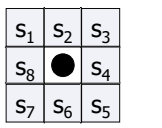
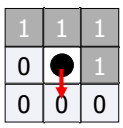
Design a Controller

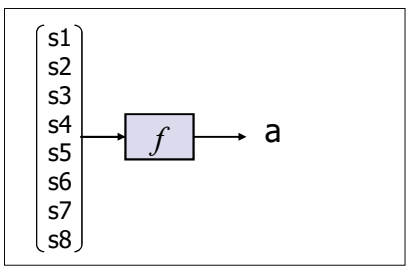
- Two approaches
  - Sensory input → action
  - Sensory → feature → action

(sensory input = s)

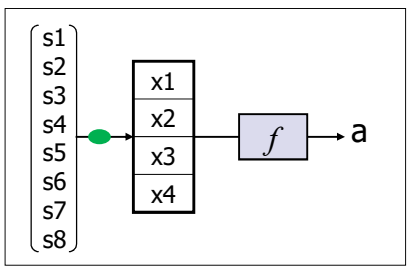




$s \in \{0,1\}^8$ $a \in \{N,E,S,W\}$



- less than 2^8 configurations



- less than 2^4 configurations
- with perceptual processing

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Model Choice

- Perceptron network
  - Input x = [s1, s2, …, s8]
  - Output units: 4 = {E, S, W, N}
- 2 Layer Perceptron (MLP)
  - Input x = [s1, s2, …, s8]
  - Hidden layer nodes: H units
  - Output units: 4 = {E, S, W, N}

Homework #2

- Solve Problem I
- Solve Problem II
- Due: 12. 1 (목)

Problem I. Create a Training Data Set

- As many as possible, say, more than 40 instances:

X		y
[0 0 0, 0, 1 1 1, 0]	→	**e**
[1 0 0, 0, 0 0 1, 1]	→	**s**
[1 1 1, 0, 0 0 0, 0]	→	**w**
[0 0 1, 1, 1 0 0, 0]	→	**n**
:		:

Problem II. Train a Neural Network

- **Perceptron network** or **Multilayer Perceptron**