



Artificial & Computational Intelligence

AIML CZG557

M1 : Introduction

&

M2 : Problem Solving Agent using Search

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Course Plan



- M1 Introduction to AI
- M2 Problem Solving Agent using Search
- M3 Game Playing
- M4 Knowledge Representation using Logics
- M5 Probabilistic Representation and Reasoning
- M6 Reasoning over time
- M7 Ethics in AI

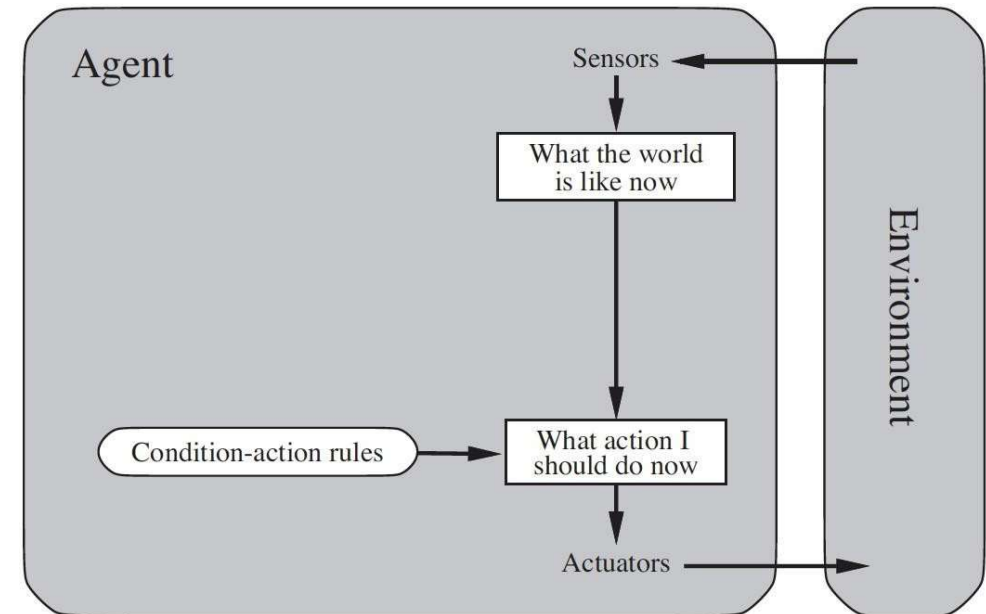


Agents Architectures

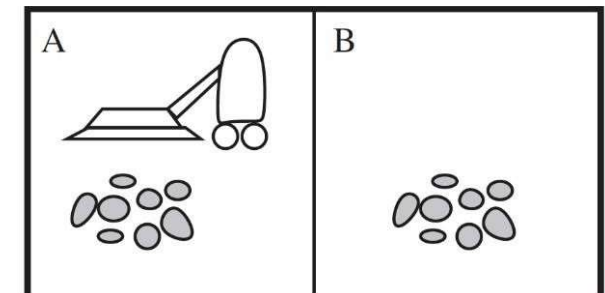
Reflex Agent

```
function SIMPLE-REFLEX-AGENT(percept) returns an action
  persistent: rules, a set of condition–action rules
  state ← INTERPRET-INPUT(percept)
  rule ← RULE-MATCH(state, rules)
  action ← rule.ACTION
  return action
```

```
function REFLEX-VACUUM-AGENT( [location,status]) returns an action
  if status = Dirty then return Suck
  else if location = A then return Right
  else if location = B then return Left
```



Simple Reflex
Agents

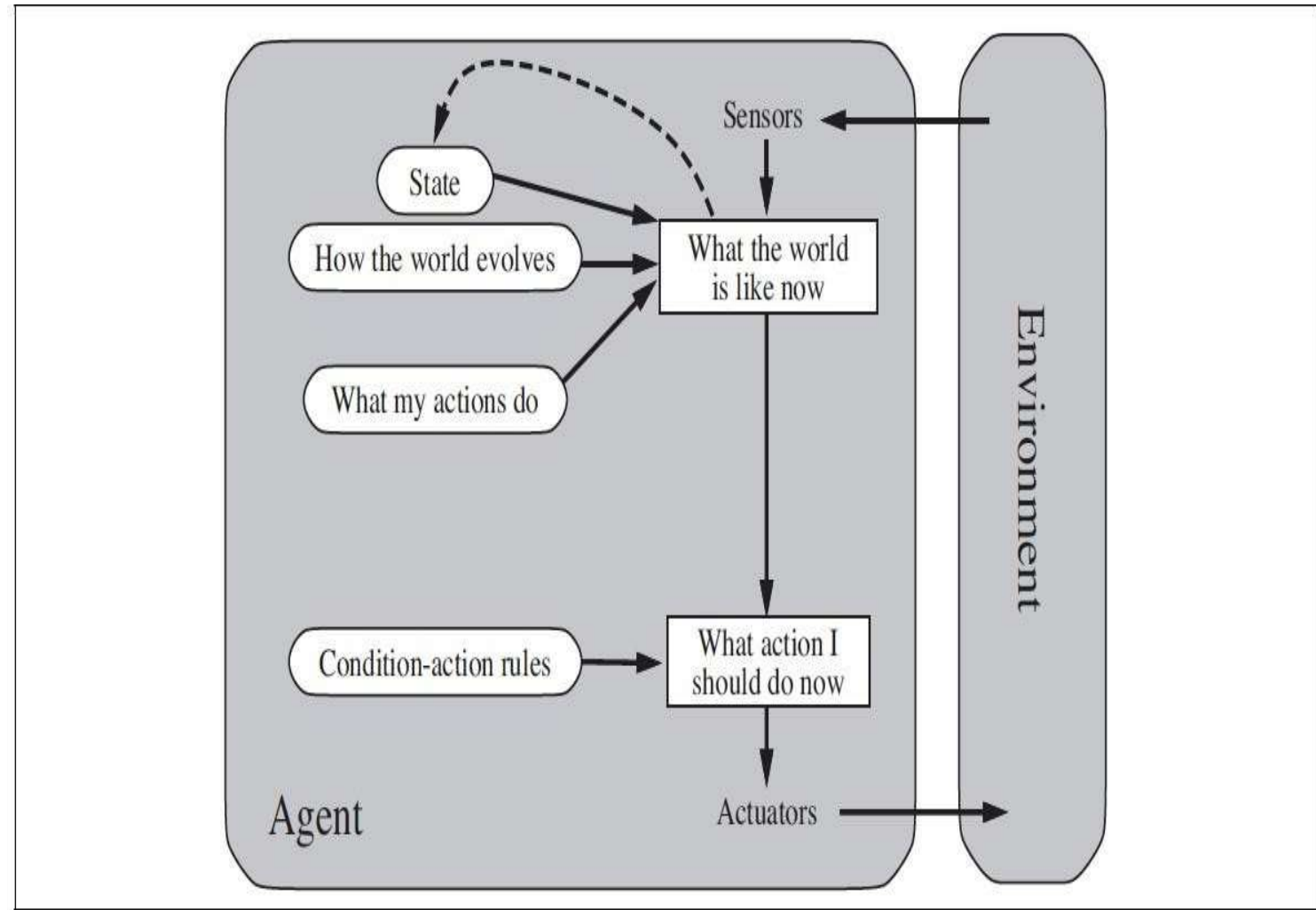


Model based Agent

Simple Reflex
Agents



Model Based
Agents



Model based Agent

function MODEL-BASED-REFLEX-AGENT(*percept*) **returns** an action

persistent: *state*, the agent's current conception of the world state

transition model, a description of how the next state depends on the current state and action

sensor model, a description of how the current world state is reflected in the agent's percepts

rules, a set of condition-action rules

action, the most recent action, initially none

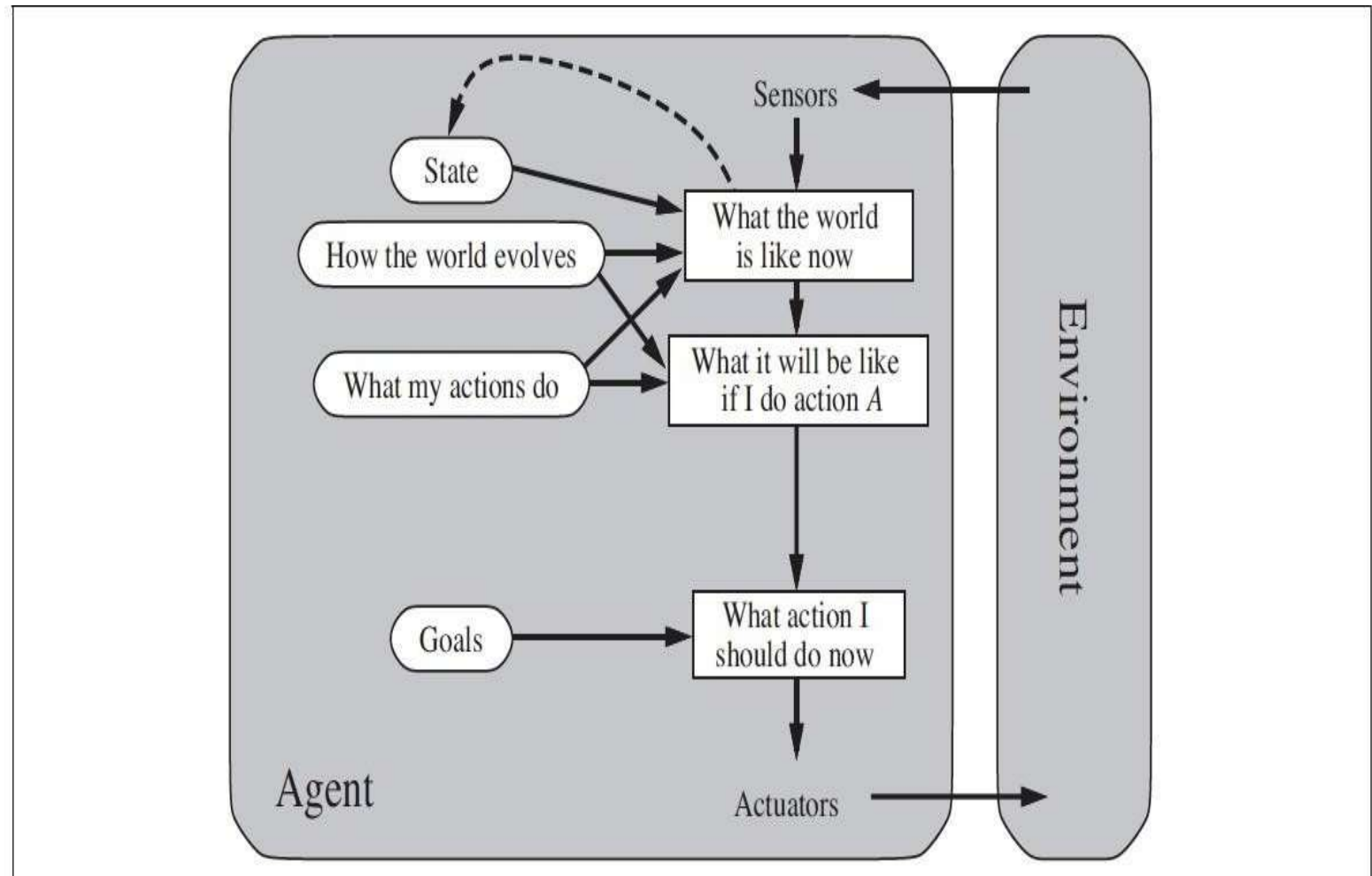
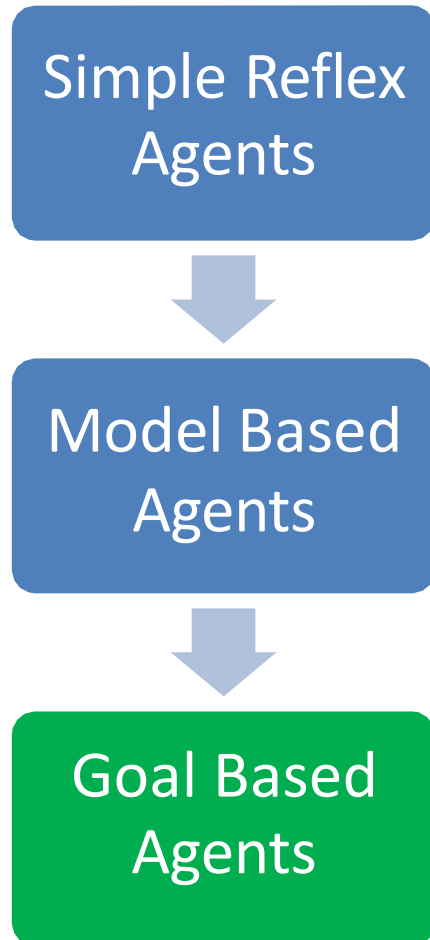
state ← UPDATE-STATE(*state*, *action*, *percept*, *transition model*, *sensor model*)

rule ← RULE-MATCH(*state*, *rules*)

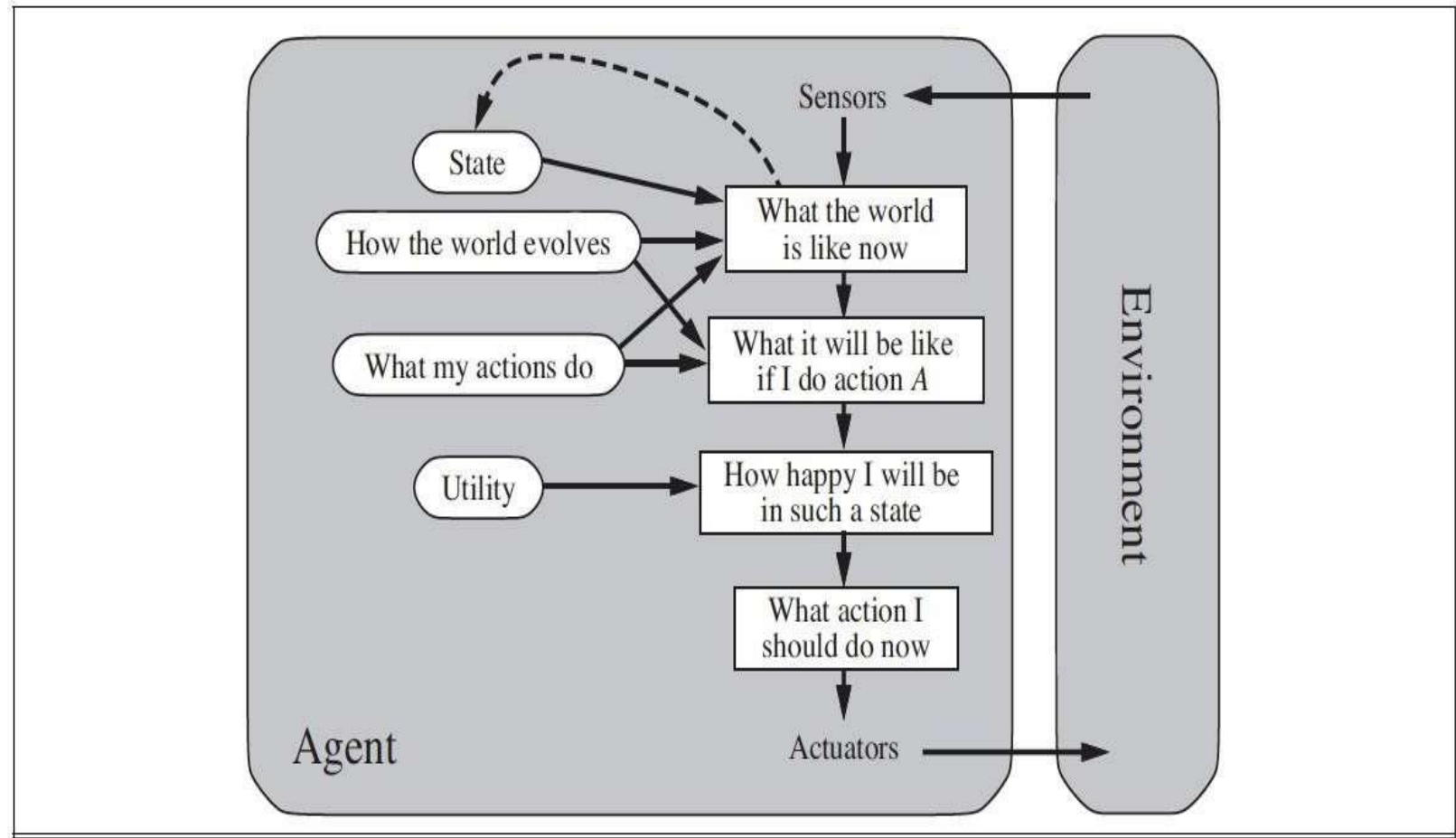
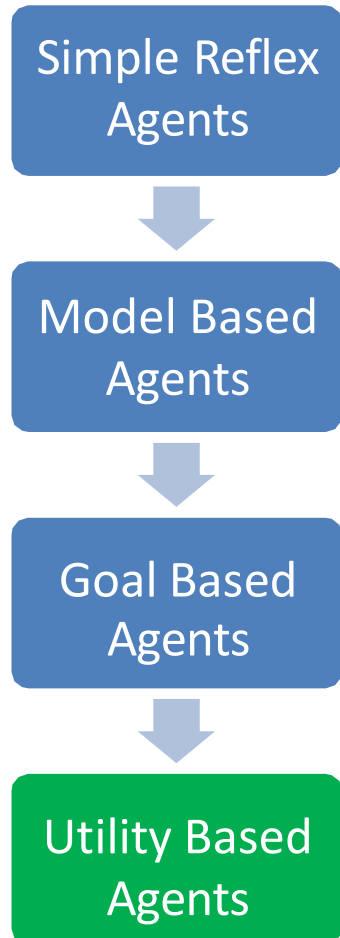
action ← *rule*.ACTION

return *action*

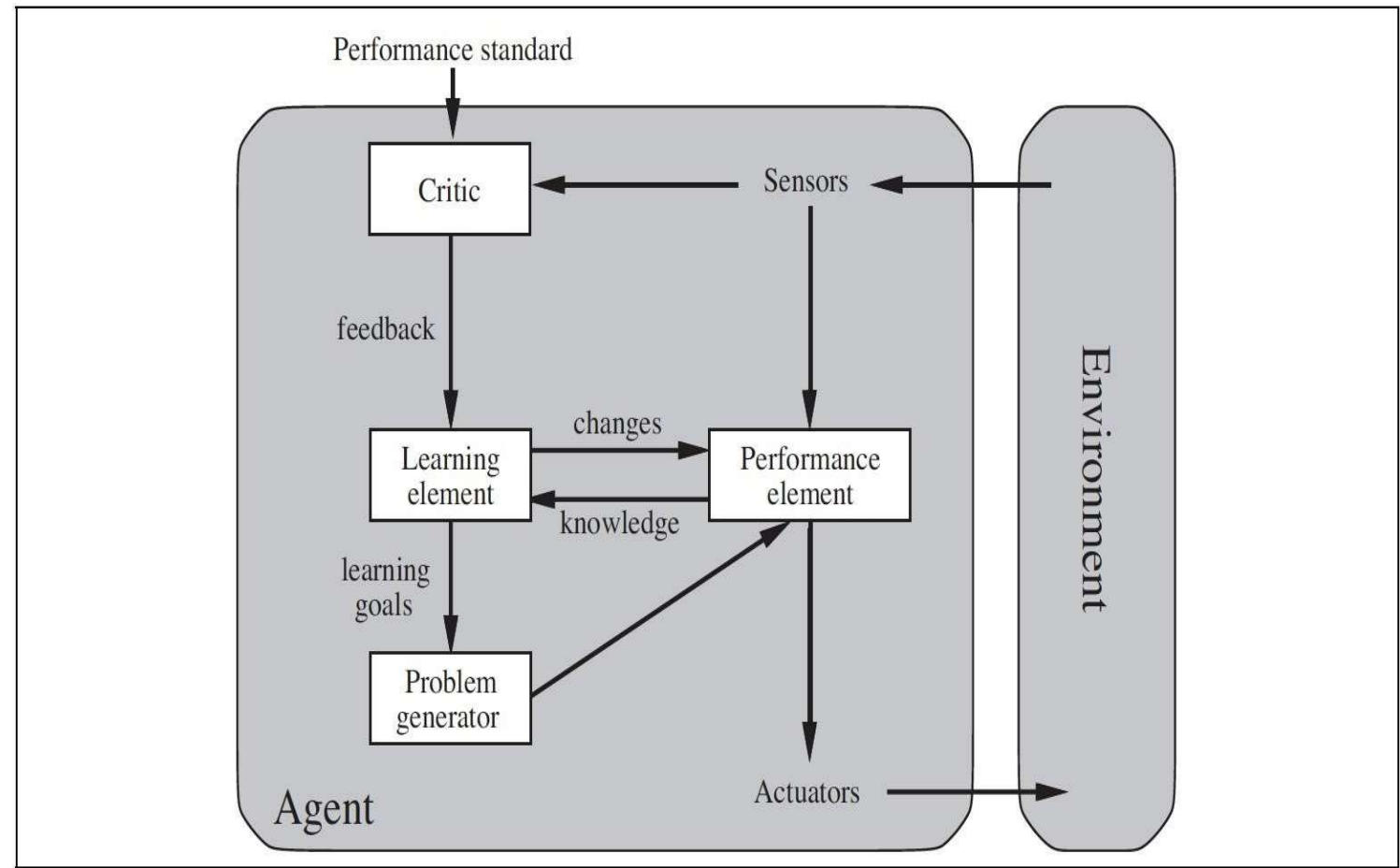
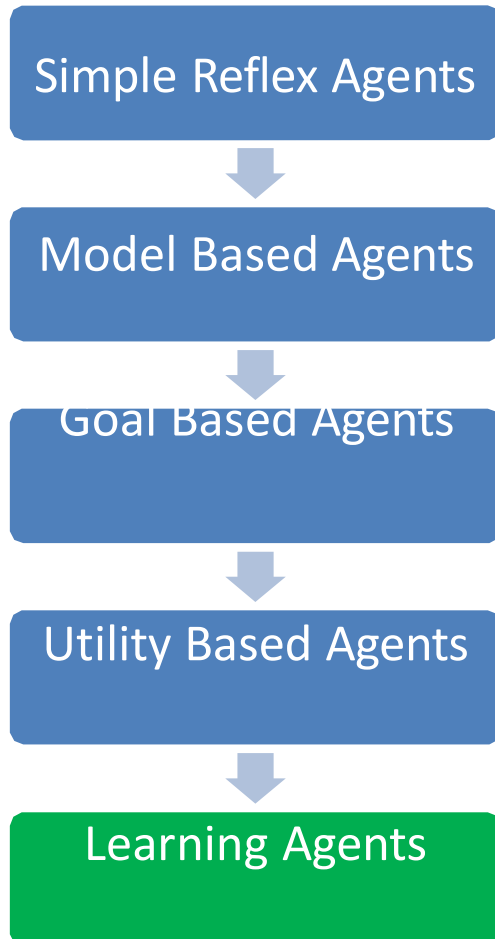
Agent Architectures



Agent Architectures

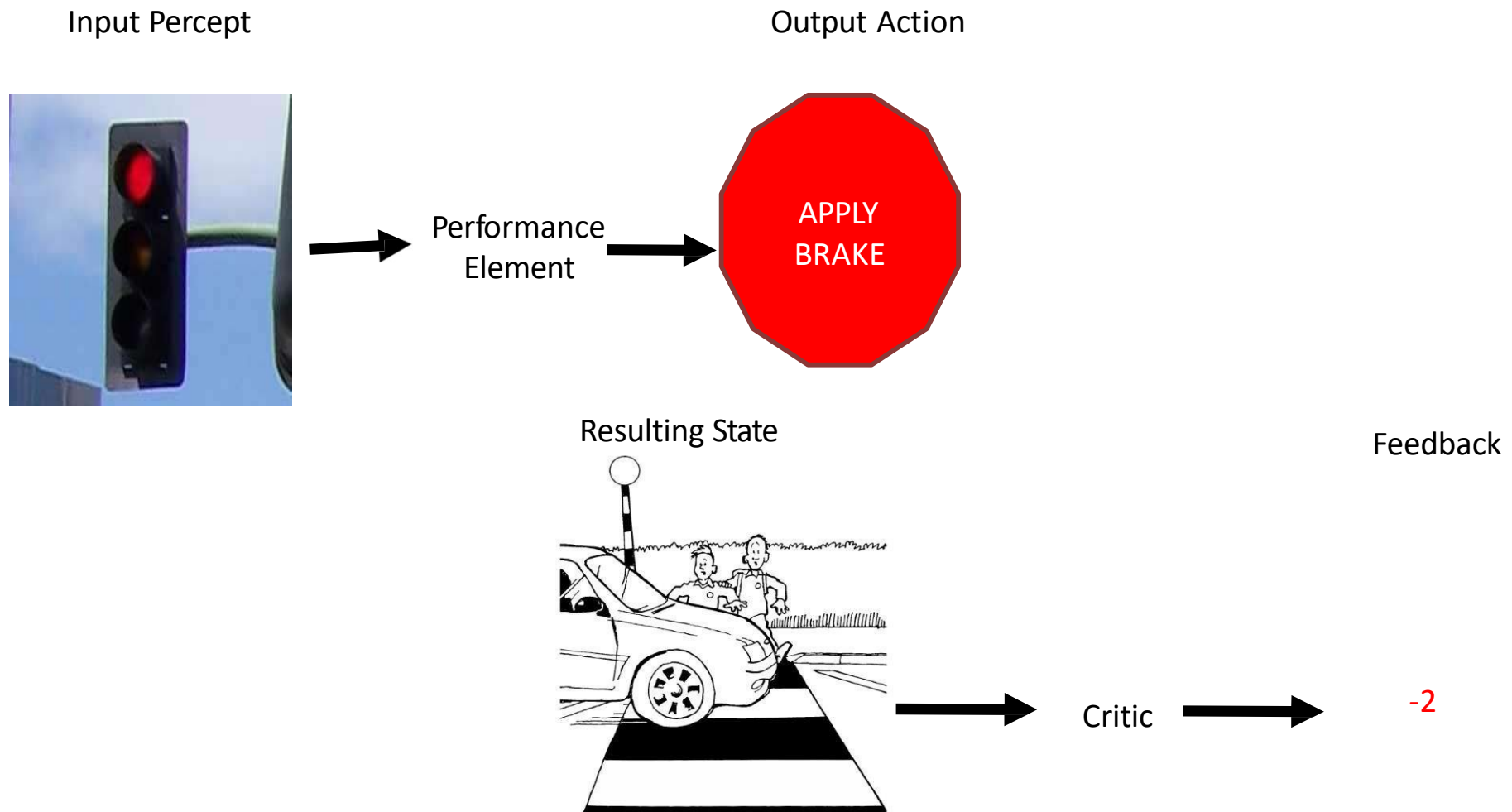


Agent Architectures



Role of Learning

Agents that improve their performance by learning from their own experiences



Role of Learning



Input Percept



Possible Actions

Brake
Change Gear to Lower
Change Gear to Higher
Accelerate
Steer left
Steer right

Random



Selected Action

Change Gear to Lower



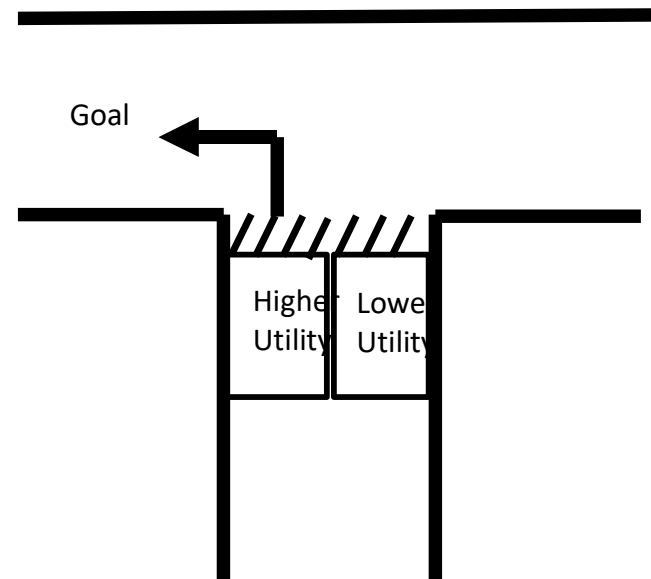
Role of Learning



Performance Element – Takes decision on action based on percept

$$\begin{aligned} f(\text{red signal}, \text{distance}) &= 15k \text{ N brake} \\ \text{distance} &= f'(\text{percept sequence}) \\ f(\text{percepts}, \text{distance}, \text{raining}) \end{aligned}$$

- $f(\text{state}_0, \text{actionA}) = 0.83,$
- $f(\text{state}_0, \text{actionB}) = 0.45$



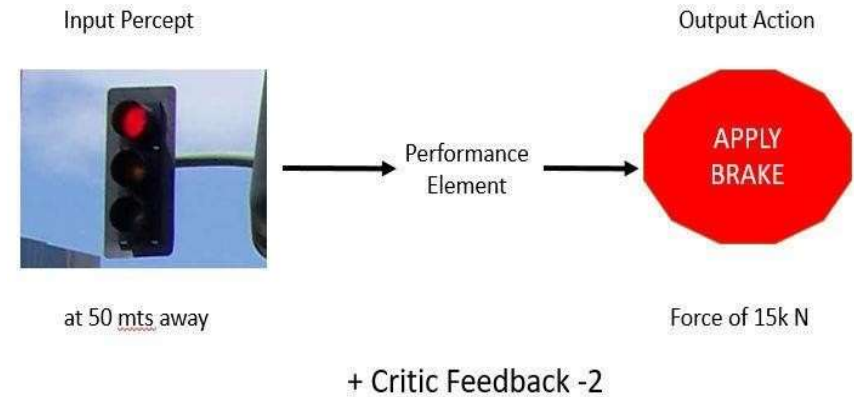
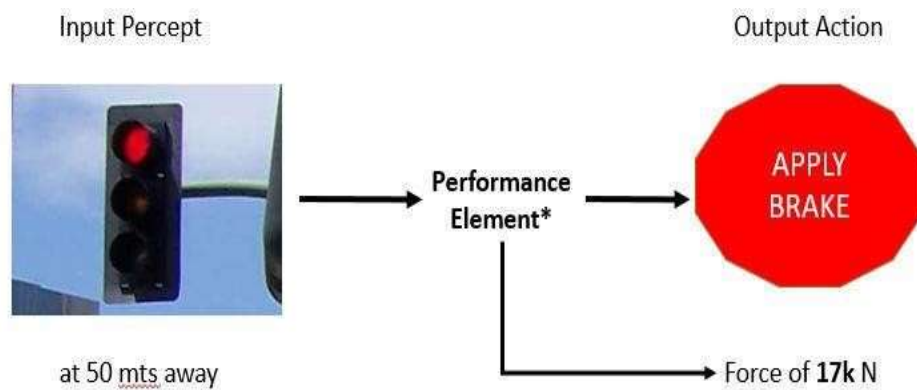
Role of Learning



Critic – Provides feedback on the actions taken

Learning :

Supervised Vs Unsupervised Vs Reinforcement



Role of Learning



Performance Element – Takes decision on action based on percept

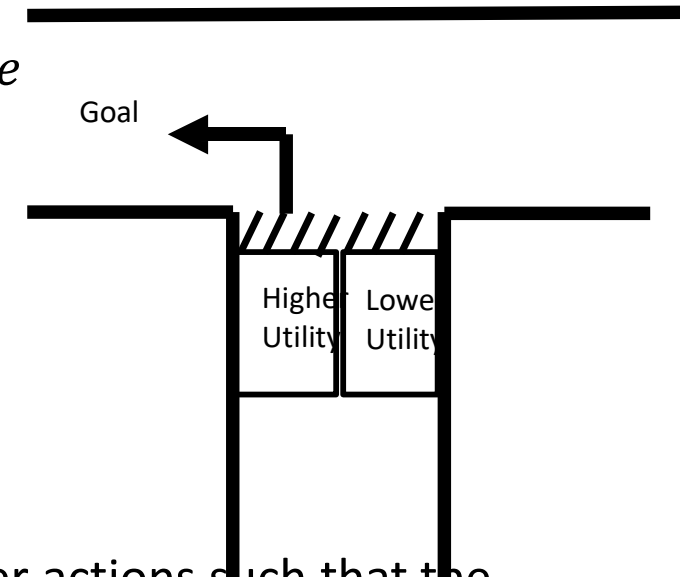
$$\begin{aligned} f(\text{red signal}, \text{distance}) &= 15k \text{ N brake} \\ \text{distance} &= f'(\text{percept sequence}) \\ f(\text{percepts}, \text{distance}, \text{raining}) \end{aligned}$$

- $f(\text{state}_0, \text{actionA}) = 0.83,$
- $f(\text{state}_0, \text{actionB}) = 0.45$

Learning Element – Make the performance element select better actions such that the utility function is optimized

Critic – Provides feedback on the actions taken

Problem Generator – Make the Performance Element select sub-optimal actions such that you would learn from unseen actions





Next Class Plan

- Problem Solving Agents
- Uninformed Search Algorithms
 - BFS vs DFS – An overview
 - Uniform Cost Search
 - Iterative Depth First Search
 - Notion of Bi-Directional Search



Required Reading: AIMA - Chapter #1, 2

Thank You for all your Attention

Note : Some of the slides are adopted from AIMA TB materials