Agent architectures
Designing intelligent agents

- An agent is defined by its *agent function* $f()$ that maps a sequence of perceptions to an action.
Rational agent

- It would be useful to design agent functions that make agents rational, namely that make them do the “right thing”
- How can rationality of an agent be defined?

For every possible sequence of perceptions, a rational agent chooses the action that maximizes the expected value of its performance measure, given its knowledge up to that moment.
Perception sequence and available knowledge

- The perception sequence represents the available knowledge of an agent about its environment.
- From the standpoint of an agent, its environment can be:
  - Completely/partially observable
  - Static/dynamic
  - Discrete/continuous
  - Single agent/multiagent
Through actions an agent can change the state of its environment. From the standpoint of an agent, its environment can be: deterministic/stochastic.
Performance measure

- The performance measure is the criterion for evaluating the success of the behavior of an agent
- The performance measure is defined by the designer
What a rational agent does?

Rational agent

For every possible sequence of perceptions, a rational agent chooses the action that maximizes the expected value of its performance measure, given its knowledge up to that moment.

- A rational agent is not omniscient
- A rational agent is not clairvoyant
- A rational agent can explore to acquire new information, can learn, ...
From agent functions to agent programs

- A designer develops an *agent program* that implements an agent function.
- An agent program has the current perception $p(t)$ as input.
  - An agent program can store the previous perceptions $p(0), p(1), ..., p(t-1)$.
- An agent program has an action $a(t)$ as output.
Structure of agent programs

- Agent programs can be classified in four basic types:
  - Simple reflex agents
  - Reflex agents with state
  - Goal-based agents
  - Utility-based agents
- All these types of agent can also learn
Simple reflex agents

AGENT

what the world is like now

sensors

condition-action rules

what action to do now

effectors
Reflex agents with state

AGENT

- state
- environment model
- action model

condition-action rules

what the world is like now

sensors

what action to do now
effectors
Goal-based agents

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- state
- environment model
- action model
- goals

what the world is like now

what the world will be like if I do action a

what action to do now

sensors

effectors
Utility-based agents

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- state
- environment model
- action model
- utility

what the world is like now

what the world will be like if I do action a

“happiness” in that state

what action to do now

sensors

effectors
Learning agents

- All the agents presented before can improve their performance with learning
- Every component of the decisional process of an agent can be modified in order to perform better