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Expert Group meeting on "Artificial Intelligence and Local Industrial Development"

Intelligent Agent in Medical Diagnosis

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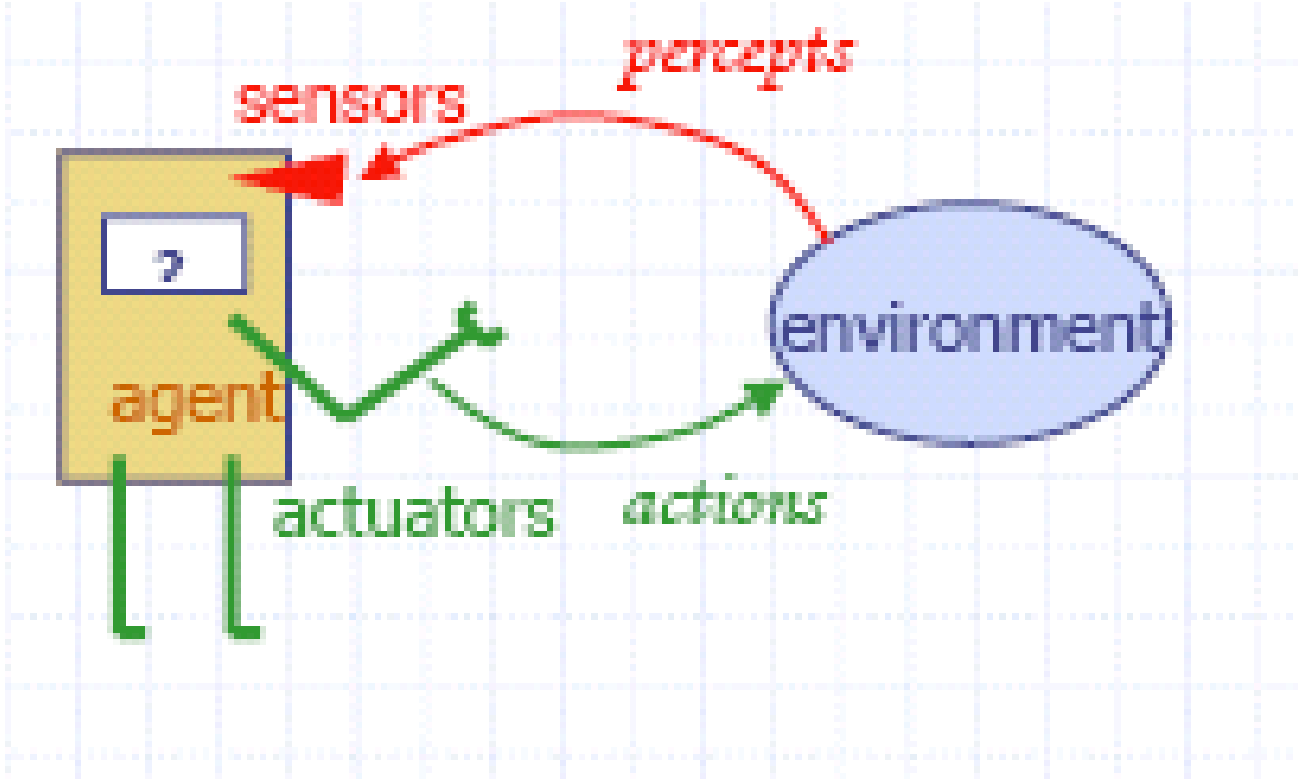
Intelligent Agent



Definition: An **intelligent agent** perceives its environment via **sensors** and acts rationally upon that environment with its **actuators**.

Humans

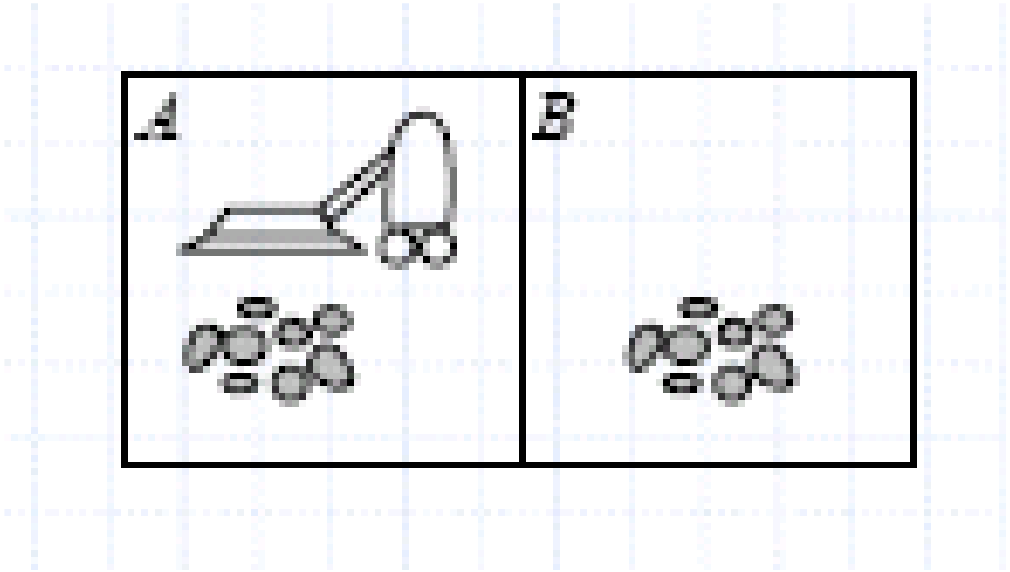
Sensors:
Eyes (vision), ears (hearing), skin (touch), tongue (gustation), nose (olfaction), neuromuscular system (proprioception)

Percepts:
At the lowest level – electrical signals
After preprocessing – objects in the visual field (location, textures, colors, …), auditory streams (pitch, loudness, direction), …

Actuators: limbs, digits, eyes, tongue, …

Actions: lift a finger, turn left, walk, run, carry an object, …

Vacuum Cleaner World



Percepts: location and contents, e.g. [A, Dirty]
Actions: Left, Right, Suck, NoOp

Vacuum Agent Function

Percept Sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
[A, Clean], [A, Dirty]	Suck
...	

Rational Agent

What is rational depends on:

Performance measure - The performance measure that defines the criterion of success

Environment - The agents prior knowledge of the environment

Actuators - The actions that the agent can perform

Sensors - The agent's percept sequence to date

We'll call all this the Task Environment (PEAS)

Vacuum Agent PEAS

Performance Measure: minimize energy consumption, maximize dirt pick up. Making this precise: one point for each clean square over lifetime of 1000 steps.
Environment: two squares, dirt distribution unknown, assume actions are deterministic and environment is static (clean squares stay clean)
Actuators: Left, Right, Suck, NoOp
Sensors: agent can perceive it's location and whether location is dirty

Automated taxi driving system

Performance Measure: Maintain safety, reach destination, maximize profits (fuel, tire wear), obey laws, provide passenger comfort, …
Environment: U.S. urban streets, freeways, traffic, pedestrians, weather, customers, …
Actuators: Steer, accelerate, brake, horn, speak/display, …
Sensors: Video, sonar, speedometer, odometer, engine sensors, keyboard input, microphone, GPS, …

Autonomy

A system is autonomous to the extent that its own behavior is determined by its own experience.

Therefore, a system is not autonomous if it is guided by its designer according to a priori decisions.

To survive, agents must have:

- Enough built-in knowledge to survive.
- The ability to learn.

Properties of Environments

Fully Observable/Partially Observable

- If an agent's sensors give it access to the complete state of the environment needed to choose an action, the environment is **fully observable**.
- Such environments are convenient, since the agent is freed from the task of keeping track of the changes in the environment.

Deterministic

- An environment is **deterministic** if the next state of the environment is completely determined by the current state of the environment and the action of the agent.
- In an accessible and deterministic environment, the agent need not deal with uncertainty.

Properties of Environments

Static/Dynamic.
A **static** environment does not change while the agent is thinking.
The agent doesn't need to observe the world during deliberation.

Discrete/Continuous.
If the number of distinct percepts and actions is limited, the environment is **discrete**, otherwise it is **continuous**.

Some agent types

(1) Table-driven agents

- use a percept sequence/action table in memory to find the next action. They are implemented by a (large) **lookup table.**

(2) Simple reflex agents

- are based on **condition-action rules**, implemented with an appropriate production system. They are stateless devices which do not have memory of past world states.

(3) Model-based reflex agents

- have **internal state**, which is used to keep track of past states of the world.

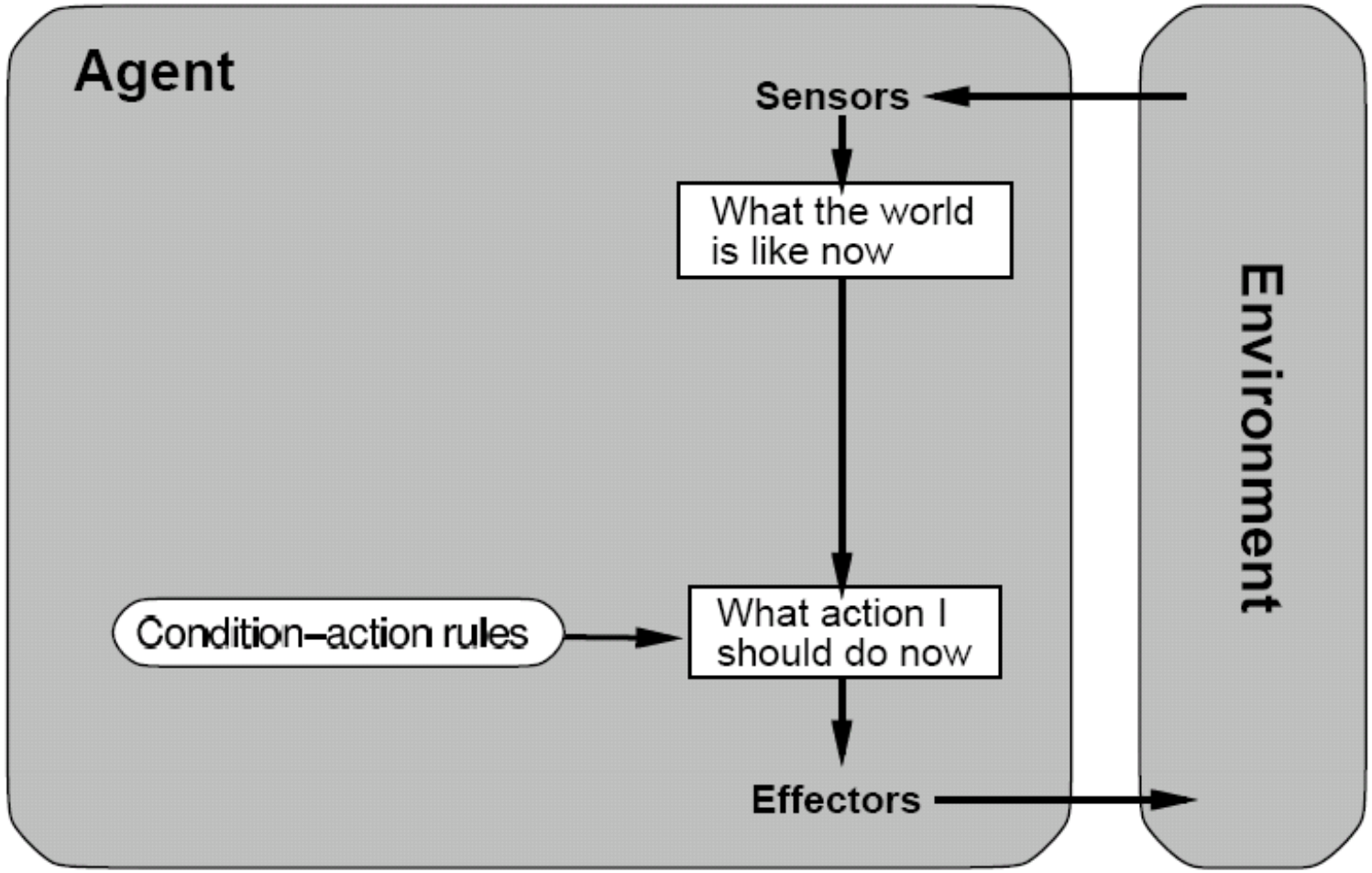
(4) Goal-based agents

- are agents that, in addition to state information, have **goal information** that describes desirable situations. Agents of this kind take future events into consideration.

(5) Utility-based agents

- base their decisions on **classic axiomatic utility theory** in order to act rationally.

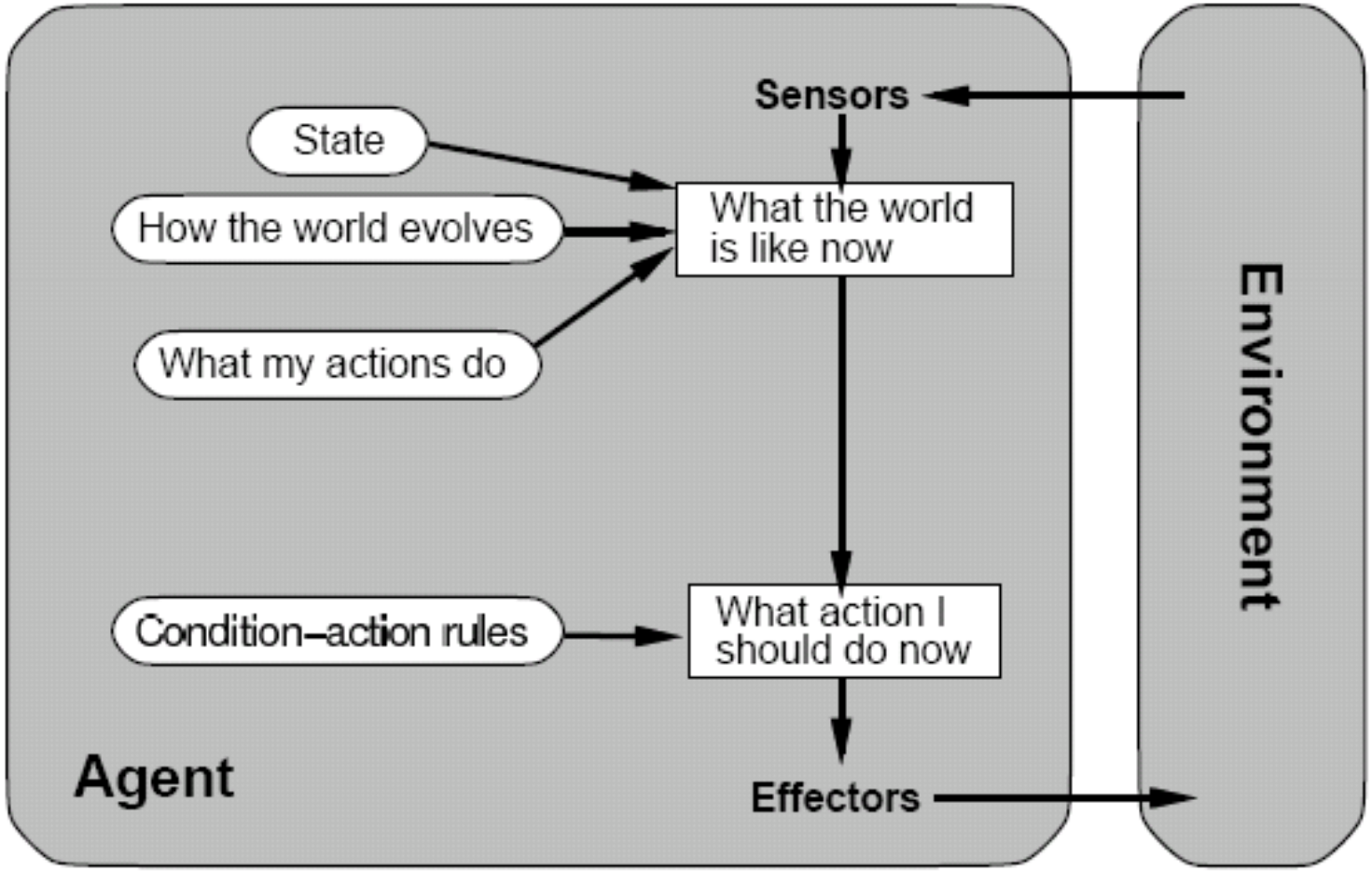
Table-driven/reflex agent architecture



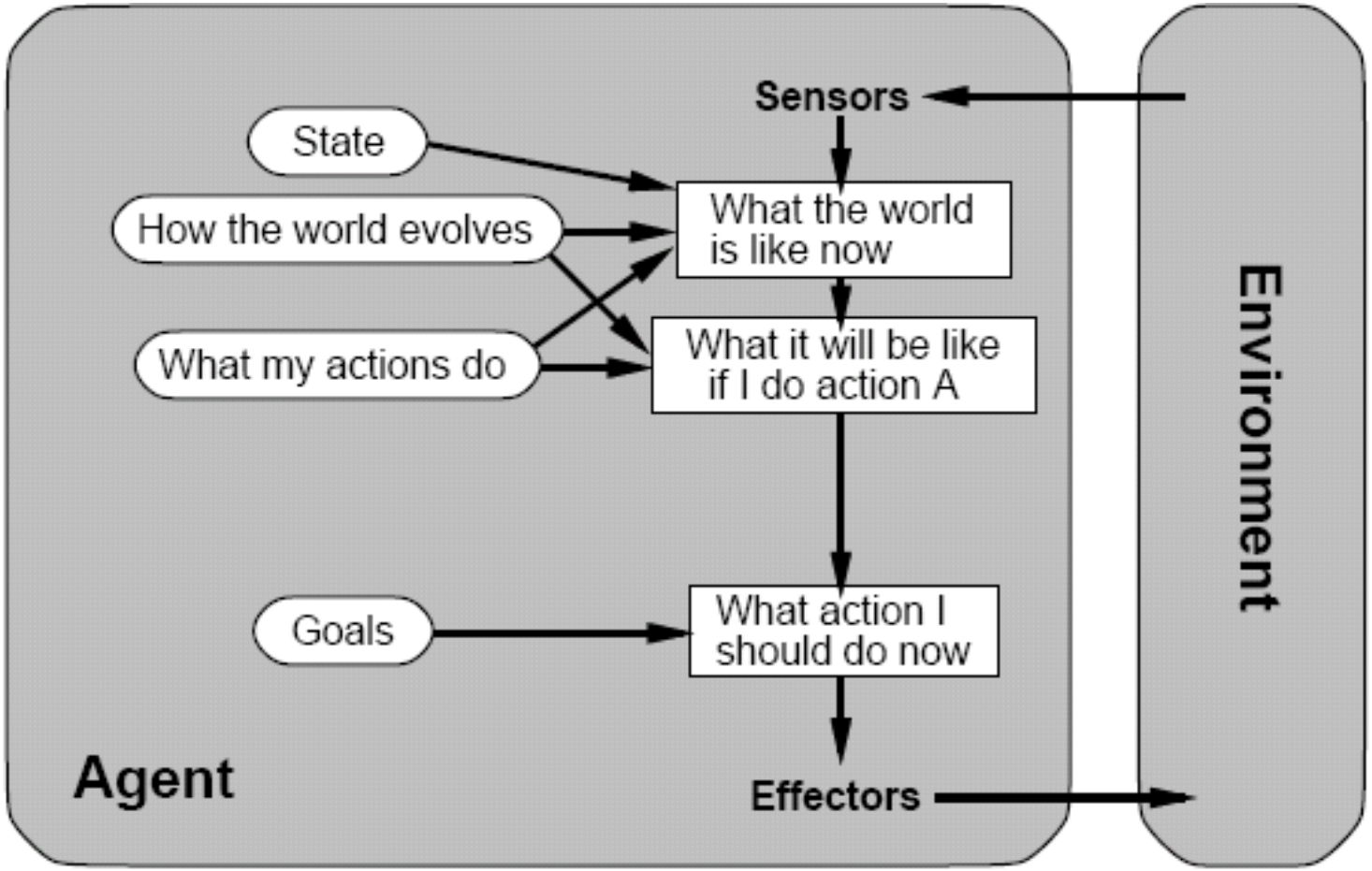
Simple Vacuum Reflex Agent

function Vacuum-Agent([location,status])
returns **Action**
if status = Dirty then return **Suck**
else if location = A then return **Right**
else if location = B then return **Left**

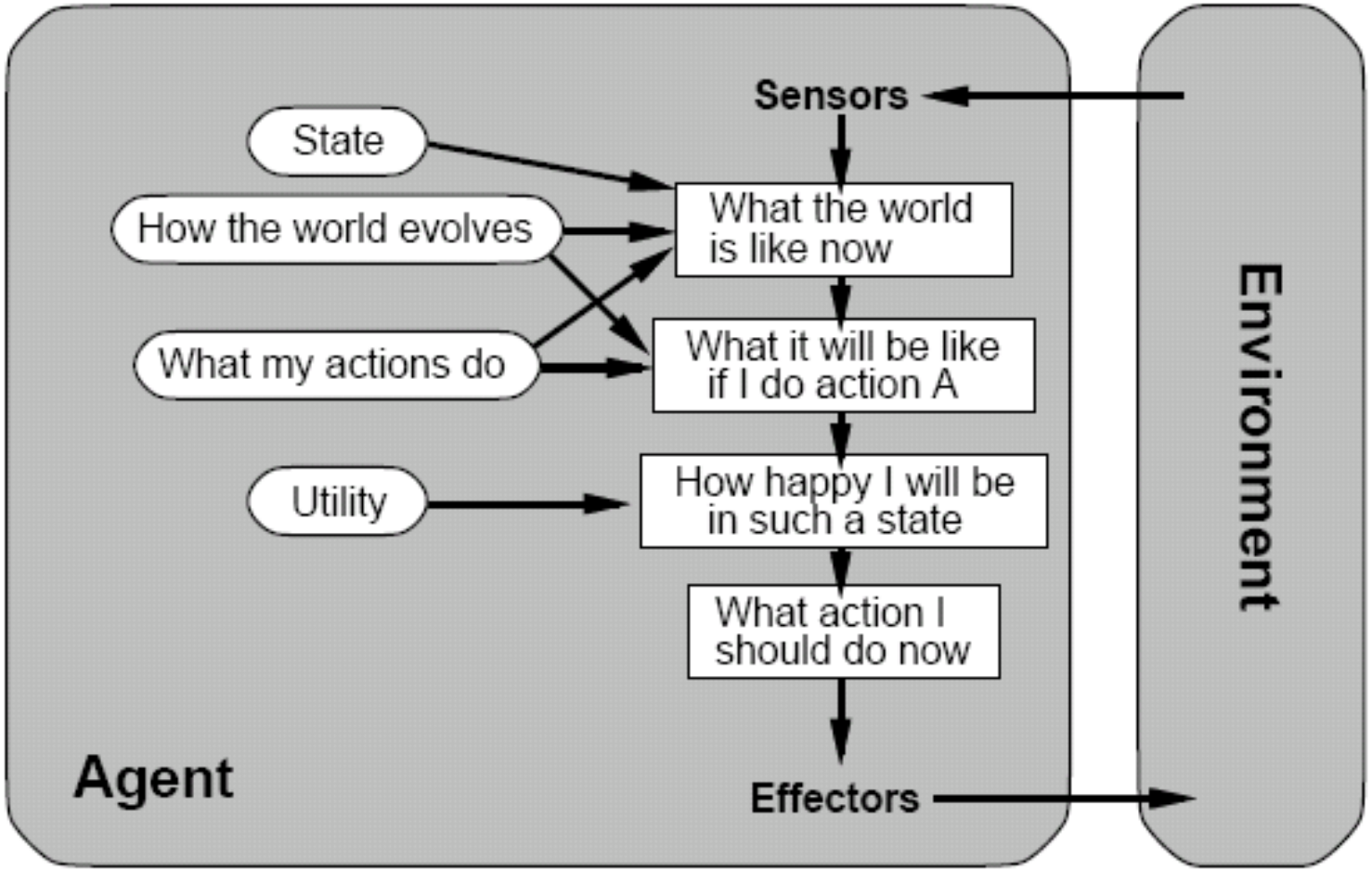
Model-based agent architecture



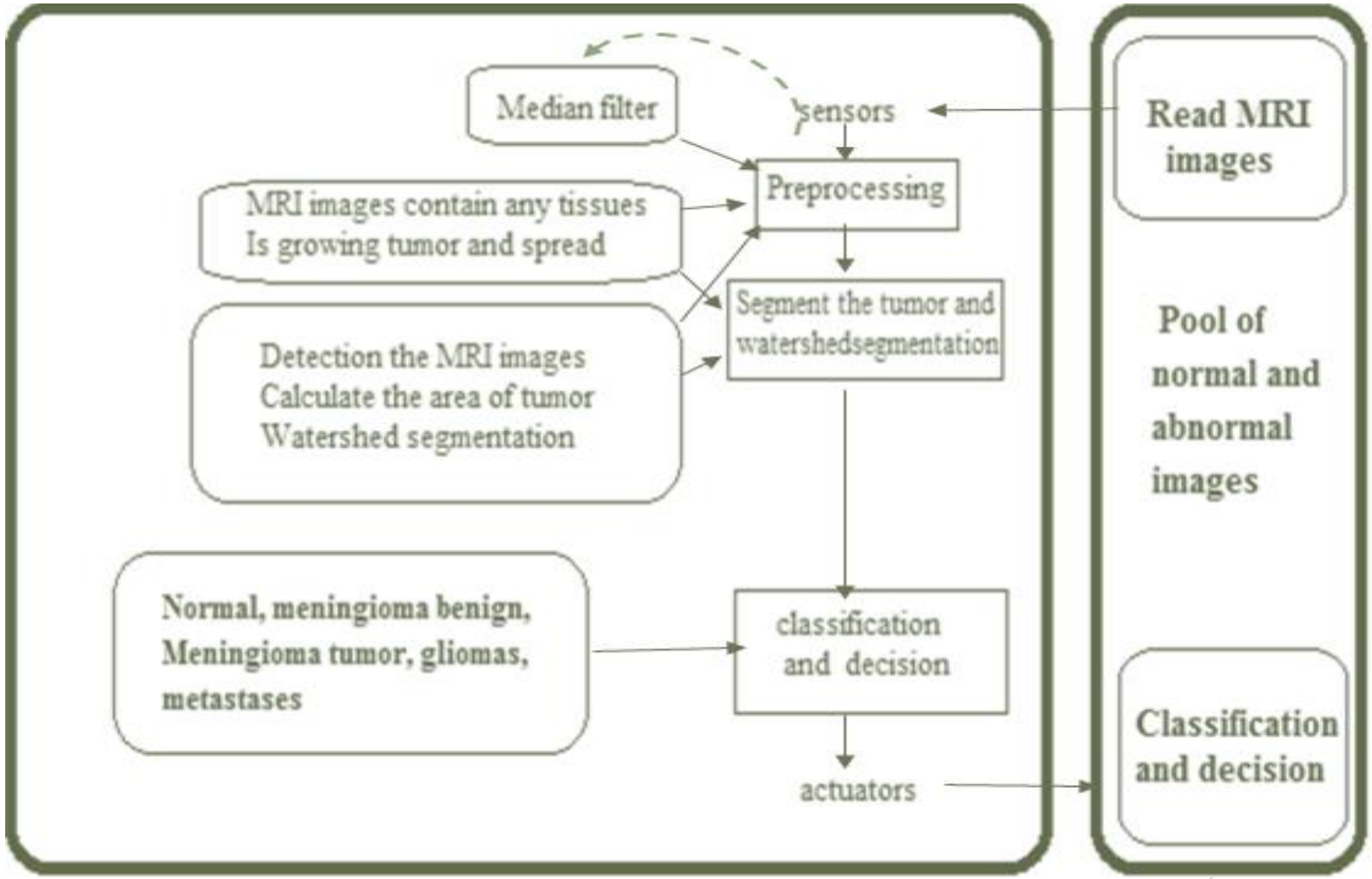
Architecture for goal-based agent



Architecture for a complete utility-based agent



Agency System for Brain Tumor Image Classification



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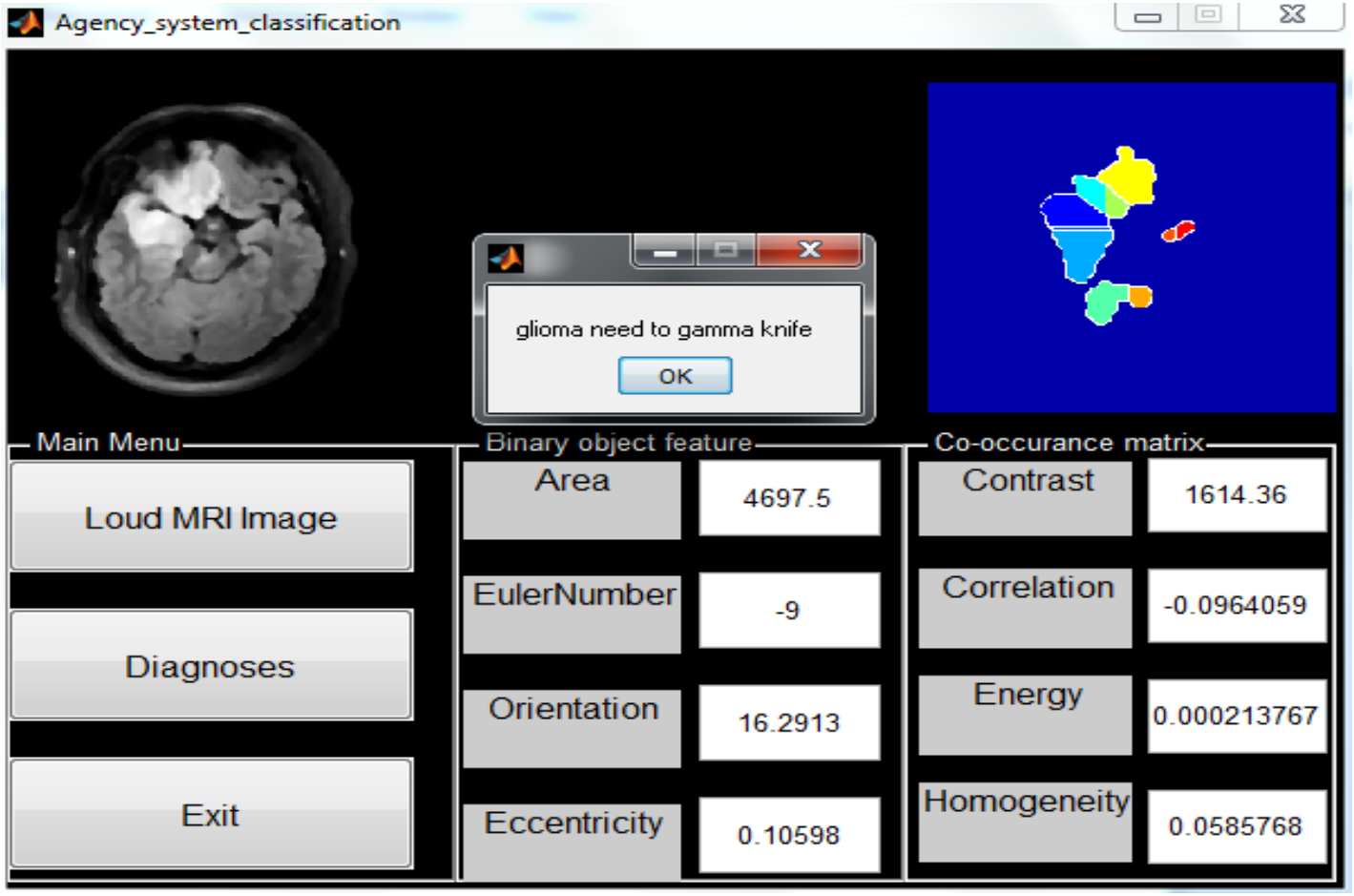
MRI image contain glioma tumor



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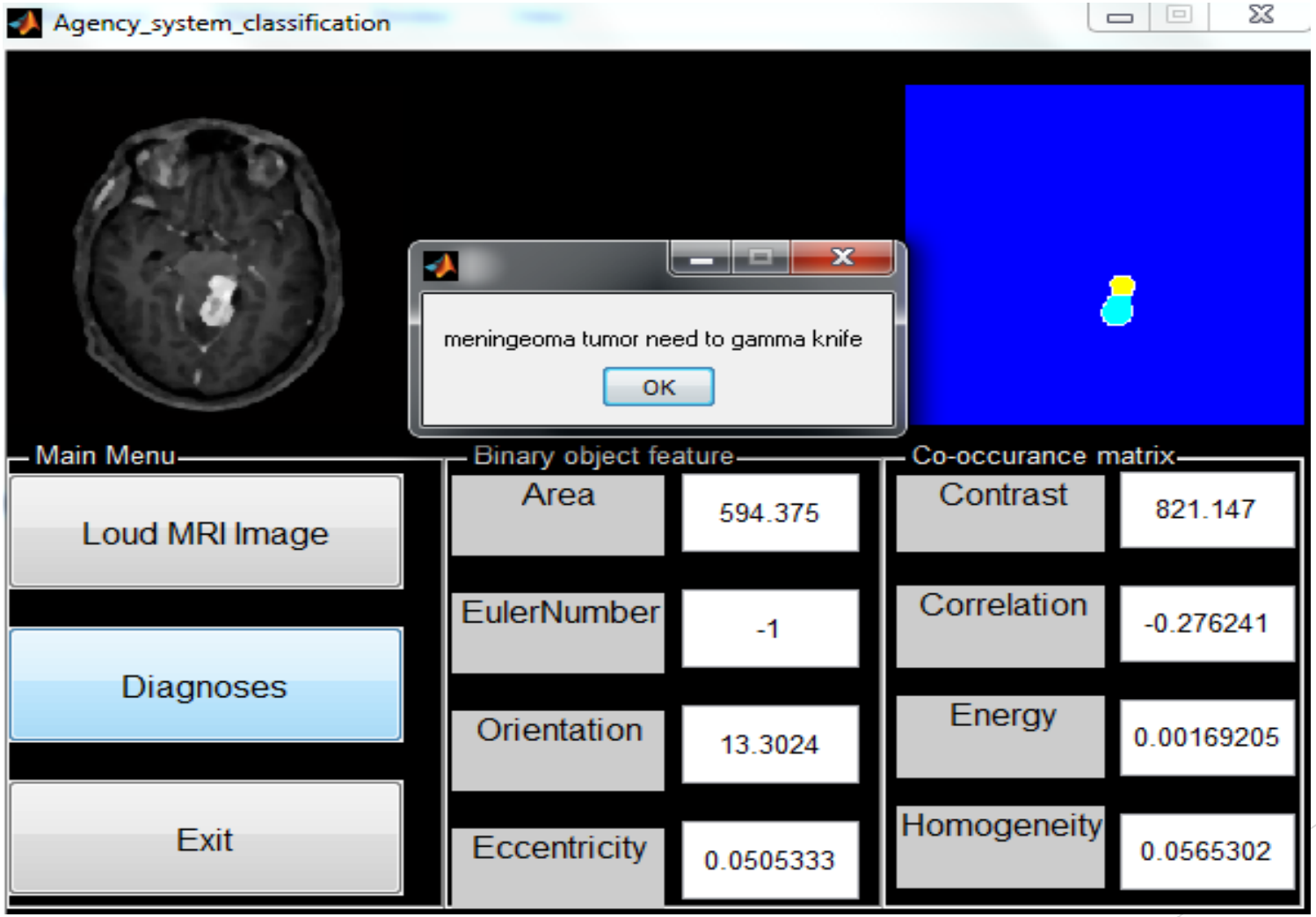
MRI image contain meningeoma benign



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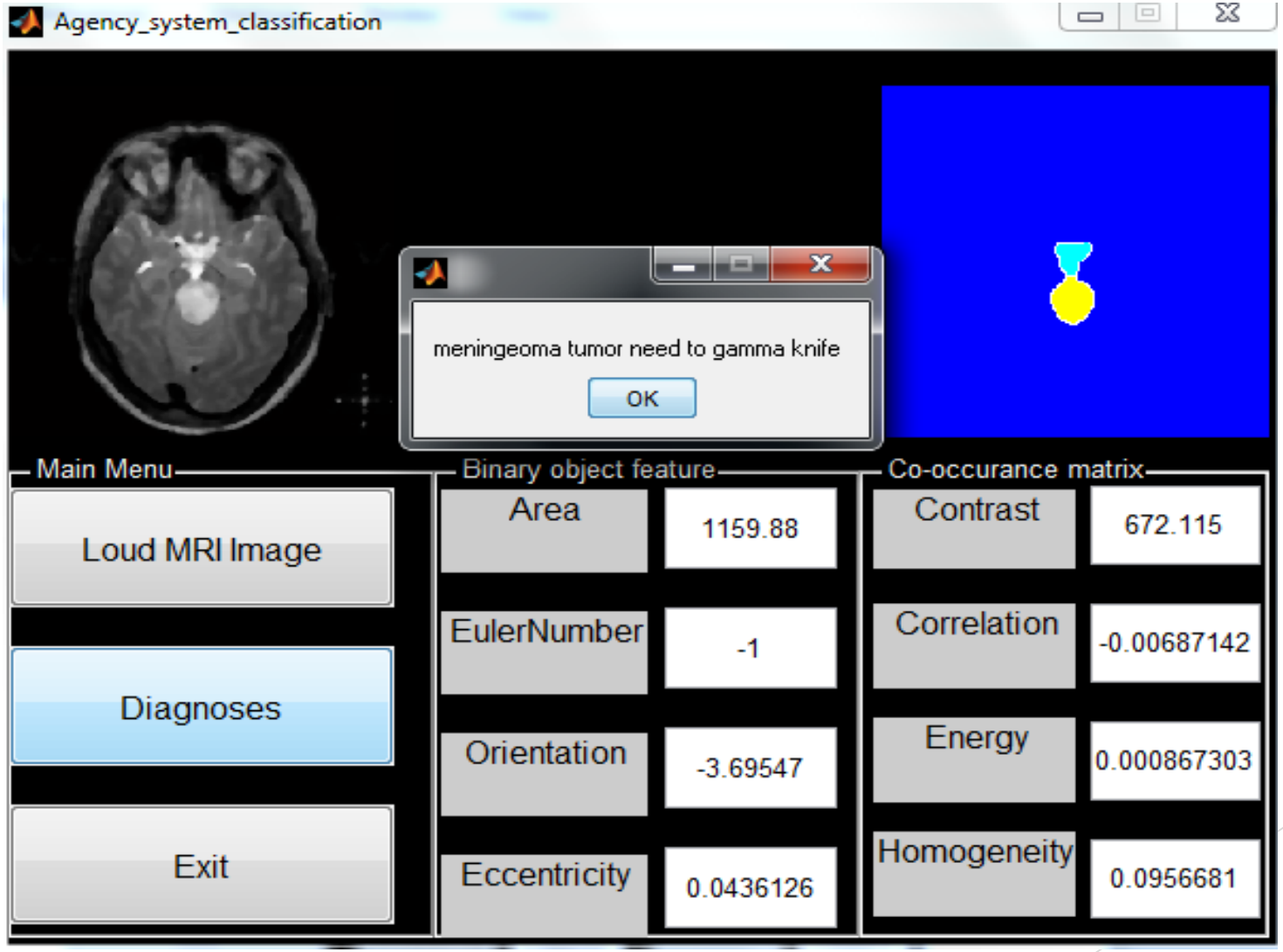
MRI image contain meningeoma tumor



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Summary

An **agent** perceives and acts in an environment, has an architecture, and is implemented by an agent program.
Task environment – **PEAS (P**erformance**, E**nvironment, **A**ctuators, **S**ensors**)**

An **ideal agent** always chooses the action which maximizes its expected performance, given its percept sequence so far.

An **autonomous agent** uses its own experience rather than built-in knowledge of the environment by the designer.

An **agent program** maps from percept to action and updates internal state.

Reflex agents respond immediately to percepts.
Goal-based agents act in order to achieve their goal(s).
Utility-based agents maximize their own utility function.
Representing knowledge is important for successful agent design.

The most challenging environments are inaccessible, nondeterministic, dynamic, and continuous

Thank you for attention