| Agents | start time: |
|---|---|

AI is about practical reasoning: reasoning in order to do something. A coupling of perception, reasoning, and acting comprises an **agent**. An agent acts in an **environment**. An agent's environment may well include other agents.

**Before you start**, share this document with your team member(s) and then complete the form below to assign the role of speaker.

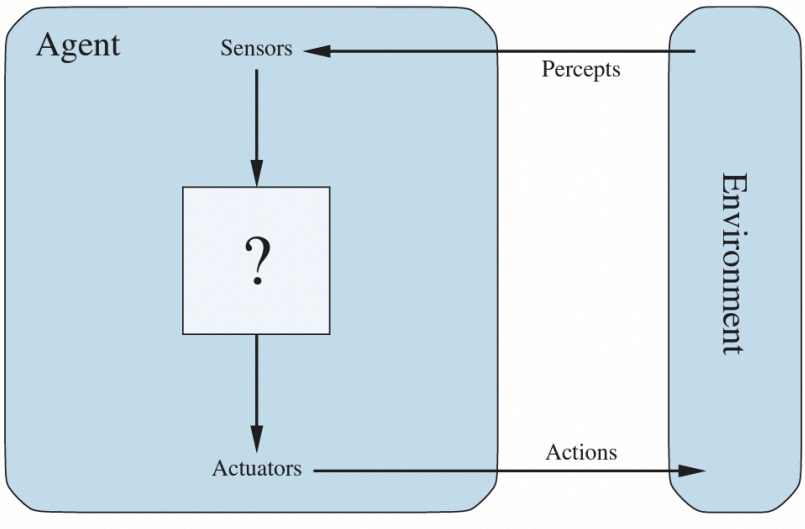
| Team Role | Team Member |
|---|---|
| **Speaker**: shares your team's ideas with the class. | Kelii Kiilehua<br>Arogya Upadhyaya<br>Tim Xu |

| A. Types of Environments | start time: |
|---|---|

**RUSSELL & NORVIG'S AGENT.**

The authors of the optional textbook, *Artificial Intelligence: A Modern Approach*, develop an agent-based model of AI.

In the agent model, the agent interacts with its world, the "environment," by receiving percepts (sensor data) and taking actions (via its actuators).




Agents interact with environments through sensors and actuators.

We group all these under the title of the **task environment**. We call it as **PEAS** (Performance, Environment, Actuators, Sensors). For example, we have this PEAS description for an automated taxi driver:

| Agent Type | Performance Measure | Environment | Actuators | Sensors |
|---|---|---|---|---|
| Taxi driver | Safe, fast, legal, comfortable trip, maximize profits, minimize impact on other road users | Roads, other traffic, police, pedestrians, customers, weather | Steering, accelerator, brake, signal, horn, display, speech | Cameras, radar, speedometer, GPS, engine sensors, accelerometer, microphones, touchscreen |

**Figure 2.4** PEAS description of the task environment for an automated taxi driver.

1. Fill in the table below with appropriate descriptions of the PEAS for various agents:

| **Agent Type** | **Performance Measure** | **Environment** | **Actuators** | **Sensors** |
|---|---|---|---|---|
| Medical diagnosis system | Accuracy of Blood pressure, heart rate, health, success rate | Hospitals, Patients, Doctors | Display Screen, | BP Monitors, Blood extractor, Heart rate monitor, Camera |
| Satellite image analysis system | Clarity of Image, Accuracy of data | Space, Space Station, Ground Station | Satellite, Display, Geographic data | Cameras, GPS, Gyroscope, Barometer |
| Part-picking robot | Maximum load, efficiency, speed, safety | Industrial complexes, Robots, | Moving legs/wheels?, arms, claw/hands | Motion sensors, Sensor that tells parts apart, camera |
| Interactive English tutor | Accuracy of grammar, spelling, syntax, ability to understand the second language of student | Schools, students, | Speech, | Microphone, Camera |

For each of the following applications, identify if an agent for that application would be:

A. Fully or partially observable
B. Single agent or multiagent
C. Deterministic or stochastic - if or not the next state of the environment is completely determined by the current state and the action.
D. Episodic or sequential - if or not the next episode depends on the actions taken in previous episode.
E. Static or dynamic - if or not the environment changes while an agent is deliberating
F. Discrete or continuous - the state of the environment

2. Fill in the table below to identify the characteristics of each environment.

| Task Environment | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Crossword Puzzle | Fully | Single | Deterministic | Sequential | Static | Discrete |
| Chess with a clock | Fully | Single | Deterministic | Sequential | Static | Discrete |
| Poker | Partially | Single | Stochastic | Sequential | Static | Discrete |
| Taxi driving | Partially | Single | Stochastic | Sequential | Dynamic | Continuous |
| Medical diagnosis | Partially | Multi | Stochastic | Sequential | Dynamic | Discrete |
| Image analysis | Fully | Single | Stochastic | Sequential | Dynamic | Continuous |
| Part-picking robot | Fully | Single | Stochastic | Episodic | Dynamic | Continuous |
| English tutor | Partially | Single | Deterministic | Sequential | Static | Continuous |

| B. Types of Agents | start time: |
|---|---|

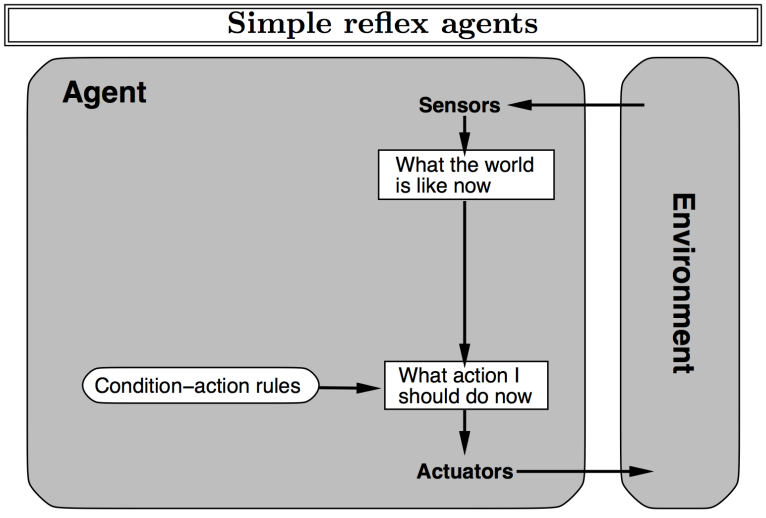
**RUSSELL & NORVIG'S FIVE AGENTS.**

Our goal is to design agents that behave in an "intelligent" way. Russell and Norvig propose five agent types. These are:

- simple reflex agent
- model-based reflex agent
- model-based, goal-based agent
- model-based, utility-based agent
- general learning agent

In the exercises that follow, you are to identify one or more examples of a specific entity which would exemplify each type of agent. You will also identify entity's corresponding environment, and write a sentence or two about why you think it's that type of agent.

The entities might be animals or organisms, physical systems, software agents, or anything. Begin with the simple reflex agent when directed.

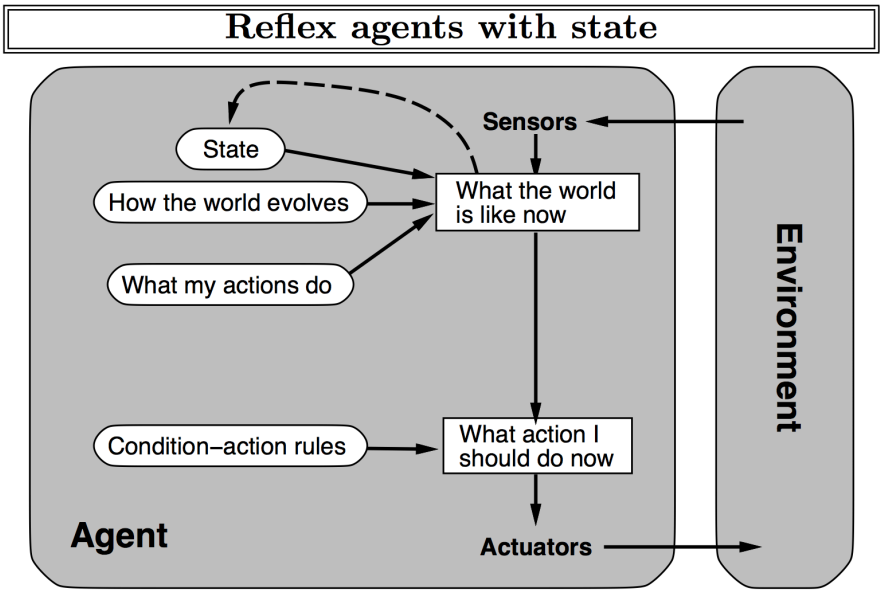



4. The simplest kind of agent is the **simple reflex agent**. It has no internal state. It takes percepts

and immediately translates them to actions, via a table (or similar structure) of "condition-action rules."

In the space below, identify one or more simple reflex agents, their corresponding environments, and describe why each is this type of agent.

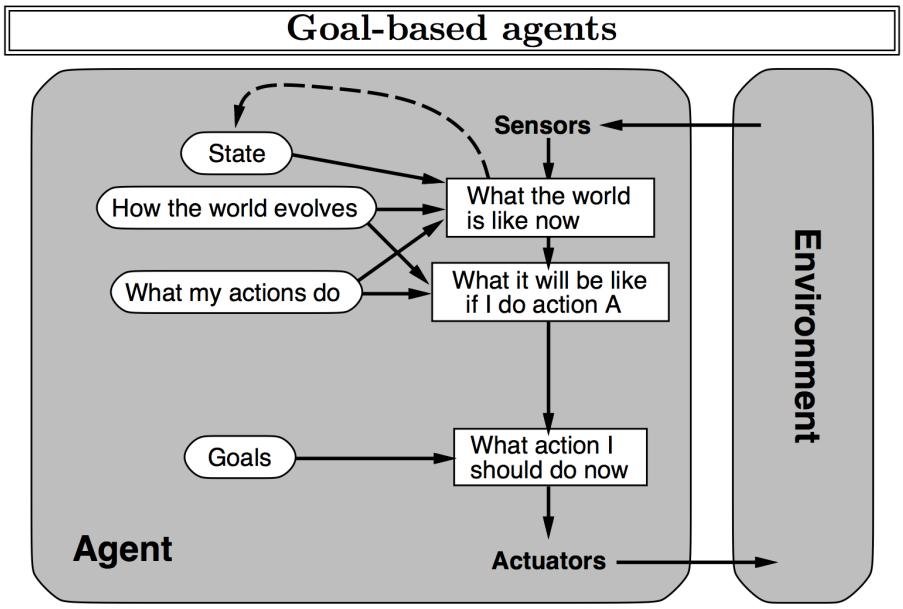
Light Intensity Sensor -> When environment light intensity increases the light bulb intensity decreases
Heart Rate Monitor (Pulse Increase -> Beeping Intensity)
Motion Sensor Connected To Alarm -> When motion is detected, the alarm is turned on




5. The **model-based reflex agent** keeps track of the world by maintaining some state. The state represents the world, including the world that is not presently perceivable. This agent also has a model about what its actions might do. It gives its model of the world to the condition-action rules of the reflex agent.

In the space below, identify one or more model-based reflex agents, their corresponding environments, and describe why each is this type of agent.

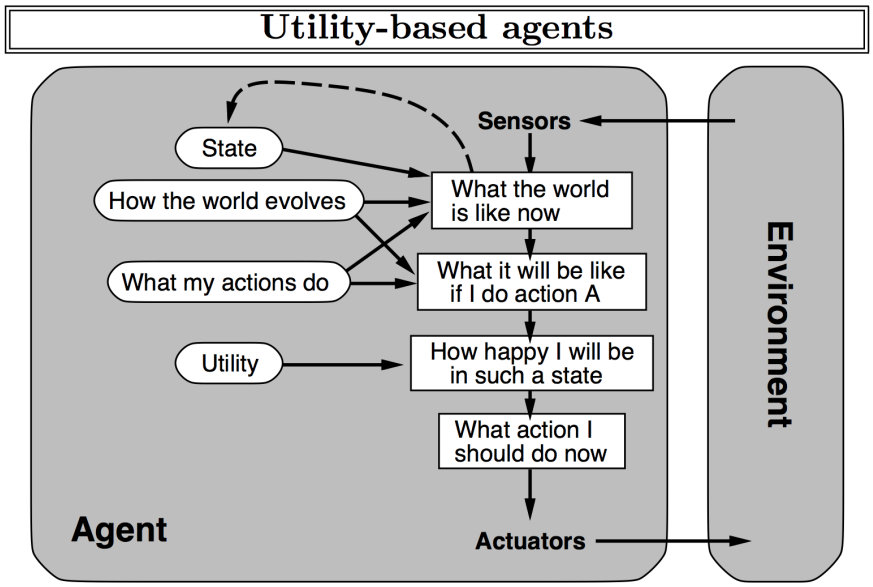
Check Engine Light -> Turn on when several part fail in engine consecutively
Self cleaning vacuum cleaner -> Records when was last cleaned and cleans based on that
Screen Time in iPhone -> When on an app for long time, the app shuts off (recording time limit)




6. The model-based, **goal-based agent** includes the world model introduced by the model-based agent. It is able to reason about how the world will change if it takes specific actions. It also has goals, and can plan its action to achieve them—e.g., minimizing the distance between its current state and a goal state.

In the space below, identify one or more goal-based agents, their corresponding environments, and describe why each is this type of agent.

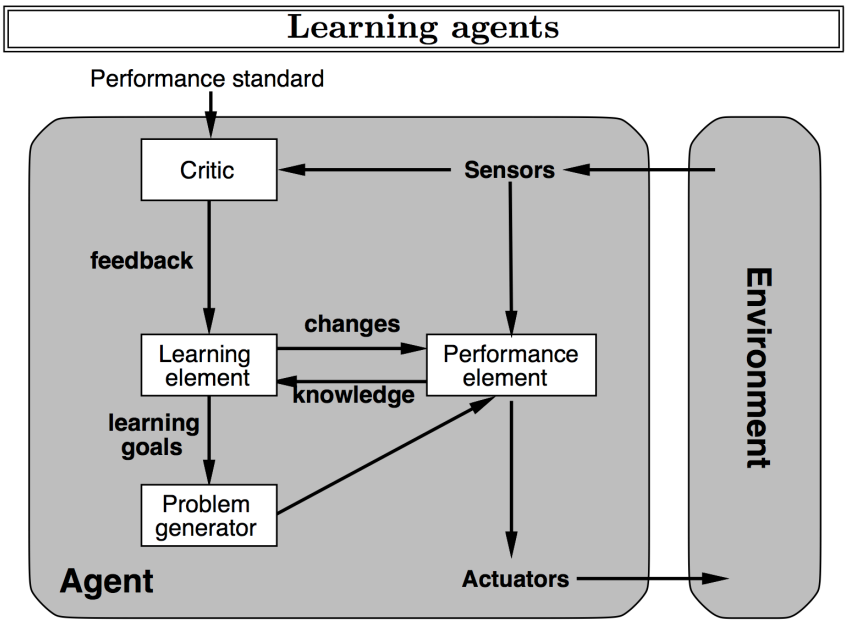
Self driving cars -> the goal is to reach the destination
Chess Bots -> the goal is to win the chess game against opponent
Maze Solver -> the goal is to complete the maze within given time




7. The model-based, **utility-based agent** evaluates its state using a utility function, which provides some measure of "goodness." The utility function may take into account both the world state and the agent's own position in the world. The agent attempts to take actions that maximize the utility function.

In the space below, identify one or more utility-based agents, their corresponding environments, and describe why each is this type of agent.

Google Maps Finding Best Possible Route and Avoiding Traffic
Travelling Salesman finding the best possible route




8. All four basic agent types can be turned into learning agents.

The **general learning agent** includes a "learning element," which is responsible for making improvements to the agent's "performance element," which takes decisions. This agent also includes a "critic," which provides feedback to the learning element, and a "problem generator," which suggests actions that should lead the agent into unfamiliar situations from which it can continue to learn.

In the space below, identify one or more learning agents, their corresponding environments, and describe why each is this type of agent.

Finish charging iPhone at wake up time -> Learns the wake-up time of the user
Google Maps learning where we want to go and suggesting that based on several factors