ECIII/ECSI 3206:
Artificial Intelligence [and expert systems]
Topic 2: Agents in A.I

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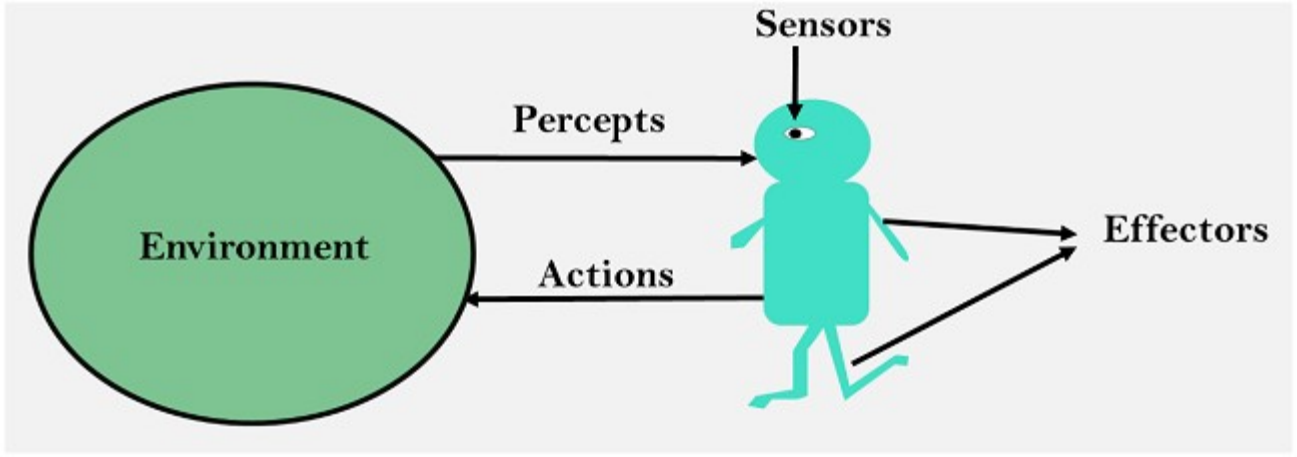
A.I agents

- Anything that can perceive its environment through the use of **sensors** and act on its environment through the use of **Effectors**



Agent Classifications

- Human agents[use organs]
- Robotic agents[use cameras, sensors and motors]
- Software agents[Use programs/bits and bytes]

Agent terminologies

- Agent function-[is the map from percept sequence to action sequence]
- Rationality-[ability to be reasonable , sensible and have good sense of judgment]
- Ideal rational Agent-[one that is capable of taking action to maximize its performance based on percept sequence and built in knowledge]
- Agent architecture-[machinery that an agent acts on]
- Agent program-[an implementation of agent function]

Factors affecting rationality of an Agent

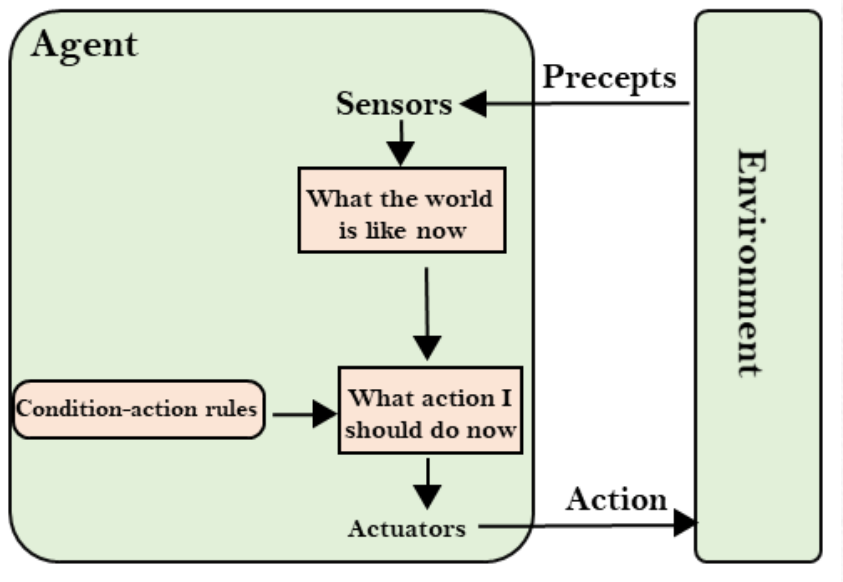
1. Performance measures
2. Agent percept sequence
3. Agent prior knowledge about the environs
4. Actions that an agent is allowed to carry out

Types of agents based on functioning

- Simple Reflex Agents
- Model based reflex agents
- Goal based agents
- Utility based Agents

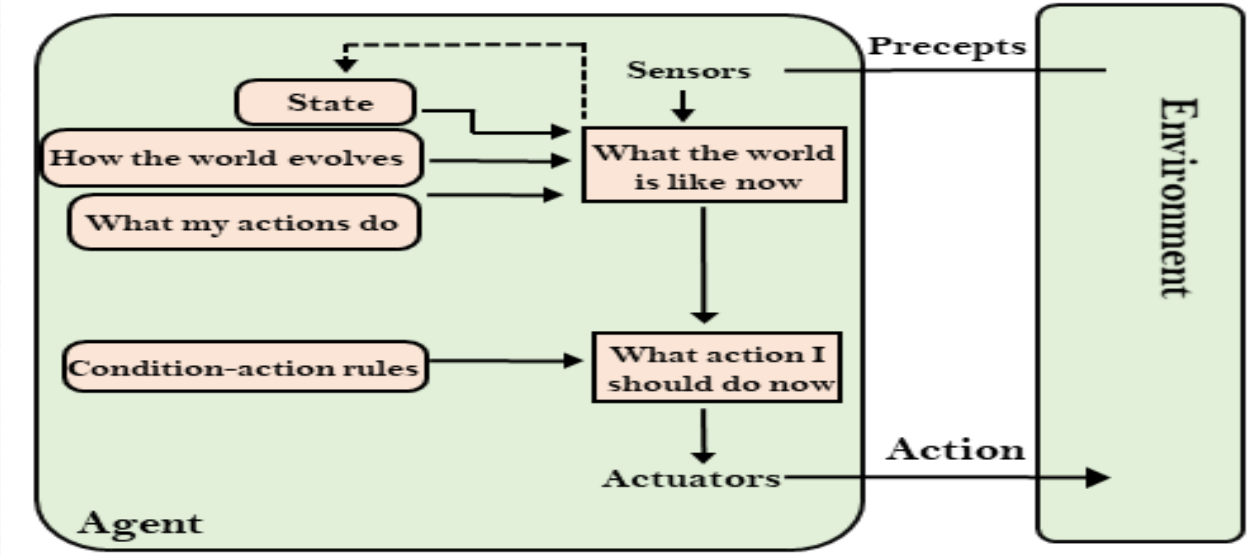
1. Simple Reflex agents

- They choose their actions based on percept sequence
- Have very little intelligence
- Any change in their environments requires collection of new rules
- Their environment is completely observable[e.g mail sorting robot]



2. Model based reflex agents

- Choose the best action based on real world model.
- They maintain an internal state which is unobserved aspects of the current state depending on the percept history.[e.g simple vacuum cleaner]



3. Goal based Agents

- Are agents that choose their actions in order to achieve a specific goal. [goal=desired state/situation]
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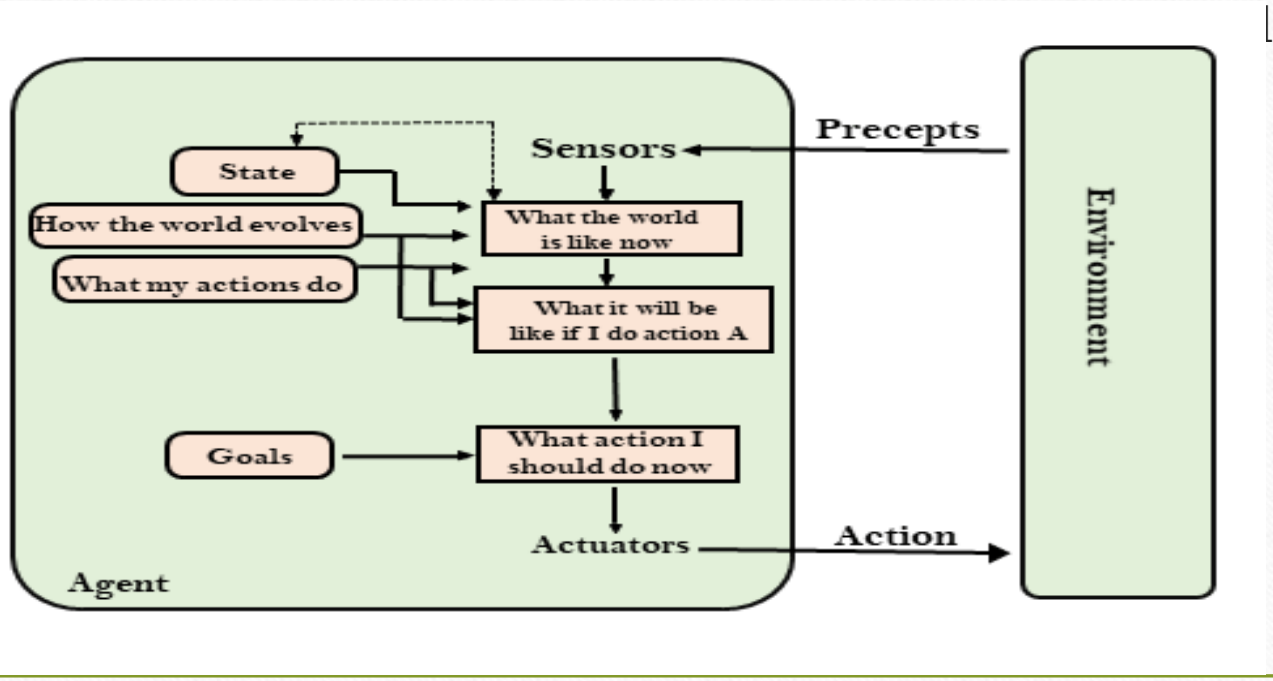
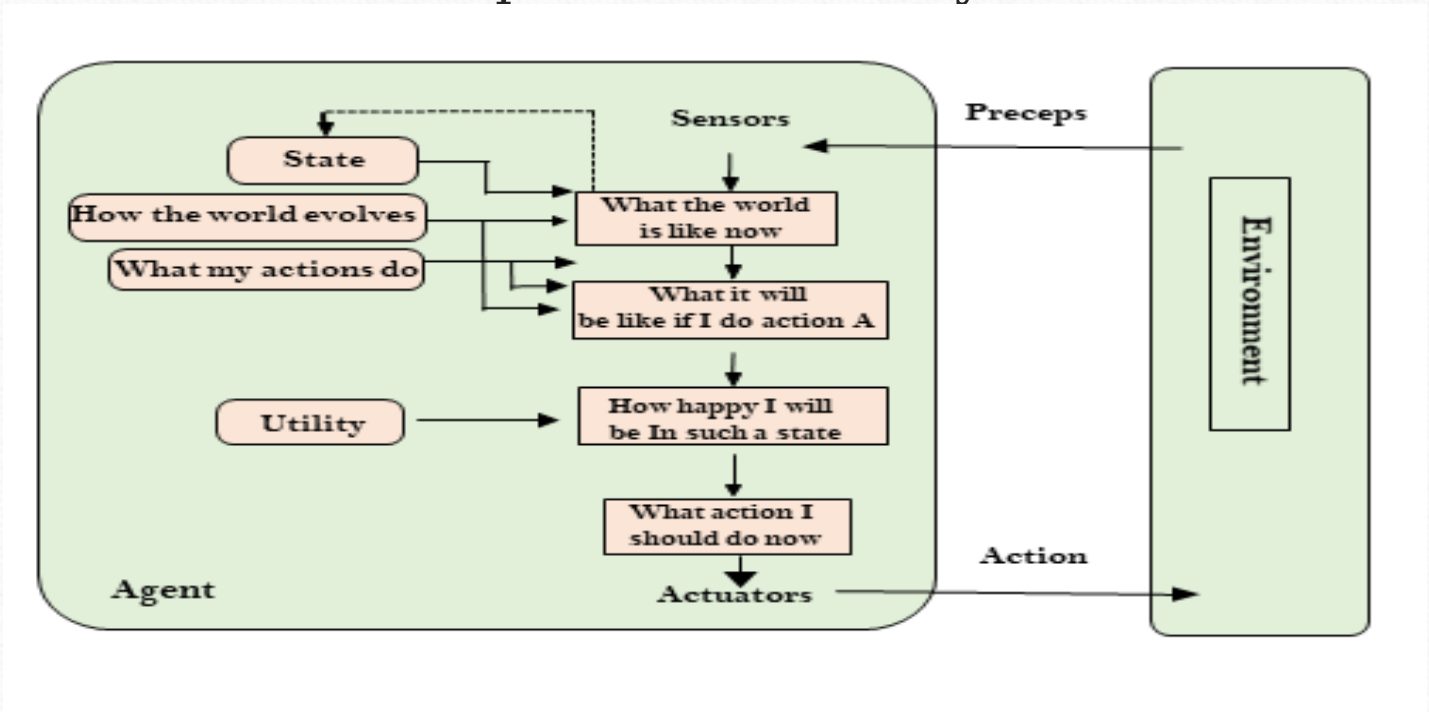


4. Utility based Agents

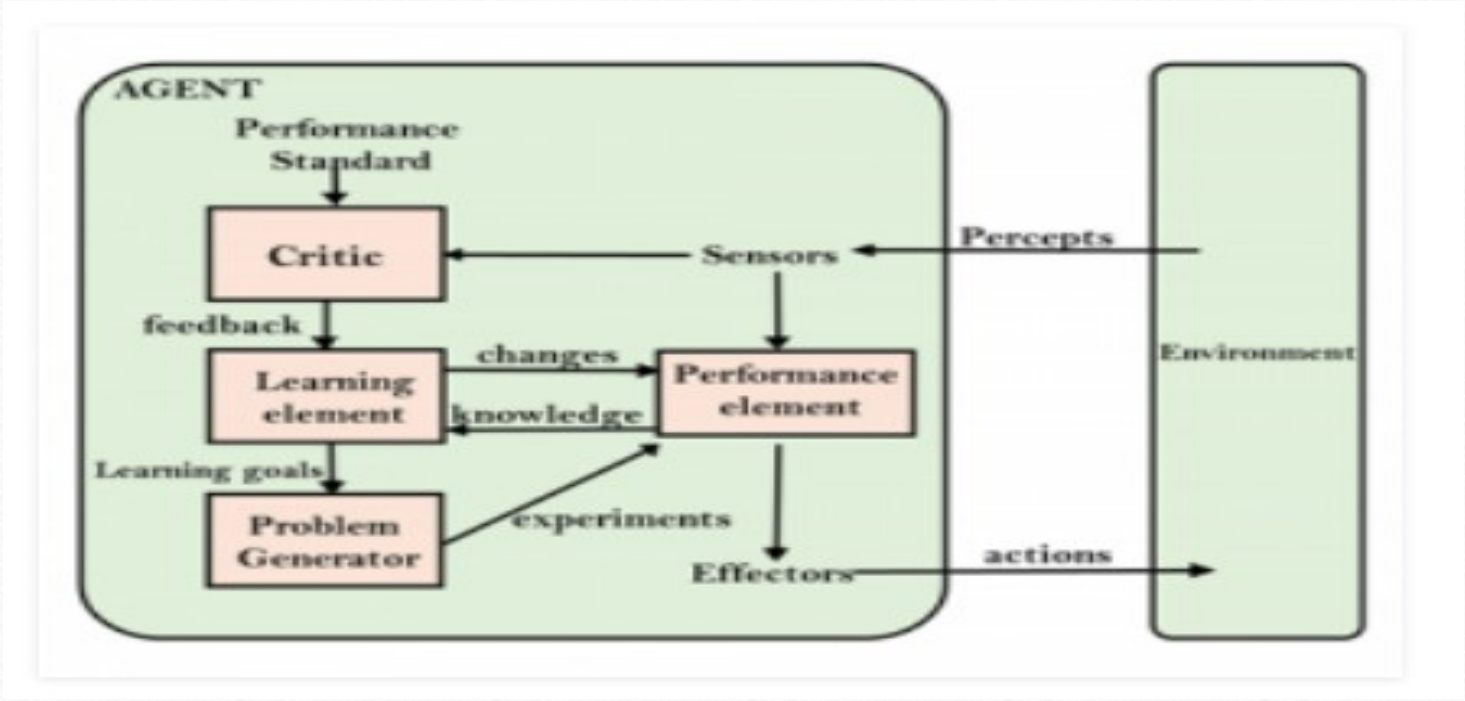
- Choose action based on preference /utility for each state



5.Learning Agents[still evolving]

- **Learning Agent**
- A learning agent in AI is the type of agent which can learn from its past experiences or it has learning capabilities.It starts to act with basic knowledge and then able to act and adapt automatically through learning.
- A learning agent has mainly four conceptual components, which are:
  - **Learning element :**It is responsible for making improvements by learning from the environment
  - **Critic:** Learning element takes feedback from critic which describes how well the agent is doing with respect to a fixed performance standard.
  - **Performance element:** It is responsible for selecting external action
  - **Problem Generator:** This component is responsible for suggesting actions that will lead to new and informative experiences.

Learning agent diagram



Agent Environments and their properties

- Discrete vs Continuous environments
- Observable vs partially observable environments
- Episodic vs non Episodic environments
- Deterministic vs non deterministic environments
- Accessible vs inaccessible environments
- Static vs Dynamic environments
- Single Agent vs Multi Agent Environments

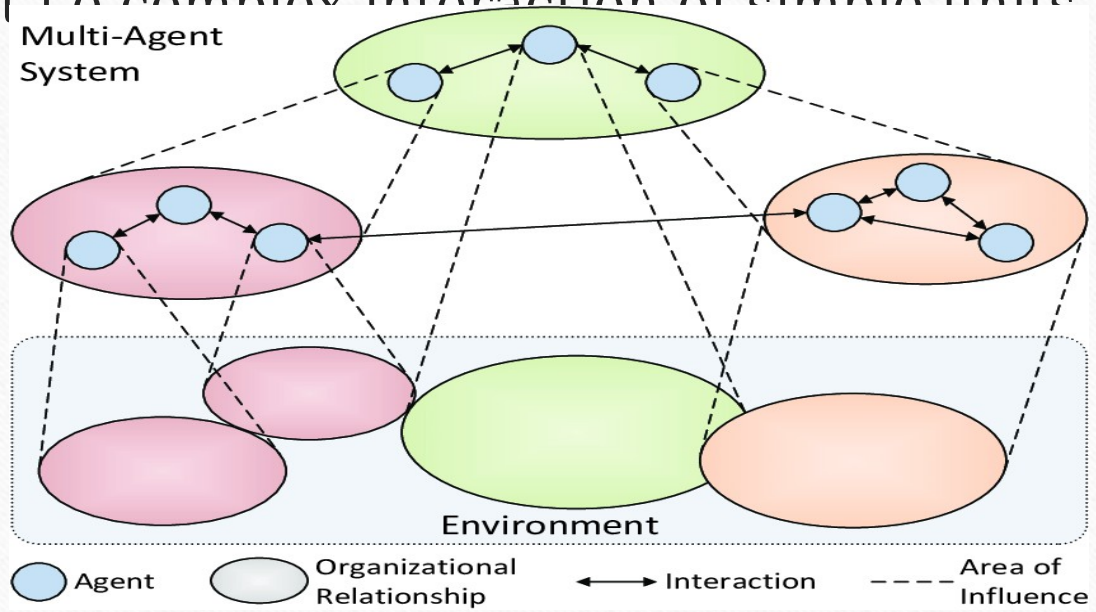
Task environment elements when designing intelligent agents

- Performance measures
- Environment itself
- Actuators
- Sensors

[examples of Vacuum cleaner or Taxi Cab]

Multi-Agent Systems[MAS]

- It’s a collection of multiple autonomous intelligent agents each acting towards its objectives while interacting in a shared environment i.e complex interaction of simple units



Advantages of M.A.S

- Solve problems that are too large for a single agent to solve
- Reduce the risk of failure
- Solve autonomous problems

Properties of Autonomous Agents

- Reactive [action driven by events] vs Proactive [agent takes initiative]
- Sociable [interacts with other agents thru’ cooperation, coordination or negotiation]
- Competitive[each agent has a different utility] vs cooperative[shared utility]

Characteristics of M.A.S

- Each agent has incomplete information/ ability
- Data is decentralized
- Computation is asynchronous
- There is no global system control

Applications of M.A.S

- Computer games
- Supply chain management
- Air traffic control
- Search and rescue [Unmanned vehicles with distributed sensors]
- Robocup
- Intelligent transport systems
- Automated manufacturing industries