



PERFORMANCE, ENVIRONMENT, ACTUATORS, AND SENSORS MODEL TO PORTRAY AN INTELLIGENT AGENT MODEL

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Abstract

Designing intelligent agents that can do functions that are currently considered to need human intelligence is the focus of the computer science subfield known as artificial intelligence. The main objective of AI is to make computers better at learning, thinking, and perceiving. It has also been applied to the imitation or emulation of human intellect by machines. What distinguishes a computer from an artificial intelligence? An AI is composed of agents, or anything that can sense its environment. Agents employ sensors to comprehend the environment around them and actuators to act in it. For instance, computers are utilized as agents in medical diagnosis systems to process data from patient symptoms, and motors are necessary for the movement of vacuum cleaners, among other things. Using PEAS, we can better comprehend how these intelligent robots operate (Peer-to-peer Artificial Intelligence). PEAS enable collaboration between two or more persons who share a common interest. The AI agent uses the PEAS model to recognize and comprehend its surroundings. It enables precise evaluations of the agent's performance in reference to that environment. In this article, we'll examine what an intelligent agent is in more detail and talk about some of the many contexts that agents may exist in. In order to help you decide which one could be most appropriate for your project or assignment, we'll also compare their descriptions.



Keywords: PEAS, PAGE, Intelligent Agent, Agent Program, Agent Architecture, Agent Types, Agent-Environment.

1 Introduction

The persistent development of digital machines has made it possible for them to carry out particular activities that closely mirror those handled by intelligent agents, such as the capacity to reason and draw lessons from the past. The goal of artificial intelligence is to develop systems with both cognitive skills and human-like behavioral characteristics. [1]

Artificial intelligence comes in two flavors: weak AI, which is constrained in scope and created to do a specific job, and strong AI, which has the ability to independently develop solutions. Strong AI systems must be programmed to be able to make judgments independently since they are more sophisticated than weak AI systems.

Algorithm design and development are the key themes of the artificial intelligence subfield known as machine learning. The primary objective is to automatically train the system so that it can identify complicated patterns and make wise judgments based on the information presented. [2-10]

2 State of Research of Intelligent Agent

Intelligent agents are now receiving more attention than artificial intelligence has since the 1970s. Data science, neuroscience, administration, and finance seem to be just a handful of the areas conducting this study. The Communications of the ACM magazine released a number of significant publications on agent theory in 1994. [11]

3 Taxonomy of Intelligent Agents

What exactly is an intelligent agent? A programmed or piece of software that has the ability to decide depending on input is termed an intelligent agent. Adaptive software and programmes are only two

such examples of the many applications that might benefit from this method of developing agents through machine learning. Because they make fewer mistakes while adjusting to their environment in real time, intelligent agents are gaining in popularity.

Agents, or anything that can be seen as detecting and responding to its surroundings, and the settings in which they operate make up artificial intelligence. An AI system is made possible by the combination of these two ideas. Any creature that has the ability to sense its environment through sensors and respond to it appropriately is considered an agent [12].

Human agents contain organs like eyes, hearing, and hands that function as sensors and actuators.

Motors and actuators are used by a robotic agent in place of cameras and rangefinders as sensors.

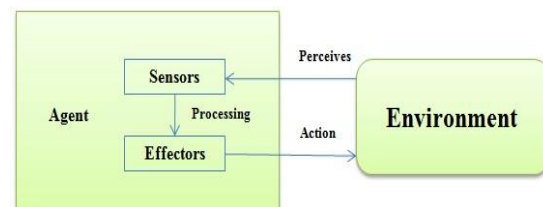


Figure 1: Engineering of Intelligent Agent. Perception and action are the two main strategies that intelligent beings adopt to communicate with their environment. Receiving information from sensors is the process of perception, whilst changing the context with a robot's effectors is the process of action (its arms). The agent has two options: it may either actively study its environment or take a passive approach. When the robot swings its arm to remove a barrier from its environment, for instance, that is an act of interaction.

3.1 Components of Intelligent [12] Agent

The three primary components of a system with intelligent agents are addressed in the section on intelligent agents. For a greater understanding of how they operate, these are explored below.

Sensors are tools that let other electronics track changes in the environment and relay that information to them. AI depends on sentient entities that use sensors to observe their environment.

Actuators are the parts that transform energy into motion. They are not in charge of developing or maintaining a system; rather, they are merely in charge of moving and controlling it.

Effectors are objects that have the power to change the environment.

The architecture, or the computing system on which it will run, and the agent programme are the two components that make up an artificial intelligence programme, according to Russell and Norvig (1995). Designing a system to put this agent mapping from perception to action into exercise becomes the main objective of AI research at that point. $F: p^* \rightarrow A$

3.2 Characteristics of [15] Intelligent Agents

If an agent has the following qualities, it is deemed to be intelligent: it is mindful of what its clients require, is quick on its feet, and has an excellent memory.

The degree of an agent is measured in this text.

It is advantageous to be aware of the environment it will be employed in.

Understanding how it is perceived can be aided by agent knowledge with past perception.

The agent is responsible for doing the necessary activity.

A intelligent agent must be able to progressively adapt to new regulations.

They must have a strong capacity for learning and be able to keep up with the demands of their position even while handling many tasks.

They appear to be somewhat automated in order to be able to do the job autonomously.

3.3 Types of Intelligent Agents

Artificial intelligence (AI) agents come in a plethora of forms. The architecture, or design, that a computer scientist develops to build an AI agent will outline the various divisions and how they are structured. [21] Various agent architecture types are addressed in this section.

3.3.1 Simple Reflex Agent

A reflex-based system is the most basic form of agent architecture. This idea is fairly straightforward and not very intelligent.

Any prior perceptions are disregarded by this reflex agent, which solely reacts to the current perception. The function is based on the condition action rule, which stipulates that if a specific circumstance is present (for example, an object is in front of you), then a particular action should be executed. [17] Even if certain areas are concealed from view, this agent will constantly loop until it has fully observed its environment.

3.3.2 Model based Reflex agent

This is a better iteration of the first kind of agent that can be controlled and used differently depending on the environment. Model-based reflex agents, like all other types of agents, need to know the status of the world right now through their sensors.

These kinds of agents can keep an internal state that some of the unnoticed characteristics of the current circumstance. Or, to put it another way, we could argue that information from the past gives us a

sneak peek into what is taking place right now without our knowledge. [18]

function REFLEX-AGENT-WITH-

STATE(percept) returns an action

static: state, a description of the current world state

rules, a set of condition-action rules

action, the most recent action, initially none

state←UPDATE-STATE

(state,action,percept)

rule←RULE-MATCH(state, rules)

action←RULE-ACTION[rule]

return action

3.3.3 Goal based reflex agent

The knowledge [19] supporting a choice is clearly represented in the goal-based method to decision making, allowing for adjustments. This makes it more adaptable than reflex agent.

This agent differs from the other two in that it does not have any guidelines for what to do in response to a certain circumstance or if anything has occurred. Because the agent isn't as precise about what it intends to achieve, it sometimes takes less effective actions because it just considers its own aims and present state while operating. This agent, however, is more adaptable since it is aware of how changes in the environment will influence its objective and may adjust its behaviors appropriately.

3.3.4 Utility based reflex agent

Utility-based agents assess an action's possible influence on a person's general pleasure, taking it a step further than goal-based agents. This may be thought of as the degree of fulfillment that an act may have in connection to achieving a particular goal. [20]

3.3.5 Learning Agents

The learning agent is an illustration of the kind of agent that can learn from the past or has the capacity to learn. As it learns more,

it naturally adapts its behavior, starting with the fundamentals.

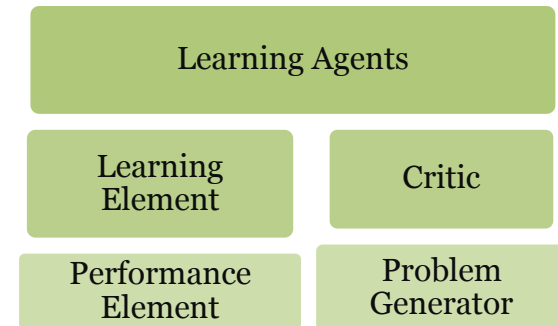


Figure 2: Category of Learning Agents.

Learning agents primarily consist of four components. The Learning Element is the first, and it improves by absorbing knowledge from its environment. The Performance Element, the second component, chooses which external actions should be made depending on input from the critic. The Problem Generator, which is in charge of proposing fresh and instructive situations that can aid increase performance, comes in third. Finally, there is the Support Element, whose role it is to offer assistance throughout these many growth stages.

4 Intelligent Agent [23] Environment

The agents are surrounded by and engaged with the environment. It may be defined as anything in the world that is close by, such as individuals, things, and locations. Simply said, it's what makes the agent distinct from their environment.

We frequently pay little attention to the context in which our models work while developing artificial intelligence (AI) solutions. In fact, the success of an AI system can be significantly influenced by this external environment. As it turns out, the environment has a considerably higher impact on an AI model's performance than any other factor.

It's crucial to comprehend the many components of an artificial intelligence ecosystem while creating one. We may divide environments into four groups since data arrives with a variety of forms, frequencies, and issues. Knowing this information will enable us to choose the sort of AI system that is most suitable to address a given issue. [22]

Complex activities may be comprehended through the use of a few essential aspects.

The observation mentioned in this line can be made in an environment that is completely or only partially observable.

Depending on whether it is possible to predict the environment's future state from the past, it may either be described as deterministic or stochastic. If so, the environment is said to be deterministic; if not, it is thought of as stochastic.

A discrete environment is one in which a task's outcome may be determined by a limited number of perceptions.

Continuous data sources are dependent on ever-changing, quickly-changing data.

Dynamic refers to this environment's ongoing adaptation to time. In the absence of change, the situation would remain static.

A multi-agent environment is one in which there are several agents present, as opposed to a single agent environment, which only has one agent.

Each episode in an episodic context consists of the agent observing, reacting, and perceiving again. Subsequent episodes don't depend on past acts; therefore the effectiveness of that action simply depends on what happened in this specific episode.

If an agent has complete and precise knowledge of an environment, it can access it. The agent cannot reach the environment if it is inaccessible.

The agents in an environment can be characterized as cooperative or competitive, depending on whether they are cooperating or engaging in inter-agent competition for the best result.

5 Implementation-Considering Task Environment

Defining the settings or task environment is the first stage in building an intelligent agent. It is the setting in which the intelligent agent carries out some type of work to address some issues. An intelligent agent takes the appropriate action, which enables the agent to succeed as much as possible in the given perceptual sequence. The history of every perception that agents have made up to this point is called a percept sequence. The action is carried out by any rational actor in a way that maximizes its performance metric. [24]

The task environment is distinguished by four key elements, which are illustrated by the following PEAS depiction.

P→ Performance

E→ Environments

A→ Actuators

S→ Sensors

6 Results and Discussion

We'll talk about some of the most helpful examples of the PEAS idea in this part. The following is a description of the aforementioned agents' intended PEAS representation.

1→ Agent Type: Medical Diagnosis System

Performance	Healthy Patient, Minimize cost
Environment	Patient, Hospital, Staff etc.
Actuators	Display questions, tests, diagnosis, treatments..
Sensors	Keyboard Entry of symptoms, findings, patient's answers.

2→ Agent Type: Smart Agriculture with Precision Irrigation

Performance	Optimize the quality of yield, cost and water saving
Environment	Soil, Plant behavior, Whether condition
Actuators	Water the plants whenever required or stop watering
Sensors	Satellite, plane or drone imagery, sensors

3→ Agent Type: Biometric Attendance System

Performance	Storage capacity, Scanning & Verification time, Durability, Flexibility, Power Consumptions
Environment	School, Colleges, Corporate Sectors, Offices, Private Sectors, Hospital
Actuators	Static Indicator, Database Storage
Sensors	Image capture surface, hand geometry sensors, optical sensors.

4→ Agent Type: Refinery Controller

Performance	Maximized purity, yield, safety
Environment	Refinery, operators
Actuators	Valves, pumps, heaters, displays.
Sensors	Temperature, pressure, chemical sensors.

5→ Agent Type: Satellite Image Analysis System

Performance	Correct image categorization
Environment	downlink from orbiting satellite
Actuators	display categorization of scene
Sensors	Color Pixel Array

7 Conclusion

One of the most significant and quickly developing fields is intelligent agent technology. Numerous multi-agent systems and agent-based applications are being developed by researchers in a wide range of domains. The reader will learn about agents and intelligent based systems in this article. The basic idea of the AI Intelligent Agent has been explained to us in this work. We now understand how intelligent agents aid in the implementation of AI systems' behaviors. We can create more complicated AI-based models with more intelligent agent creation and study.

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♣ patients, medical staff, insurers, courts ♣ environment ♣ patient health, cost, reputation ♣ performance measure ♣Peas: Medical diagnosis system.
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