

Chapter 53

Intelligent Agents and Autonomous Robots

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ABSTRACT

Over decades new technologies, algorithms and methods are evolved and proposed. We can witness a paradigm shift from typewriters to computers, mechanics to mechnotronics, physics to aerodynamics, chemistry to computational chemistry and so on. Such advancements are the result of continuing research; which is still a driving force of researchers. In the same way, the research in the field of artificial intelligence (Russell, Stuart & Norvig, 2003) is major thrust area of researchers. Research in AI have coined different concepts like natural language processing, expert systems, software agents, learning, knowledge management, robotics to name a few. The objective of this chapter is to highlight the research path from software agents to robotics. This chapter begins with the introduction of software agents. The chapter further progresses with the discussion on intelligent agent, autonomous agents, autonomous robots, intelligent robots in different sections. The chapter finally concluded with the fine line between intelligent agents and autonomous robots.

INTRODUCTION

The term “agent” is an outcome of research in software development. The word “agent” gets easily confused with terms such as “object”, “actor” or “module”. Occasionally these terms are used like synonyms but technically the terms have different meaning specific to the context. For example, the sentence “an agent is an object” can be interpreted on the basis of literal meaning of words “agent” and “object” (Franklin & Graesser, 1996).

Despite the lack of a technical description, researchers are able to discuss their work with others based on this notion while describing agents. An agent can be defined as a system have well defined objective and positioned within or the part of an environment; senses it and acts to achieve its goal. The software agent is a program which acts as change agent and has the capability to sense, learn and react (Nwana, & Ndumu, 1999).

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Attributes of an Agent

The agents are usually characterized on the basis of characteristics or essential attributes. Some common attributes which an entity must possess are mentioned below:

- **Situatedness:** In some environment wherein the agent is situated and gets sensory input and can achieve desired actions lead to change in environment.
- **Autonomous:** Agents have control over their state and actions, and they can take action without direct interference.
- **Responsive:** Agents are able to identify their environment and act in response in a timely fashion to changes that occur in it.
- **Pro-Active:** Agents are able to show desired behavior and proactively reacts according to the environment.
- **Socialability:** Agents interact with each other to solve problems or act as co-actor for the same purpose.

In addition to these common attributes agents do possess other important but non-essential attributes as mentioned below:

- **Mobility:** An agent can or can't move from one computer system to another within their environment.
- **Reasoning Model:** An agent can have a deliberative or a reactive or a hybrid model to make the decisions. The decisions can be on the basis of reasoning (deliberative), set of stimulus/response behaviors (reactive) or both (hybrid) (Kasabov, 1998).
- **Learning:** An agent which have capability of learning can change their behavior and decision based upon their knowledgebase and previous experience.

Why Agents

Agents are used to represent and explain the behavior of complex systems. Though the performance of these systems could also be explained without the concept of an agent but the literature survey motivates us to use the concept of agents (Mascardi, Martelli, & Sterling, 2004) due to following reasons:

- An agent is a model for a decision making entity. It is valuable in applications where the decisions are required to perform a particular action.
- An agent can be useful in those application areas which act by communicating with other agents and wish to hide implementation details.
- Agents can be used to represent the behavior of complex systems.
- Agent is a practical system that is intended to design multifaceted computing systems based on the concepts of agents, communication, cooperation and coordination of actions.

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