International Journal of Advance Research in Computer Science and Management Studies

An Empirical Study on Single, Multi and Complex Agent

Jyoti Ranjan Mohanty[1]
Department of CSA
OUAT
Bhubaneswar – India

Manas Ranjan Mohapatra[2]
Department of Computer Science
Banki College (Autonomous)
Cuttack – India

Abstract: In the context of AI, an intelligent agent plays a vital role by performing various cognitive tasks. This paper briefly explain agent, intelligent agent concepts and focuses the role and behavior of single, multi and complex agent with their way of perceptions and actions in the real world environment. Also here the comparison is being made among all these agent types based upon their performances.

Keywords: Agent, Intelligent Agent, Complex Agent, Single Agent, MAS, Agent Environment.

I. INTRODUCTION

An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.
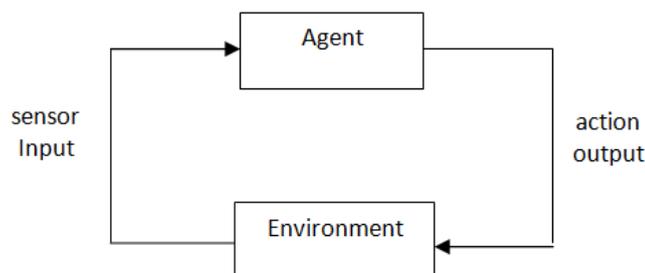

Figure 1: A Simple Agent

Abilities that an agent should exhibit are:

    (i)   Decide one's own behavior autonomously.

    (ii)   Exchange information with other agent and environment.

    (iii)   Respond to unexpected situations to some extent.

The complete set of inputs at a given time is called a percept and a percept sequence is the complete history of everything that the agent has ever perceived.

The current percept or sequence of percepts influences the actions of an agent. The agent can change the environment through actuators/effectors. An operation involving an effector is called an action which can be grouped into action sequences.

The fundamental faculties of agents are:

    (i)   Acting

    (ii)   Sensing

(iii)   Understanding, Reasoning and Learning

Humans can be viewed as agents with their eyes, ears, skin etc. as sensors and hands, fingers, legs, mouth etc. as effectors. Similarly robots can be considered as agents with their camera, infrared, sonar etc. as sensors and wheels, speakers, lights etc. as actuators. An intelligent agent must sense, act and must be autonomous and it also must be rational.

It must be able to have the following three things:

 (i)   Reactivity

 (ii)   Pro-activeness

 (iii)   Social ability

The agents operate in the environment which must have the following attributes [1].

 (i)   Observability

 (ii)   Determinism

 (iii)   Episodicity

 (iv)   Dynamism

II. SINGLE AGENT

An agent that operates by itself called as single agent. A single agent can monitor its environment and chooses a decision process dynamically based on a strategy that was determined previously. One path to developing such a strategy is by learning optimal choices over multiple environments [2].
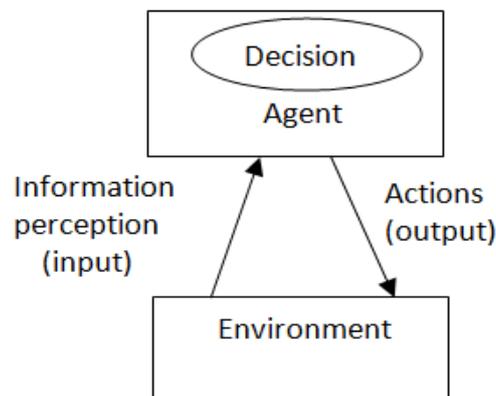

Figure 2: A Single Agent System

It gets information from the environment which is transferred into some internal information which acts as the primary input into a decision process by which an action is choosen. The agent has a choice to determine the transformation of environmental information, the internal information and the decision process from a possible sets.

Comparison over Multi-Agent System (MAS)

The process of interactions with the real world environment involved in single agent is not sufficient in MAS. Because the system performance doesn't depends only on the environment and these agents decisions are made based on the information available along with other agents decision process in the multi-agent environment.

III. MULTI AGENT SYSTEM (MAS)

It is a system that accelerates and achieves the objectives in a self-organizing manner by cooperative and combined behavior of more than one agent.

The primary features of MAS are:

(i)   Adaptable flexibly to situational changes
(ii)   Easy to extend/modify the system
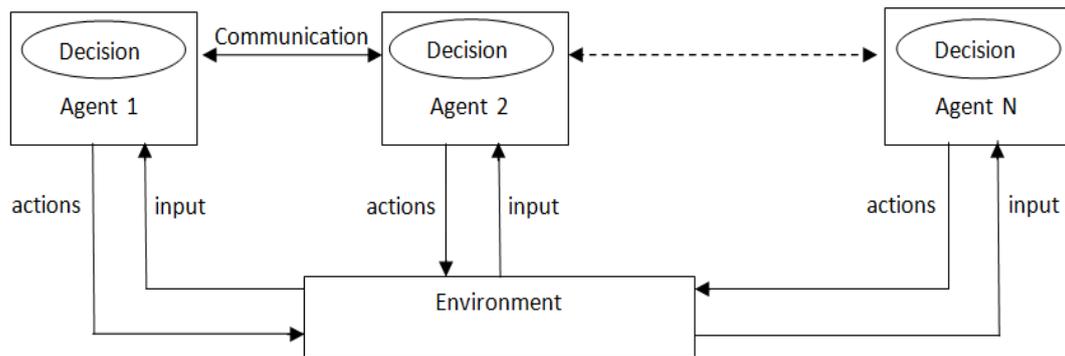(iii)   Robust against failure of system components

Figure 3: A Multi Agent System

MAS involves decentralized process where each of the multiple agents percepts inputs from the environment that may be in communication with other agents and thereby decides which output actions to be produced. Here the behavior/performance is determined globally through the interaction between the agents.

Comparison of Multi-Agent System (MAS) over Single Agent

In MAS the behavior of any single agent can be changed and new agent required can be added to the existing system, thus it improves the scalability and modularity. It is also robust in term of its decentralized aspect.

IV. COMPLEX AGENT

A Complex Agent is a new concept in the agent type that has been used in the modern research filed of AI. Moreover it can replace more than one MAS and that of huge number of single agent [3].

It is defined as an intelligent agent capable of doing more than one task/s at a time in an environment. It percepts information from the real world environment with sensors, store in memory and find out the number of cognitive tasks to be carried out at a certain moment of time, hence produces action/s to be taken with actuators based on the decision process. It also use the principle of metacognition (thinking of thinking) to perform the activities[2].
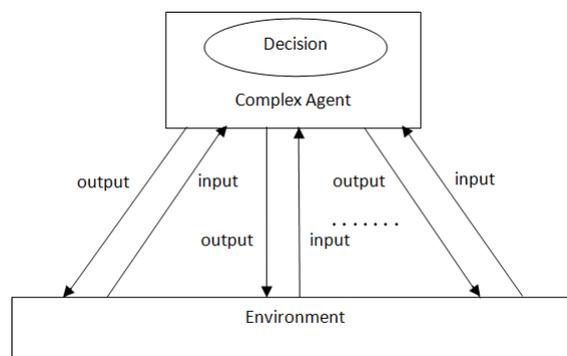

Figure 4: A Complex Agent

V. CONCLUSION

From the above studies it can be concluded that a complex agent can substitute one or more MAS and no. of Single Agent. In terms of its performance & output produced in a environment, a Complex Agent can be able to perform several cognitive tasks effectively and simultaneously in comparison to other agents.

Jyoti et al.,

International Journal of Advance Research in Computer Science and Management Studies
Volume 6, Issue 4, April 2018 pg. 9-12

References

1. Russel and Norvig, "Artificial Intelligence, A Modern Approach", University of California, Berkley,1995.

2. N.K.Kamila, R.K.Swain, Manas Ranjan Mohapatra," Metacognition in Complex Agent",3(2),93-104,2013.

3. N.K.Kamila, R.K,Swain, "A Role Based Architecture in Complex Agent",3(1),20-27,2013.

4. P.S.Winston, "Artificial Intelligence", 2nd Edition, Addison Wesley Reading, MA, 1984.