

Chapter 77

Modernization of Healthcare and Medical Diagnosis System Using Multi Agent System (MAS): A Comparative Study

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ABSTRACT

The healthcare system that prevailed some years ago was a mere pen and paper based system. A number of workers, staff, and written records were the main components of the prevailing system of healthcare. This had a number of drawbacks, and a number of mishaps occurred due to mismanagement of data and information. There was a need for development. Then, the concept of telemedicine came, which revolutionized the healthcare paradigm to a great extent. With the advancement of telemedicine, many major problems of the prevailing system were removed. But, still there were many other aspects which could be further improved to make healthcare facilities more enhanced. Keeping this in mind, the concept of Multi Agent System (MAS) was introduced in the healthcare system later. MASes are considered as the best and most appropriate technology that can be used in the development of applications in healthcare paradigm where the presence of multiple agents, heterogeneous and loosely coupled components, the data management in a dynamic and distributed environment, and multi-user collaborations are considered the most pertinent requirements for healthcare system. This chapter focuses mainly about MAS, its applications, and some systems that were developed by the authors.

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INTRODUCTION

Most researchers in AI have dealt with the developing theories, techniques and systems to study and understand the behaviour and reasoning properties of a single cognitive entity. AI has matured its endeavours to attack more complex and realistic and large-scale problems. Such problems are beyond the capabilities of individual agents. The capacity of individual agents is limited by its knowledge, its computing resources and its perspective. The most powerful tool for handling complexity are abstraction and modularity which are definitely offered by a system where a number of or a group of agents work together to perform a task. Such a system is said to be a Multi Agent System (MAS).

A multi-agent system (MAS) is one that consists of a number of agents, which interact with one another, typically by exchanging messages through some computer network infrastructure. In the most general case, the agents in a multi agent system will be representing or acting on behalf of users or owners with very different goals and motivations. In order to successfully interact, these agents will thus require the ability to cooperate, coordinate, and negotiate with each other, in much the same way that we cooperate, coordinate, and negotiate with other people in our everyday lives. Multi Agent Systems offer modularity. Thus, in an attempt to solve more complex real-life problems, the concept of MAS was developed which uses a number of agents working together interactively and solving complex problems successfully.

It has been said that the Multi Agent System acts as the latest Software Engineering paradigm. The Multi Agent Systems can be used specifically when following domains are encountered:

- The domain contains problem that can be decomposed into several sub-problems, which may have some kind of inter-dependencies.

- The knowledge is administered in various places.
- A number of entities need to join their problem-solving abilities, keeping their autonomous nature intact to solve a complex problem.

Now-a-days there is a growing trend of using agent-based techniques to apply to the problems in the medical domain. The main aim of this chapter is to describe the reasons why Multi Agent Systems are opted as one of the most interesting and effective technologies to solve various health related problems and some of the applications that have already revolutionized the medical paradigm.

BACKGROUND

Whenever we examine the medical diagnosis system, we will find that the knowledge required for solving a problem is spatially distributed at various locations. Each specialist doctor uses their own knowledge along with the knowledge of any previous tests and diagnosis if carried out to solve the particular problem. Various tests needed, are carried on at some different location with help of some different set of knowledge. For providing a complete solution to a particular case, it requires better co-ordination between different individuals present at different locations with their different skills and functionalities.

Now, to provide a better functionality, the system is developed with Multi Agent Technology. The system contains many agents that give information about the medical centers, departments and doctors of a city. These units coordinate their execution in order to offer to the user varied functionalities such as searching for a medical centre, accessing the medical record, or booking a visit to be examined by doctor. Special attention has been paid for the implementation of security mechanisms that

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