Chapter 1.24

# A Review of Recent Contribution in Agent Based Healthcare Modeling

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## ABSTRACT

This chapter reviews and summarizes eight selected paper in the area of agent-based healthcare systems. The objective of the summaries is to provide an overview of recent research work in the area and to examine the characteristics of agent-based healthcare applications. The chapter also briefly discusses reasons for adopting agent-based simulation and modeling over traditional modeling techniques.

## INTRODUCTION

Agent-based modeling and simulation is a modern approach to model complex systems. Agent-based simulation systems are comprised of autonomous agents that interact with each other to create a working dynamic model of a real world system. Today,

applications of this new paradigm of modeling and simulation can be found in variety of domains ranging from modeling the stock market and supply chains behaviours to modeling the complexities of the human immune system and predicting the spread of epidemics (Macal & North, 2006). Traditional modeling techniques are no longer sufficient in dealing with the complexities of real world systems as they are becoming increasingly more sophisticated. Software agents can break a large problem or task to smaller tasks and distributes the work over number of agents to provide an optimal solution. The operation of healthcare is complex as it involves large numbers of staff and other resources that work together to deliver healthcare services to patients. The agent-based modeling and simulation approach is increasingly attracting researchers who exploit the capability of agent system in order to explain the complex behaviour of healthcare systems.

Software agents can be defined in numerous ways. Each definition varies depending on the

context and the application. However the main attributes are common to all the definitions. The common attributes of software agents are: autonomy, pro-activity/re-activity, communicativity, collaborative problem solving and mobility. The mobility attribute refers to the ability of an agent to travel across different platforms to achieve its goal. Autonomy pertains to the ability of an agent to act autonomously with limited or no user interaction and to completely represent an object or entity. Pro-activity/re-activity implies the ability to react to the environment and adapt its behaviour accordingly. Communicativity refers to the capability of agents to exchange messages between each other and with the external users and systems. The collaborative problem solving attribute pertains to the ability of agent to collaborate and work together to accomplish a common goal which no single agent is able to attain on its own.

Software agents should only be used to develop applications for systems which require some or all of the above attributes of agents. Most of these attributes are required in order to create effective and accurate simulations and models of healthcare systems. In this chapter, we review and summarize eight recent papers to provide an overview of the state of research in agent-based healthcare modeling system. Agent-based modeling and simulation is a relatively new approach in healthcare modeling. We observe three common themes in the work presented in this chapter - these are: (i) support for patients and medical professionals; (ii) effective and efficient communication between health professionals; and (iii) optimization of healthcare delivery services.

We provide a brief introduction on each selected paper to give a high level picture of the content of the summaries before proceeding to the actual summaries.

## A Multi-Agent Approach to the Design of an E-Medicine System

This paper proposes a multi-agent based framework for the development of an e-medicine system. E-medicine integrates information communication technology with medical technology to deliver healthcare to geographically distributed areas. The paper presents a case study on telemedicine for diabetes to illustrate the development of an e-medicine system.

## Building Agent Based Corporate Information Systems: An Application to Medicine

In this paper, author proposes an agent-based framework for supporting collaborative work among human and software agents. The proposed framework is applied in the field of telemedicine to build complex and cooperative decision support systems (DSS) within the context.

## A Framework for Building Cooperative Software Agents in Medical Applications

This paper focuses on improving the cooperation and interoperability among different health care professionals engaged in the process of delivering health care services with the aid of software agent technology. This paper experiments the management of patients affected by acute myeloid leukemia (AML) with the help of developed prototype.

## HealthSim: An Agent-Based Model for Simulating Health Care Delivery

This paper introduces an agent-based simulation model, called HealthSim, which facilitates users understand various health care delivery issues in a hospital environment through simulations. The system is primarily designed for managers

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