Chapter 3
Artificial Intelligence Review

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ABSTRACT

In this chapter, the authors present a profound literature review of artificial intelligence (AI). After defining it, they briefly cover its history and enumerate its principal fields of application. They name, for example, information system, commerce, image processing, human-computer interaction, data compression, robotics, route planning, etc. Moreover, the test that defines an artificially intelligent system, called the Turing test, is also defined and detailed. Afterwards, the authors describe some AI tools such as fuzzy logic, genetic algorithms, and swarm intelligence. Special attention will be given to neural networks and fuzzy logic. The authors also present the future research directions and ethics.

INTRODUCTION

The study of intelligence is one of the oldest disciplines. Artificial Intelligence (AI) is a very growing and actively changing field. In this paper, we present a profound review of the AI. After defining it, we briefly cover its history and enumerate its major fields of application. Also, the test that defines an artificially intelligent system called The Turing test, is also defined and detailed. Along the way, we describe some AI tools such as Fuzzy logic, genetic algorithms and swarm intelligence. Special attention will be given to neural networks. We also present the future research directions and ethics.

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BACKGROUND

Artificial intelligence (AI) may be defined as the branch of computer science that is concerned with the automation of intelligent behavior (Luger & Stubblefield, 1993). It is a research area and a field of technology that creates both software and hardware sophisticated features in order to include virtual artificial agents. It can be divided into two categories based on thinking and acting shown in Figure 1.

Alan Turing, a British mathematician, introduced the 'Turing test' for intelligence, referred to the accredited test as the imitation game (Hodges, 2002). The famous test appeared in Turing's paper, Computing Machinery and Intelligence, was published in October 1950 in the philosophical journal, Mind (Turing, 1950). In fact, this test was designed to provide a satisfactory operational definition of intelligence (Russell & Norvig, 2009).

This Turing test states four conditions for a computer to be called an intelligent machine. The first is the natural language processing (Kok et al, 1993). The second condition concerns the knowledge representation (Russell & Norvig, 2009).The third is automated reasoning (Kok et al, 1993). The computer has to be able to reason based on the knowledge that has been put in its memory. Finally, the machine must be able to learn from its environment (Kok et al, 1993). Some scientists have argued that the Turing test presents some limits such as not rating the intelligence of the machine (French, 1990).

The apparition of artificial intelligence was due to the inventions in electronics and other disciplines (Buchanan, 2005). The term was first coined by John McCarthy in 1956 in the conference: Artificial Intelligence, a new term to the human understanding (Stewart, 2000). The fifties saw the growth of an AI community and witnessed the opening Dartmouth Artificial Intelligence Conference and the creation of DARPA: Defense Advanced Research Projects Agency (Knight, 2006). This conference (McCarthy et al. 2006) made it possible to examine the use of computers in order to process symbols. Doubts amongst some researchers concerning the efficiency of machines began to occur in the 1960s (Coppin, 2004). In the 1970s, the AI industry went through a short era described as AI Winter where AI faced a dramatic regression (University of Washington, 2006) due to factors such as the failure of machine translation in 1966. The expert system is a computer system that imitates the decision-making ability of a human expert, was first created in the 1970s and then spread in the 1980s (Peter, 1998; Leondes, 2002). The first expert system was called DENDRAL, for Dendritic Algorithm (Bhadeshia, 2015).In the recent decades, artificial intelligence became used in several domains (Russell & Norvig, 2009; Ray, 2004; NRC, 1999). The success was due to: the increasing power of computers, the creation of new links between AI and fields working on similar problems, and a new commitment by researchers to establish mathematical methods and rigorous scientific standards (Russell & Norvig, 2009; Ray, 2004; NRC, 1999; Pamela, 2004).

Figure 1. AI categories
Source: Russell & Norvig, 2009

Think like Humans		Act like Humans	
Think rationally	Think like Humans	Act rationally	Act like Humans