

# Chapter 3

## Artificial Intelligence in Healthcare

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### **ABSTRACT**

*Artificial intelligence (AI) has been applied to various domains to improve the quality of human life. This chapter outlines the recent application of AI in healthcare. A brief history of AI development is first introduced. Machine learning, one of the current AI advancements, is explained. Successful AI application in different areas of healthcare is then showcased, including different medical diagnosis and long-term care. The popular ChatGPT series of systems and their extraordinary performance are described. This chapter ends with debates and future expectations of AI.*

### **1. INTRODUCTION**

The giant progress in artificial intelligence (AI) development has fueled a rapid rise in the applications of various domains over the last decade. Why AI is a big deal? Brynjolfsson & McAfee (2017) provide two reasons. First, via AI, we can automate many tasks. Second, AI is an excellent learner. Some interesting AI applications have been identified as in Table 1 (Brynjolfsson & McAfee, 2017; Jordan & Mitchell, 2015). For example, we can take drug chemical properties as the input to the AI applications and the AI applications can produce treatment efficacy as the output. And this type of application can be used in pharmacy R&D.

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*Table 1. Interesting AI applications*

<b>Input</b>	<b>Output</b>	<b>Application</b>
Voice	Transcript	Speech recognition
Photo	Caption	Image tagging
Drug	Treatment efficacy	Pharma R&D
Store transactions	Fraudulent transactions	Fraud detection
Purchase records	Future purchase behavior	Customer retention
Car location	Traffic flow	Traffic lights
Face	Name	Face recognition

AI was considered to have the potential to exploit meaningful relationships in a data set and the relationships can be used in the diagnosis, treatment and predicting outcome in many clinical scenarios (Ramesh et al., 2004). AI in healthcare has two main branches: virtual and physical (Hamet & Tremblay, 2017). The virtual branch includes informatics approaches from machine learning to control of health management systems; and the physical branch is represented by robots assist the elderly patient or the attending surgeon.

The use of AI in healthcare has become quite popular, including medical images (Ker et al., 2018), the detection of drug interactions (Han et al., 2022), the identification of high-risk patients (Beaulieu-Jones et al., 2021), etc. Recently, the performance of ChatGPT by Open AI has recently shown amazing performance and attracted many studies.

This chapter introduces and discusses the application of artificial intelligence (AI) in healthcare. First, we briefly present AI development by covering expert systems and machine learning. For machine learning, we explain how an artificial neural network (ANN) can achieve learning step by step. We subsequently cover some current AI applications in medical diagnosis, some possible applications of it in long-term care, and the popular ChatGPT application in medicine. AI offers opportunities as well as the potential for both positive and negative impacts for society and individuals (Dwivedi et al., 2023). This chapter ends with debates and doubts about the application of AI.

## **2. ARTIFICIAL INTELLIGENCE (AI)**

### **Expert Systems**

AI can be classified into two categories. The first category is named classical AI. This category intends to build computers systems that replicate human behavior. One sub-category is expert systems. These systems capture the expertise of human experts by using sets of rules.

The classical example in medical application is MYCIN, which was one of the earliest medical expert systems developed in the 1970s. It was designed to model a physician’s diagnostic expertise by using around 500 rules and helped diagnose and treat bacterial infections based on reported symptoms and medical test results (Bionity, 2023). MYCIN provides advice based on three subsystems: a consultation system that chooses proper medication based on its own knowledge base; an explanation system that answers questions to justify its decisions; and a knowledge acquisition system that codes rules for future

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