Chapter 8
A Review on Application of Reinforcement Learning in Healthcare

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ABSTRACT

We are witnessing the era of data science where data is generating in an exponential manner. This big data is working as fuel to explore the business in every domain and healthcare is not the exception for this. Data analysis and data analytics in collaboration with machine learning techniques are playing an important role in every domain. Supervised and unsupervised approaches in machine learning depends on one shot, exhaustive, and reward output. Reinforcement learning (RL) handles these issues with sequential decision making problems, concurrent evaluation, and feedback methods. RL technique can be a suitable candidate for developing powerful solutions in a variety of healthcare domains. This chapter will focus on the broad applications of RL techniques in healthcare domains, which can be helpful to the researchers with systematic understanding of conceptual information, techniques, and an overview of RL applications in healthcare domains for various types of diseases right from chronic diseases and mental disorder.

INTRODUCTION

We are witnessing the era of data science where data is generating in an exponential manner. This big data is working as fuel to explore the business in every domain

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and healthcare is not the exception for this. Artificial Intelligence (AI) is playing a master key role in healthcare from the last decade due to its specialty in handling large multimodal data, powerful algorithms and computational models (V. L. Patel, et al, 2009), (S. E. Dilsizian and E. L. Siegel, 2014). Collaborative work of Machine Learning (ML), a subfield of AI, Data Analysis and Data Analytics are playing an important role in every domain (A. E. Johnson, et al, 2016). Supervised and Unsupervised approaches in Machine learning depends on one shot, exhaustive and reward output. Reinforcement Learning (RL) is a machine learning technique that allows an agent to learn by trial and error in an interactive environment using feedback from its own actions and experiences. Reinforcement Learning (RL) handle these issues with sequential decision-making problems, concurrent evaluation and feedback methods. RL technique can be suitable candidate for developing powerful solutions in a variety of healthcare domains (A. Esteva, et al, 2019).

Reinforcement learning (RL), a subdomain of machine learning, has made significant theoretical and technical advances in generalisation, representation, and efficiency in recent years, leading to increased applicability to realworld problems in gaming, robotics control, financial and business management, autonomous driving, natural language processing, computer vision, biological data analysis, and art creation, to name a few. (M. L. Littman, 2018), (V. Mnih, et al, 2015)

REINFORCEMENT LEARNING

Though both supervised and reinforcement learning involve mapping between input and output, reinforcement learning uses incentives and punishments as signals for positive and negative behaviour, unlike supervised learning, which provides the agent with a right set of behaviours for executing a task. Reinforcement learning differs from unsupervised learning in terms of its objectives. In unsupervised learning, the goal is to detect similarities and differences between data points; in reinforcement learning, the goal is to develop an appropriate action model that maximises the agent's total cumulative reward (Shreya Bhatt, 2018).

The main elements of an RL system are:

1. The agent
2. The environment
3. The policy
4. The reward signal