The Application of Articial Intelligence and Machine Learning in Academic Libraries

Elisha Mupaikwa

National University of Science and Technology, Zimbabwe

INTRODUCTION

The study of Artificial Intelligence (AI) and Machine Learning (ML) is both inter and multidisciplinary. This is because the concepts of AI and ML are an integration of computer science, behavioural and social sciences. This has seen these technologies being adopted across various disciplines to facilitate solving problems related to data collection, storage, organization, processing, dissemination, communication and the broader areas of information processing. Research on these cross-cutting technologies has not been limited to one discipline although to laypeople the concept of AI and ML could easily be associated with computer science.

Among some fields that have increasingly adopted artificial intelligence is the field of library and information science. The 21st-century librarianship and the broader information science discipline across the globe have handled diverse ever-increasing volumes of information. In addition to this, the information and knowledge world of the century has produced patrons of various backgrounds all looking up to the libraries and the broader information environment to meet their information needs. This has called for stronger adaptation and adoption approaches in proving information services and complementing human effort and expertise with the distant potential to completely substitute human expertise and skills. Under the current knowledge and information environment, human expertise is limited in providing services to these diverse users.

The 21st-century library users have become digital users often demanding independent use of digital library resources. Besides this, the library has also diversified its services to provide a fountain of solutions to problems confronting humanity. Users in their various categories, have continuously realized and acknowledged the vitality of libraries in providing information that enables information users to address problems that confront them daily. Traditional libraries have often been ill-equipped to address these needs. It has been suggested that through the use of artificial intelligence, collections can be enhanced to become more useful to patrons (Cordell, 2020). Despite the seemingly low research and usage of AI in libraries, associations such as the International Federation of Library Associations (IFLA), the American Library Association (ALA) and the Canadian Federation of Library Associations (CFLA) among others have begun to acknowledge the importance of AI in libraries and have also recommended AI innovations among their membership (Wheatley & Hervieux, 2019). This chapter will examine key concepts of artificial intelligence and machine learning together with their applications in library and information science. Key challenges and opportunities offered to the broader discipline of librarianship will also be discussed.

BACKGROUND

This section presents the basic concepts of artificial intelligence and machine learning. This covers key definitions of AI and the different branches of AI as well as the diverse generic application areas of AI. The section also defines machine learning and the types of machine learning together with the associated algorithms. Generic applications of machine learning are also presented.

Basic Concepts of Artificial Intelligence

Historically, humans have always dreamed of nonhuman creatures that could solve problems beyond human capabilities (Griffey, 2019). Actualizing such dreams would make humans accomplish tasks that they perceive to be beyond their capabilities. Such dreams then resulted in a sequence of inventions and automation activities that were witnessed by individuals like Ad Lovelace and Charles Babbage, who sought to utilise the growth of computing technology to manage complex problems confronting humanity. This led to the development of technologies that provide platforms for machines to learn like humans, to interpret and employ information to execute tasks with capabilities traditionally associated with human experts. These technologies, called Artificial Intelligence, however, lack reasoning associated with humans.

Definitions of AI seem to vary from one text to the other but generally, it is described as a computer system that can think and act on its own with no supervision. Often writers have described AI as a study of how to make computers do things which at the moment people can do better (Ertel, 2017). This enables computers or computer-controlled robotics to solve problems that are normally associated with higher intellectual capabilities of humans. Key characteristics of AI are: thinking humanly, acting humanly, thinking rationally, and acting rationally (Russel & Norvig, 2010). The concept of thinking humanly involves computer systems with minds, capable of making decisions and solving problems with excellence that would normally be associated with humans. The development of such applications involves observations on how humans solve problems and argue that computer systems go about similarly solving problems. Acting humanly refers to machines that perform functions that require intelligence when performed by people. To be considered intelligent, a computer system must be able to act sufficiently like a human. Thinking rationally involves studying computers that make it possible to perceive, reason and act. Thinking rationally involves making correct inferences based on logic and then acting on one's conclusions. Acting rationally focuses on performing actions that would enable one to achieve one's goals. Intelligent agents display intelligent behaviours by performing actions that result in goal attainment. These capabilities seem to be relevant and have become widely available in library systems to support reference services and recommender systems through innovations in robotics and chatbots.

The major categories of AI according to Quintarelli et al., (2021) are:

i)   Artificial General Intelligence (AGI): This involves machines with human capabilities to learn and understand tasks. This suggests that machines have cognitive reasoning and problem-solving abilities.
ii) Artificial Super Intelligence (ASI): This technology not only resembles human intelligence but can exceed and surpass it
iii) Narrow Artificial Intelligence (Weak AI): While this still resembles human intelligence, it does this in a narrow scope.

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