Chapter 4
Applications of Chatbots in Education

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ABSTRACT

This chapter mainly concerns the application of artificial intelligence (AI) based chatbots in education (in the general sense). Three general applications of such systems are studied: a) language learning, b) teaching a course, and c) assistive for educational purposes (in the narrow sense). There are advantages and disadvantages for using chatbots in education. Their interaction with the students, human-like conversation simulation, 24/7 availability, and easy accessibility are some of the key advantages of using AI-based chatbots in education. The main disadvantage of such systems is their knowledge-bases (KB) requirement. A KB plays as the brain of a chatbot. However, their development is labor intensive and expensive in terms of time and effort. In this chapter, the main research studies on chatbots for the educational domain are reviewed and general construction of a chatbot as well as the evaluation metrics of chatbots are explained; and the available chatbot tools and systems used in education, in the general sense, are collected.

INTRODUCTION

Language is a means of communication to convey a message from the speaker (producer) to the listener (recipient) through an information channel. This tool makes it possible for people in society to have dialogues or conversations with each other. In 1950, Turing (1950) raised a question whether machines can think, and Turing Test was created. In 1966, Wiesenbaum (1983) developed the first system

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at the MIT lab, called ELIZA, to open a dialogue with. This system operated in such a way that it first recognized the keywords or phrases from the input data to reproduce a response using those keywords based on the predefined responses. The dialogue was predefined to illustrate machinery understanding. In 1972, Kenneth Colby developed a computer program, called Parry, to model the behavior of a paranoid schizophrenic.[1] Rollo Carpenter developed Jabberwocky[2] chatbot in 1981 to "simulate natural human chat in an interesting, entertaining and humorous manner." In 1985, the Tomy Chatbot, a wireless robot toy, was created. This toy repeated any message recorded on its tape.[3]

It was almost in 1992 when a revolution in developing chatbots happened such that the chatbots were empowered with Artificial Intelligence (AI). Since then, the speed of developing various chatbots for research or commercial purposes has increased. In early 1992, Dr. Sbaitso, speech synthesis software, was released by the Creative Labs in Singapore within the MS-DOS environment. This software, which was an ELIZA-like chatbot, was able to converse with a user as a psychologist in a digitized voice.[4] In 1994, Michael Mauldin created Julia[5] and Verbot. Mauldin coined the word "chatterbot", which is later known as "chatbot". This word is derived from the term "verbot" which is constructed from "verse" and "robot" to mean "talking robot". In 1995, Richard Wallace developed an artificial-based chatbot, called ALICE which is the acronym of Artificial Linguistic Internet Computer Entity. This chatbot used heuristic patterns instead of static rules based on human's input. In 1996, Jason Hutchens developed Hex, which was another ELIZA-like chatbot and won the prize in the Loebner contest.[6] In 2001, the SmarterChild chatbot was developed at ActiveBuddy Inc.[7] It could access real-time news and information and could do tasks, like looking up the weather, storing notes, triggering timed instant message reminders, calculating, converting measures and scales, and generally answering any kinds of questions, like "What's the population of Indonesia?" or "What movies are playing near me tonight?". This chatbot became the cornerstone of the current well-known chatbots, namely Siri[8], Google Assistant[9], and Alexa[10], from 2010 to 2014. In 2015, Microsoft developed Cortana[11], and in 2016, Facebook created Messenger[12]. In 2017, Woebot, an automated conversational agent that helps to monitor mood and to learn about yourself, was developed.[13] This chatbot was a combination of natural language processing (NLP) techniques and psychological expertise. Endurance, an open-source chatbot, was created in 2018.[14] In 2019, Insomnobot was developed to be used for people who have insomnia.[15] Nowadays, conversational chatbots that use NLP methods are developing. Figure 1 represents the evolution timeline of chatbots.

Research and development of chatbots have become a hot topic since early 2000, and it has increasingly caught researchers' attention (Caldarini et al., 2022). Chatbots have various applications in different fields, from health (Crisseyb et al.,