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Is AI Augmenting or Substituting Humans?
An Eye-Tracking Study of Visual Attention Toward Health Application

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ABSTRACT

In this paper, the authors focus on artificial intelligence as a tangible technology that is designed to sense, comprehend, act, and learn. There are two manifestations of AI in the medical service: an algorithm that analyzes and interprets the test result and a virtual assistant that communicates the result to the patient. The aim of this paper is to consider how AI can substitute a doctor in measuring human health and how the interaction with virtual assistant impacts one's visual attention processes. Theoretically, the article refers to the following research strands: human-computer interaction, technology in services, implementation of AI in the medical sector, and behavioral economy. By conducting an eye-tracking experimental study, it is demonstrated that the perception of medical diagnosis does not differ across experimental groups (human vs. AI).

KEYWORDS

Healthcare, Artificial Intelligence, AI-Human Interaction, Virtual Assistant, Experimental Economics, Eye-tracking, Cognitive Effort

INTRODUCTION

Artificial Intelligence (AI) is being applied to more and more areas of everyday life, including medical diagnostics (McDougall, 2019). In the past two decades, many types of IT-based systems have been broadly utilized in health care in different domains (Rajabion, Shaltooki, Taghikhah, Ghasemi, & Badfar, 2019). Various scenarios have been made possible by rapid advances in information and communications technologies and by the increasing number of smart things (portable devices and sensors) (Kashyap, 2020). The promise of artificial intelligence (AI) in health care offers substantial opportunities to improve patient and clinical team outcomes, reduce costs, and influence the health of the general population. From the patient's point of view, it enables constant monitoring of the body's condition, and analysis of the results through comparison with a vast database containing information no doctor or human analyst would have time to process (Grzywalski, et al., 2019). From the doctor's point of view, it allows them to diagnose patients without having to have contact with them. And the doctor, thanks to AI support, can focus on patients who need direct personal contact (Davenport

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& Kalakota, 2019). This raises high expectations for various applications and devices that monitor health using AI, e.g., Patient Monitoring Devices based on Internet of Things (Shah & Chircu, 2018).

In this article, we identify the reactions of patients to such solutions. We are interested in the reaction to the diagnosis issued by AI and the reaction to a message about the result of the diagnosis delivered by artificial intelligence. These are important issues, because it is the users' attitude towards these solutions that will mostly decide about their distribution on the market (Nasirian, Ahmadian, & Lee, 2017). Research on AI is about any device that perceives its environment and takes actions that maximize its chance to successfully achieve its goals (Russell & Norvig, 2009). In this paper, we focus on AI as a tangible technology that is designed to sense, comprehend, act, and learn to be capable of performing tasks that, if performed by a human, would be said to require intelligence (Scherer, 2016). We deal with medical diagnostic services in which two manifestations of AI are present: (1) an algorithm that collects data from the patient and analyzes and interprets the test result and a (2) Virtual Assistant that communicates the result to the patient and manages his or her communication with the doctor.

The subject of our research is user cognitive reactions to the performance of the test by the AI algorithm, and to the Virtual Assistant's communication of this result. This approach is similar to one presented by Wijesinghe, Gamage, Perera, and Chitraranjan (2019) for smart telemedicine system to manage diabetic retinopathy. Empirically, this paper is focused on the Polish health system because it has high hopes for the implementation of telemedicine in order to improve its condition (Domagała & Klich, 2018).

BACKGROUND

AI in Services

One of the fundamentals of service science says that interaction takes a unique role in services because usually the value is delivered to a customer during those interactions (Maglio & Spohrer, 2008). However, it is not always a human actor who interacts with a customer - technology can also play such a role in service delivery. Specifically, technology can play an augmenting or substituting role for a human actor in service delivery (Marinova, De Ruyter, Huang, Meuter, & Challagalla, 2017). It can enhance the human ability to think (e.g., by collecting and analyzing data) and to act (e.g., by communicating). In some settings, technology can interact with customers faster, cheaper, and in a more convenient way than a human, all in the name of service delivery (De Keyser, Köcher, Alkire, Verbeeck, & Kandampully, 2019). It can also be used by a customer who consumes a service, e.g., using a smart band to collect medical data from a person who wears it and sending it to an algorithm that provides real-time analysis and alerts a doctor if the results exceed allowable levels.

According to Marinova et al. (2017), technology can also replace a human actor who delivers a service. A chatbot or Virtual Assistant (VA) can be one example of such substitution as they are made available, thanks to AI-based technology (Kot & Leszczyński, in press). It can communicate with a patient who uses the medical service to present the results of medical tests, comment on those results, and schedule a meeting with a doctor if needed. Bots and VAs can be shaped to appear as human-like, animal-like, cartoon-like, and functional (Fong, Nourbakhsh, & Dautenhahn, 2003) to facilitate natural and effective interaction. Their interactive behavior can be programmed to include an emotional display, gaze, personality, sense of humor, or even gestures and movements (De Keyser et al., 2019). Their interface can be based on text, voice, graphics, touch, or biometrics. Wijesinghe et al. (2019) in a research paper on an Intelligent Diabetic Assistant present such a system which decides the diagnosis and the treatment priority depending upon the observations that have appeared on the screen. Summing up, both sides of health care service interaction can use the technology as a part of the service. It allows clinical services to be delivered to patients remotely, into areas which were previously served by well-trained human clinicians (Aborujilah et al. 2020). Other examples