Chapter 13
Managing Sensitive Health Data Through Federated Learning and Generative AI Privacy Preserving Techniques: Conversational AI for Patient Engagement Transforming the Future of Healthcare Communication

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DOI: 10.4018/979-8-3373-7426-0.ch013

ABSTRACT

Conversational Artificial Intelligence (AI), encompassing chatbots, voice assistants, and virtual health companions, is redefining how patients interact with healthcare systems in the digital age. The convergence of AI technologies such as Natural Language Processing (NLP), Machine Learning (ML), and Sentiment Analysis has enabled the creation of intelligent communication interfaces that can understand, interpret, and respond to patient needs in real time. This transformation is not merely technological-it represents a paradigm shift in patient engagement, care continuity, and the overall healthcare experience. In a system traditionally constrained by time, resources, and accessibility, conversational AI provides scalable, personalized, and always-available support, bridging gaps between healthcare providers and patients.

1. INTRODUCTION

The engagement of patients with their healthcare would cost lots of money, as it would achieve the optimum utilization of the existing resources; at the same time, it would enhance the very important link between the patients and the healthcare practitioners (Smith & Brown, 2019). The current patients are more aware in terms of sensitivity compared to any other generation in the past regarding their disease and options for treatment, and this is attributed to the side effects of widespread spread of technological advancements and access to information. There are those who opt to try all other avenues of treatment or consult a further medical opinion, and therefore, medical professionals need to give way to such efforts as the rights of the patient who happened to be the one who trusted the healing professions (Taylor & Green, 2018). The technological advancements, particularly in the module of Artificial Intelligence (AI), are emerging as an enabler in driving the paradigm shift in the healthcare segment in the twenty-first century (Kumar et al., 2022). Patient engagement programs understand the dynamics of patient care that are evolving in societies near a paradigm shift towards health care. It has been observed that the development of conversational AI systems, which are technologies to mimic reproducing a human conversation in both the spoken and written word, has been popular because in the recent past developments in AI, specifically voice recognition and natural language processing, have provided tangible improvements. This technological advancement can be seen in terms of renowned virtual assistants like Google Assistant, Alexa, Cortana, and Siri. The earliest models of conversational agents were based on the desire to make them almost indistinguishable to the human response to be able to transcend the Turing Test. Another landmark development in the progress of chatbot technology was not until 1966 when, in one of the first and

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Surjit Paul, Sanjay Kumarand Rajiv Ranjan Suman (2019). *International Journal of Information Security and Privacy (pp. 1-11).*
www.irma-international.org/article/a-quantum-secure-entity-authentication-protocol-design-for-network-security/237207