


Chapter 8


AI-Enabled Virtual Nursing Assistants: Seq2Seq LSTM Neural Networks for Digital Healthcare

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ABSTRACT

Background: The rapid growth of artificial intelligence (AI) is reshaping the quality of delivering the healthcare services, creating new opportunities to support patients beyond traditional clinical environments. Unfortunately, not all individuals can access medical services equally and efficiently. This research aims to develop a virtual nursing assistant by utilizing a neural network model to provide patients with immediate and effective answers to medical inquiries. Methods: In this study we adopted a generative artificial intelligence (AI) powered by neural network layers. The architecture starts with encoding the input of health enquiry into the embedding layer. We utilized the MedQud dataset from Kaggle website, it includes

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47,457 medical question-answer pairs covering questions about treatment, diagnosis and side effects. Results: The proposed model performs well during the training phase. However, during the execution phase, the performance metric shows a higher precision score (40%) compared to the recall and F1-score. Conclusions: The healthcare industry can implement an affordable conversational assistant to help patients with medical inquiries by adopting a virtual nursing assistant that utilizes a sequence model with encoder-decoder architecture. In the future, the model will be enhanced to expand the dataset and incorporate a speech mechanism, enabling users to interact with the system through voice commands.

1 INTRODUCTION

In today's era, the artificial intelligence (AI) is being utilized across a wide variety of domains. For example, it's being used in education and learning (Baidoo-Anu & Ansah, 2023; (Assayed, Alkhatib, & Shaalan, 2024)) in banking systems (Umamaheswari & Valarmathi, 2023) and in healthcare and medical applications (Lee & Yoon, 2021; Assayed, Shieh, & Gupta, 2025) While the 4th Industrial Revolution emphasized on improving the technology through the state-of-art networking and artificial intelligent systems as well as improving speed up the customers' satisfactions and maximizing the company profits, the 5th Industrial Revolution, continued working on this goal but by focusing on human-centric values in enhancing human lives by contributing positively to human wellbeing, equity and sustainability (Noble et al., 2022). As a result, researchers and developers are currently paying more attention to novel technologies such as artificial intelligence (AI) and Internet of Things (IoT) applications, that can effectively collaborate with humans in order to maximize both human and technological strengths toward Society 5.0 (Ziatdinov et al., 2024) Notably, Industry 5.0 includes several digital technologies that can significantly contribute to the health sector by enhancing digital health solutions through the integration of intelligent systems with human intelligence (Nahavandi, 2019). However, this contribution aligns with the vision of the World Health Organization (WHO) on the regional digital health in improving the health outcomes by developing and promoting digital health infrastructures and solutions (World Health Organization, 2022).

Within Healthcare 5.0, various smart sensors and agents have been integrated into medical services, enabling applications such as remote patient monitoring and smart health solutions (Mbunge, Muchemwa, & Batani, 2021; Assayed & Maheshwari, 2023). This has led to a substantial increase in the volume of available health data. To analyze data behavior and predict diseases, researchers have applied a range of

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