

Multimodal Deep Learning in Healthcare Recommender Systems: A Review of CNN-Based Architectures

Hikmat Z. Neima^a , Maha S. Abdulridha^b , Rana M. Ghadban^c , Ghaihab H. Adday^a 

^a Department of Computer Science, College of CSIT, University of Basrah, Iraq.

^b Department of Computer Information Systems, College of CSIT, University of Basrah, Iraq.

^c Department of Intelligent Medical Systems, College of CSIT, University of Basrah, Iraq.

ARTICLE INFO

Keywords:

Multimodal Deep Learning,
Healthcare Recommender
Systems,
Convolutional Neural
Networks,
Explainable AI,
Federated Learning

ABSTRACT

Recent multimodal deep learning approaches are changing how healthcare systems process and integrate widely different types of patient information. Based on this, in this review we investigate the Convolutional Neural Network CNN-based architectures in Healthcare Recommender Systems HRS, which incorporate a variety of data from different sources, such as medical imaging, Electronic Health Records EHRs, wearable sensor streams, clinical narratives. At the core of this ecosystem, CNNs learn hierarchical representations from high-dimensional visual and other unstructured medical data and are increasingly the feature-extraction backbone of modern healthcare recommendation pipelines. We first discuss CNN-based architectures for HRS and then examine their combination with traditional recommendation schemes such as collaborative filtering, hybrid recommendation techniques and other multimodal fusion methods. The review furthermore covers new research developments to leverage CNN-based HRS, including vision–language models, reinforcement learning, causal inference, fairness-aware optimization, federated learning and edge/IoMT deployment. This review reports methodological advances and recent challenges. These challenges include generalization, interpretation, privacy preserving, and clinical integration. Taken together, these analyses summarize the progress of recent research and also provide open challenges. The goal is to guide the design of transparent and scalable systems. These systems should be also ethically sound. They focus on CNN-based healthcare recommender systems for next-generation personalized medicine.

1. INTRODUCTION

The volume of medical data is rising very rapidly. As a result, healthcare is quickly moving toward digital systems. The change is driven by the many types of health data now available. These types include Electronic Health Records EHRs, medical images, and data collected from wearable devices. Healthcare providers seek cost-effective and tailored interventions. Diverse data sources provide many opportunities for improving medical decision-making and require new analytical methods. Advanced neural network architectures and other deep learning methods have been designed to tackle this issue. Computer Vision CV technology is used to interpret X-rays, MRI scans, and pathological slides for clinical diagnosis. Computer vision techniques such as Convolutional Neural Networks CNNs have been reported to enhance image classification, object detection, segmentation, and feature extraction. These successful approaches are particularly recognized for cancer detection and ophthalmology [2]. At the same time, Healthcare Recommender Systems HRS have emerged as a major form of personalized

E-mail address:

hikmat.taher@uobasrah.edu.iq^a

ghaihab.aday@uobasrah.edu.iq^a

maha.abdulradha@uobasrah.edu.iq^b

rana.ghadban@uobasrah.edu.iq^c

Corresponding* : Hikmat Z. Neima

Received 13 February 2026,

Accepted 21 April 2026



DOI: 10.25195/ijci.v52i1744.