CHAOS
Theory and Applications
in Applied Sciences and Engineering

e-ISSN: 2687-4539
REVIEW ARTICLE
Vol.5 / No.4 / 2023 / pp.267-280
Special Issue
https://doi.org/10.51537/chaos.1326790

Unveiling the Complexity of Medical Imaging through Deep Learning Approaches

Novsheena Rasool [*,1] **and Javaid Iqbal Bhat** [*,2]
[*]Department of Computer Science, Islamic University of Science & Technology, Kashmir, J & K, 192122, India.

ABSTRACT Recent advancements in deep learning, particularly convolutional networks, have rapidly become the preferred methodology for analyzing medical images, facilitating tasks like disease segmentation, classification, and pattern quantification. Central to these advancements is the capacity to leverage hierarchical feature representations acquired solely from data. This comprehensive review meticulously examines a variety of deep learning techniques applied across diverse healthcare domains, delving into the intricate realm of medical imaging to unveil concealed patterns through strategic deep learning methodologies. Encompassing a range of diseases, including Alzheimer's, breast cancer, brain tumors, glaucoma, heart murmurs, retinal microaneurysms, colorectal liver metastases, and more, the analysis emphasizes contributions succinctly summarized in a tabular form.The table provides an overview of various deep learning approaches applied to different diseases, incorporating methodologies, datasets, and outcomes for each condition.Notably, performance metrics such as accuracy, specificity, sensitivity, and other crucial measures underscore the achieved results. Specifically, an in-depth discussion is conducted on the Convolutional Neural Network (CNN) owing to its widespread adoption as a paramount tool in computer vision tasks. Moreover, an exhaustive exploration encompasses deep learning classification approaches, procedural aspects of medical image processing, as well as a thorough examination of key features and characteristics. At the end, we delve into a range of research challenges and put forth potential avenues for future improvements in the field.

KEYWORDS
Deep learning
Complexity
CNN
Medical image analysis
Pattern recognition
Segmentation

INTRODUCTION

Deep learning (DL) stands as an advanced form of machine learning (ML), centred on the utilization of artificial neural networks (ANNs) for the analysis and prediction of data.The inception of deep learning dates back to 1943, when Warren McCulloch and Walter Pitts formulated a computational framework inspired by the neural networks within the human brain (Wang and Raj 2017). These DL models draw inspiration from the intricate communication observed among biological neurons within the brain, serving as a structural framework to understand information. Furthermore, similar to their biological counterparts, DL models comprise multiple layers of artificial neurons,including an initial input layer, a conclusive output layer, and a varying number of intermediate processing layers positioned between them.These intermediary layers, collectively referred to as hidden layers,play a pivotal role in extracting crucial features from the input images and recognizing intricate patterns.In each layer, artificial neurons activate upon receiving impulses from neighboring neurons in subsequent layers,leveraging multiple processing levels within the deep architecture (LeCun *et al.* 2015).In essence, each layer within a deep architecture holds a specific algorithm that employs a designated activation function.The amalgamation of these algorithms constructs complex and generalized machines, endowed with remarkable capabilities to address a diverse range of medical image-related challenges (Saba *et al.* 2020).

Over the past few decades,DL has risen to prominence as an incredibly powerful technology.This is primarily due to its remarkable ability to handle and make sense of enormous amounts of data (Islam and Zhang 2018).These algorithms have demonstrated superior capabilities in learning and categorizing

Manuscript received: 13 July 2023,
Revised: 22 August 2023,
Accepted: 27 August 2023.

[1]novsheena.rasool@iust.ac.in (**Corresponding author**).
[2]javaid.iqbal@iust.ac.in