Chapter 15
Advancing Medical Diagnostics on Computer-Assisted Analysis for Digital Medicinal Imagery

Ashwini Kumar
Graphic Era University (Deemed), Dehradun, India

Vishu Tyagi
Graphic Era University (Deemed), Dehradun, India

Harikesh Singh
https://orcid.org/0000-0003-2203-0828
JSS Academy of Technical Education, Noida, India

Sourabh Jain
Indian Institute of Information Technology, Sonepat, India

ABSTRACT

Digital medicinal imagery, comprising MRI, CT scans, and PET scans, constitutes a cornerstone of contemporary medical diagnostics. However, interpreting these intricate images presents formidable challenges, demanding considerable expertise and time. Computer-assisted analysis emerges as a promising approach to augment the accuracy and efficiency of medical diagnosis. This research proposal delineates a comprehensive study aimed at pioneering advanced computer-assisted analysis techniques tailored for digital medicinal imagery. The proposed study on investigating

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cutting-edge machine learning algorithms suitable for analyzing digital medicinal imagery, devising novel algorithms for automated disease detection, diagnosis, and treatment planning based on medical imaging data, rigorously evaluating the performance of these algorithms against existing methods through robust validation studies, and assessing the clinical feasibility and utility of integrating computer-assisted analysis tools into routine clinical practice.

INTRODUCTION

Medical imaging is one of the crucial components of contemporary healthcare, offering an opportunity to observe the internal structures and mechanisms of the human body. Over the past years, the variety of available techniques has increased dramatically and now includes not only traditional X-rays and CT scans but also MRI and ultrasound. This range allows healthcare specialists to achieve high clarity in visualizing the anatomy and errors while offering avenues for further diagnostic procedures and treatments. Nevertheless, for many years, the interpretation of results has been conducted by experienced radiologists and clinicians, implying a long time for conducting such analyses and introducing a possibility for variability (Yazdani et al, 2022).

In recent years, the marriage of medical imaging with computational methods has brought about the advent of computer-assisted analysis, a change expected to significantly increase diagnostic accuracy, effectiveness, and patient prognosis (AlEisa et al, 2022). In this setting, algorithms and software are employed to assist in or perform the assessment of medical images, according to which the skills of medical professionals are complemented.

The development of computer-assisted analysis is motivated primarily by the increasing need for more precise and effective diagnostic methods. Due to the rapid increase in the amount of medical imaging data, radiologists face the problem of being unable to analyze all cases properly because they receive an entire ocean of images every day (Owens et al., 2013). Computers can aid in this issue by facilitating the identification of abnormalities and marking cases that require immediate analysis or reanalysis. Through machine learning, artificial intelligence, and image-processing algorithms, computers may indicate cases that require thorough examination, reducing error and boosting confidence in diagnostic decision-making. Besides, in this phase it could be also used to show the scientifically supportive statistically meaningful data which are could not be “read” with the human eye without proper technological tools. Illustrating, it is worth mentioning, special image processing algorithms which can detect and measuring biomarkers, quantify heterogeneous tissue properties, and simulate the disease model, giving a clear vision of the disease complexity to the