Chapter 4
Revolutionizing Brain Tumor Detection by Exploring the Environmental Impact and Deep Learning in MRI Segmentation

Snehal Rahul Rathi
https://orcid.org/0009-0004-7638-6429
Vishwakarma Institute of Information Technology, Pune, India

Pratik Kanhaiya Rathod
Vishwakarma Institute of Information Technology, Pune, India

Adarsh R. Dawkhare
Vishwakarma Institute of Information Technology, Pune, India

Sanket Sunil Anbhule
https://orcid.org/0009-0004-7807-7435
Vishwakarma Institute of Information Technology, Pune, India

Shilpa Prashant Kalantri
https://orcid.org/0000-0002-7011-2513
Shah and Anchor Kutchhi Engineering College, India

DOI: 10.4018/979-8-3373-0179-2.ch004

Copyright © 2026, IGI Global Scientific Publishing. Copying or distributing in print or electronic forms without written permission of IGI Global Scientific Publishing is prohibited. Use of this chapter to train generative artificial intelligence (AI) technologies is expressly prohibited. The publisher reserves all rights to license its use for generative AI training and machine learning model development.

ABSTRACT

Maligancy of the brain is a disorder that affects the health of populations worldwide and for diagnosis, calls for complex skills and high-resolution techniques. This work proposes the use of a new strategy for the detection and segmentation of brain tumors with the help of MRI images. Concerning MRI, although the tumors are high in water content and possess hydrogen atoms, they give variations in signal intensity when compared to normal tissues. Thus, the utilization of CNNs for classifying and detecting brain tumors is quite efficient, provided the combined application of the CLAHE algorithm to boost the image contrast, where the outcomes of the classification attained a high accuracy. This chapter reflects on the Sustainable Development Goals in general by contributing to the development of more effective diagnostic tools and, consequently, enhancing the health of individuals. It is in line with the need to have sustainable healthcare systems for the constant and fair diagnosis and treatment of brain tumors regardless of the climate situation.

INTRODUCTION

The brain has an amazing number of cells and is one of the finest-built organs of the human body. Brain tumor is one of the main reasons for the growth of human demise. The brain tumor is an abnormal growth of the cells which are known as cancerous tumor or also known as a malignant tumor (Kumar et al., 2021). Tumors can occur where they start in one area and continue to grow, or they begin and develop at the same location in other tissues. This form of tumor is said to be the primary tumor; it is said that it cannot differentiate from other areas like spreading. The brain, with its astonishing number of neurons, stands as one of the most intricately designed organs in the human body. Brain tumors represent a significant cause of mortality, marked by abnormal cell growth, known as malignant or cancerous tumors. Tumors can either initiate in a singular location and proliferate or emerge and expand within the same tissue region. These are classified as primary tumors, distinguished by their non-metastatic nature.

Among the most frequently diagnosed brain tumors are gliomas, meningiomas, pituitary adenomas, medulloblastomas, and schwannomas. Although the precise etiology of brain tumors remains elusive, several factors are believed to contribute, including high radiation exposure, various genetic conditions, and a compromised immune system, particularly in younger individuals. The clinical manifestations of brain tumors vary with their size and location but commonly include headaches, seizures, visual or auditory impairments, limb weakness or numbness, and difficulties with speech or movement. Diagnostic methods typically involve a combination

22 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/revolutionizing-brain-tumor-detection-by-exploring-the-environmental-impact-and-deep-learning-in-mri-segmentation/399400

Related Content

Collaborative Exploration based on Simultaneous Localization and Mapping
Domenec Puig (2014). *Robotics: Concepts, Methodologies, Tools, and Applications (pp. 1572-1599).*
www.irma-international.org/chapter/collaborative-exploration-based-on-simultaneous-localization-and-mapping/84966

Vision Based Localization for Multiple Mobile Robots Using Low-cost Vision Sensor
Seokju Lee, Girma Tewolde, Jongil Limand Jaerock Kwon (2020). *Robotic Systems: Concepts, Methodologies, Tools, and Applications (pp. 575-589).*
www.irma-international.org/chapter/vision-based-localization-for-multiple-mobile-robots-using-low-cost-vision-sensor/244026

Collision Avoidance in Dynamic Environment by Estimation of Velocity and Location of Object by Robot using Parallax
Ajay Kumar Raiand Ritu Tiwari (2015). *International Journal of Robotics Applications and Technologies (pp. 63-75).*
www.irma-international.org/article/collision-avoidance-in-dynamic-environment-by-estimation-of-velocity-and-location-of-object-by-robot-using-parallax/152362

Machine Learning-Based Comparative Analysis for Chronic Kidney Disease Prediction Using Clinical Data
Mahesh Shinde, Satyajit Pangaonkar, Parikshit G. Mahalle, Surendra Rahamatkarand Dattatray G. Takale (2026). *Revolutionizing Medicine With Autonomous Robotics (pp. 213-232).*
www.irma-international.org/chapter/machine-learning-based-comparative-analysis-for-chronic-kidney-disease-prediction-using-clinical-data/399405

Wearable IoT Devices in Rehabilitation: Enabling Personalized Precision Medicine

Rabia Aziz, Firdaus Jawed, Sohrab Ahmad Khanand Habiba Sundus (2024). *Medical Robotics and AI-Assisted Diagnostics for a High-Tech Healthcare Industry (pp. 281-308).*

www.irma-international.org/chapter/wearable-iot-devices-in-rehabilitation/341123