ISSN: 3068-7527

Review Article

Open Access Journal of Medicine and Healthcare

OPENPUB GLOBAL PUBLISHERS

Received: 12-11-2025 Accepted: 02-01-2026 Published: 08-02-2026

Volume 2 | Issue 1

AI-Based Automated Analysis of MRI and CT Scans

Patrik James Kennet[1*] and Soren Falkner[2]

[1]Massachusetts Institute of Technology, Massachusetts Ave, Cambridge, MA 02139, United States

[2]Vienna University of Technology, Faculty Of Computer Engineering, Vienna, Austria

[*]**Corresponding author:** Patrik James Kennet, Massachusetts Institute of Technology, Massachusetts Ave, Cambridge, MA 02139, United States.

Citation: Patrik James Kennet, Soren Falkner (2026) AI-Based Automated Analysis of MRI and CT Scans. Open Access Journal of Medicine and Healthcare 2(1): 1-5.

Abstract

Artificial Intelligence (AI) has become a transformative tool in medical imaging, particularly in the automated analysis of Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans. These imaging modalities generate vast amounts of data that require precise interpretation for diagnosis and treatment planning. Traditional image analysis methods rely heavily on radiologist expertise, which can be time-consuming and subject to human error. This paper explores the application of deep learning and machine learning algorithms in automating the analysis of MRI and CT scans. We review major AI techniques such as convolutional neural networks (CNNs), support vector machines (SVMs), and generative adversarial networks (GANs) for segmentation, classification, and anomaly detection. The study highlights how AI improves diagnostic accuracy, reduces workload, and accelerates image interpretation. Challenges such as data standardization, model transparency, and ethical considerations are also discussed. The findings emphasize the growing potential of AI in creating efficient, accurate, and accessible diagnostic imaging systems.

Keywords: Artificial Intelligence, Deep Learning, MRI, CT Scans, Medical Imaging, Automated Diagnosis, Convolutional Neural Networks

Introduction

Medical imaging plays a critical role in modern healthcare, enabling non-invasive visualization of internal organs, tissues, and pathologies. MRI and CT scans are among the most frequently used imaging modalities, offering high-resolution and cross-sectional views essential for diagnosing diseases such as cancer, stroke, and neurological disorders. However, manual interpretation of these images by radiologists is labor-intensive and prone to inter-observer variability [1-34].

The integration of Artificial Intelligence (AI), particularly deep learning, has revolutionized biomedical image analysis. AI-based systems can automatically detect abnormalities, segment tissues, and predict disease outcomes with minimal human intervention. This paper discusses the principles, applications, benefits, and challenges of using AI for automated MRI and CT image analysis [35-54].

Background

MRI uses magnetic fields and radio waves to produce detailed images of soft tissues, while CT employs X-rays to create cross-sectional images of internal structures. The complexity and volume of imaging data make manual analysis a bottleneck in clinical workflows. AI offers a solution by automating feature extraction and classification tasks that mimic the decision-making process of radiologists [55-63].

Recent advances in computational power and the availability of large annotated datasets have accelerated the use of AI in radiology. Convolutional neural networks (CNNs) have emerged as the most powerful tools for image analysis due to their ability to automatically learn hierarchical features from raw data [64-74].

Methodology

AI-based automated analysis involves several stages:

1. **Data Acquisition and Preprocessing**
   MRI and CT images are collected from hospital databases or open repositories. Images undergo preprocessing, including normalization, noise reduction, and augmentation to enhance model robustness.
2. **Model Architecture**
   - **Convolutional Neural Networks (CNNs):** Widely used for detecting tumors, lesions, and anatomical structures.
   - **U-Net Models:** Popular for image segmentation tasks in MRI brain scans and CT lung images.
   - **Recurrent Neural Networks (RNNs):** Applied when temporal data or multi-slice image sequences are analyzed.
   - **Generative Adversarial Networks (GANs):** Employed to improve image resolution and synthesize medical images for training.
3. **Training and Validation**
   Models are trained on labeled datasets, often using cross-validation to prevent overfitting. Performance is evaluated using metrics such as accuracy, sensitivity, specificity, and area under the curve (AUC) [75-83].
4. **Deployment and Integration**
   Once validated, AI systems are integrated into clinical Picture Archiving and Communication Systems (PACS) to assist radiologists in real-time diagnosis.

Results and Discussion

AI-based automated analysis has demonstrated remarkable accuracy in numerous diagnostic applications:

- **Brain Tumor Detection (MRI):** CNN-based models such as Res Net and Dense Net achieve accuracy levels exceeding 95% in differentiating between gliomas and other lesions.
- **Lung Disease Identification (CT):** AI systems detect pneumonia, pulmonary nodules, and COVID-19 with precision comparable to expert radiologists.
- **Organ Segmentation:** U-Net architectures provide automated delineation of organs such as the liver and kidneys, improving the precision of radiotherapy planning.

Despite these advances, challenges persist. Data heterogeneity across imaging centers affects model generalizability. Explain ability remains a key issue radiologist often find it difficult to interpret AI-generated outputs. Moreover, ethical and legal concerns, including data privacy and algorithmic bias, must be addressed before full clinical adoption.

Challenges and Future Directions

Future Research should Focus on:

- **Multimodal Data Fusion:** Combining MRI, CT, and other imaging modalities for comprehensive diagnosis.
- **Explainable AI (XAI):** Developing interpretable models that provide transparent reasoning for their predictions.
- **Federated Learning:** Training AI models across multiple institutions without compromising patient privacy.
- **Regulatory Frameworks:** Establishing global standards for validation and approval of AI-based medical imaging tools.

As AI technologies evolve, they are expected to become indispensable collaborators rather than replacements for radiologists, enhancing decision-making and patient outcomes.

Conclusion

AI has demonstrated immense potential in automating the analysis of MRI and CT scans, offering faster and more accurate interpretations than traditional methods. While deep learning models have achieved state-of-the-art performance, challenges related to data quality, interpretability, and ethical implementation remain. Continued collaboration between computer scientists, clinicians, and regulatory bodies will be crucial to translating AI innovations into safe and effective clinical tools.

References

1. Panahi O, Azarfardin A (2025) Computer-Aided Implant Planning: Utilizing AI for Precise Placement and Predictable Outcomes. Journal of Dentistry and Oral Health 2: 1-5.
2. Panahi O (2025) AI in Health Policy: Navigating Implementation and Ethical Considerations. Int J Health Policy Plann 4: 01-05.
3. Panahi O, Eslamlou SF, Jabbarzadeh M (2025) Digital dentistry and artificial intelligence. ISBN: 978-620-8-73914-0.
4. Panahi O (2025) Innovative Biomaterials for Sustainable Medical Implants: A Circular Economy Approach. European

Journal of Innovative Studies and Sustainability 1: 1-5.
5. Panahi O (2024) Bridging the Gap: AI-Driven Solutions for Dental Tissue Regeneration. Austin J Dent 11: 1185.
6. Panahi O, Eslamlou SF, Jabbar Zadeh M (2025) Digital dentistry and artificial intelligence. ISBN: 978-620-8-73912-6.
7. Panahi O, Zainuddin M (2024) The Convergence of Precision Medicine and Dentistry: An AI and Robotics Perspective. Austin J Dent 11: 1186.
8. Omid P, Mohammad Z (2024) "The Remote Monitoring Toothbrush for Early Cavity Detection using Artificial Intelligence (AI)", IJDSIR 7: 173-178.
9. Omid P (2024) Modern Sinus Lift Techniques: Aided by AI. Glob J Oto 26: 556198.
10. 10. Panahi O (2024) The Rising Tide: Artificial Intelligence Reshaping Healthcare Management. S J Publc Hlth 1: 1-3.
11. Panahi P (2008) Multipath Local Error Management Technique Over Ad Hoc Networks. In 2008 International Conference on Automated Solutions for Cross Media Content and Multi-Channel Distribution. 187-194.
12. Panahi O, Eslamlou SF, Jabbar Zadeh M (2025) Digital dentistry and artificial intelligence. ISBN: 978-620-8-73913-3.
13. Panahi U (2025) AD HOC Networks: Applications, Challenges, Future Directions, Scholars' Press. ISBN: 978-3-639-76170-2.
14. Panahi, U (2025) AD HOC networks: Applications, challenges, future directions. SCHOLARS'PRESS. ISBN: 978-620-8-72963-9.
15. Panahi O, Eslamlou SF, Jabbarzadeh M (2025) Digital odontology and artificial intelligence. ISBN: 978-620-8-73911-9.
16. Koyuncu B, Gokce A, Panahi P (2015) The use of the Unity game engine in the reconstruction of an archeological site. In 19th Symposium on Mediterranean Archaeology 95-103.
17. Koyuncu B, Meral E, Panahi P (2015) Real time geolocation tracking by using GPS+GPRS and Arduino based SIM908. IFRSA International Journal of Electronics Circuits and Systems (IIJECS) 4: 148-150.
18. Koyuncu B, Uğur B, Panahi P (2013) Indoor location determination by using RFIDs. International Journal of Mobile and Adhoc Network (IJMAN) 3: 7-11.
19. Uras Panahi (2025) Redes AD HOC: Applications, Challenges, Future Directions. Our Knowledge Editions.
20. Panahi P, Bayılmış C, Çavuşoğlu U, Kaçar S (2021) Performance evaluation of lightweight encryption algorithms for IoT-based applications. Arabian Journal for Science and Engineering 46: 4015-4037.
21. Panahi U, Bayılmış C (2023) Enabling secure data transmission for wireless sensor networks based IoT applications. Ain Shams Engineering Journal 14: 101866.
22. Panahi O, Panahi U (2025) AI-powered IoT: Transforming diagnostics and treatment planning in oral implantology. J Adv Artif Intell Mach Learn 1: 1-4.
23. Panahi P, Dehghan M (2008) Multipath video transmission over ad hoc networks using layer coding and video caches. In 16th Iranian Conference on Electrical Engineering (ICEE) 50-55.
24. Panahi DU (2025) HOC A Networks: Applications. Challenges, Future Directions. Scholars' Press.
25. Panahi O, Esmaili F, Kargar Nezhad S (2024) Artificial Intelligence in Dentistry. Scholars Press Publishing. ISBN: 978-620-6772118.
26. Omid P (2011) Relevance between gingival hyperplasia and leukemia. Int J Acad Res 3: 493-49.
27. Panahi O (2025) Secure IoT for Healthcare. European Journal of Innovative Studiesand Sustainability 1: 1-5.
28. Panahi O (2025) Deep Learning in Diagnostics. Journal of Medical Discoveries 2.
29. Panahi O (2024) Artificial intelligence in oral implantology, its applications, impact and challenges. Adv Dent & Oral Health 17: 555966.
30. Panahi O (2024) Tele dentistry: Expanding access to oral healthcare. Journal of Dental Science Research Reviews & Reports. J Dental Sci Res Rep 6: 2-3.
31. Omid P (2024) Empowering dental public health: Leveraging artificial intelligence for improved oral healthcare access and outcomes. JOJ Pub Health 9: 555754.
32. Kevin Thamson, Omid Panahi (2025) Bridging the Gap: AI as a Collaborative Tool Between Clinicians and Researchers. J. of Bio Adv Sci Research 1: 1-08.
33. Panahi O (2025) Algorithmic Medicine. Journal of Medical Discoveries 2.
34. Panahi O (2025) The Future of Healthcare: AI, Public Health and the Digital Revolution. MediClin Case Rep J 763-766.
35. Kevin Thamson, Omid Panahi (2025) Challenges and Opportunities for Implementing AI in Clinical Trials. J. of Bio Adv Sci Research 1: 1-08.
36. Kevin Thamson, Omid Panahi (2025) Ethical Considerations and Future Directions of AI in Dental Health¬care. J. of Bio Adv Sci Research 1: 1-07.
37. Kevin Thamson, Omid Panahi (2025) Bridging the Gap: AI, Data Science, and Evidence-Based Dentistry. J. of Bio Adv Sci Research 1: 1-13.
38. Omid Panahi (2021) Research system in health management

information systems. M Gholizadeh - Sciencia Scripts Publishing,
39. Panahi DO, Esmaili DF, Kargarnezhad DS (2024) Artificial intelligence in dentistry, EDITION NOTRE SAVOIR Publishing Publishing.
40. Panahi DO, Esmaili D., Kargarnezhad DS (2024) Artificial Intelligence in Dentistry.
41. Panahi O, Panahi U (2025) AI-powered IoT: Transforming diagnostics and treatment planning in oral implantology. J Adv Artif Intell Mach Learn 1: 1-4.
42. Panahi O, Eslamlou SF (2025) Periodontium: Structure. Function and Clinical Management.
43. Panahi O, Ezzati A (2025) AI in dental-medicine: Current applications & future directions. Open Access J Clin Images 2: 1-5.
44. Panahi O, Dadkhah S (2025) Mitigating aflatoxin contamination in grains: The importance of postharvest management practices. Advances in Biotechnology & Microbiology 18: 555996.
45. Panahi O (2024) Empowering Dental Public Health: Leveraging Artificial Intelligence for Improved Oral Healthcare Access an d Outcomes. JOJ Pub Health 9: 555754.
46. Omid P, Fatmanur KC (2023) Nano Technology. Regenerative Medicine and, Tissue Bio-Engineering. Acta Scientific Dental Sciences 7: 118-122.
47. MARYAM M, GHOLIZADEH P, OMID D (2021) INVESTIGATING SYSTEM IN HEALTH MANAGEMENT INFORMATION SYSTEMS. SCHOLARS'PRESS.
48. Panahi O (2025) AI-Powered IoT: 54. Trans forming Diagnostics and Treatment Planning in Oral Implantology. J Adv ArtifIntell Mach Learn 1: 1-4.
49. Mansoureh Zeynali (2025) Will AI Replace Your Dentist? The Future of Dental Practice. OnJ Dent & Oral Health 8.
50. Panahi O (2024) Artificial intelligence: A new frontier in periodontology. Mod Res Dent 8: 000680.
51. AI in modern times 48, DO Panahi, DS Dadkhah - Zahnmedizin.
52. Panahi U (2025) AD HOC networks: Applications, challenges, future directions. SCHOLARS'PRESS. ISBN 978-620-8-72962-2.
53. Panahi, U (2025) AD HOC networks: Applications. Challenges, Future Paths. Our Knowledge.
54. Panahı U (2022) Design of a lightweight cryptography-based secure communication model for the internet of things.
55. Koyuncu B, Panahi P (2014) Kalman filtering of link quality indicator values for position detection by using WSNs. power 2: 4.
56. Koyuncu B, Gökçe A, Panahi P (2015) Archaeological site: An integrative game engine demonstration for the reconstruction of an archaeological site. In SOMA 2015. ISBN, 2024
57. Panahi O, Eslamlou SF (2025) Peridonium: Structure, function and clinical management. ISBN: 978-620-8-74559-2.
58. Panahi O, Dadkhah S (2025) AI in modern dentistry. ISBN: 978-620-8-74877-7.
59. Panahi O (2025). Dental pulp stem cells. ISBN: 978-620-4-05358-5.
60. Omid Panahi, Faezeh Esmaili, Sasan Kargarnezhad (2024) Artificial Intelligence in Dentistry. SCIENCIA SCRIPTS Publishing.
61. Panahi O, Melody FR (2011) A novel scheme about extraction orthodontic and orthotherapy. International Journal of Academic Research 3: 1057-1058.
62. Panahi O (2025) The evolving partnership: Surgeons and robots in the maxillofacial operating room of the future. J Dent Sci Oral Care 1: 1-7.
63. Panahi O, Dadkhah S, Artificial intelligence in modern dentistry. ISBN:978-620-8-74884-5.
64. Panahi O (2025) The Future of Medicine: Converging Technologies and Human Health. Journal of Bio-Med and Clinical Research. RPC Publishers 2.
65. Panahi O, Raouf MF, Patrik K (2011) The Evaluation Between Pregnancy and Periodontal Therapy. Int J Acad Res 3: 1057-1058.
66. Panahi O, Nunag GM, Nourinezhad Siyahtan A (2011) Molecular Pathology: P-115: Correlation of Helicobacter Pylori and Prevalent Infections in Oral Cavity. Cell Journal (Yakhteh), 12(Supplement 1 (The 1st International Student Congress On Cell and Molecular Medicine). 91-92.
67. Panahi O (2025) Journal of Bio-Med and Clinical Research.
68. Panahi O, Eslamlou SF (2025) Peridoncio: Structure, function and clinical management. ISBN: 978-620-8-74557-8.
69. Panahi O, Farrokh S (2025) Building healthier communities: The intersection of AI, IT, and community medicine. Int J Nurs Health Care 1: 1-4.
70. Panahi O (2024) Dental pulp stem cells: A review. Acta Scientific Dental Sciences 8: ISBN: 978-620-4-05357-8.
71. Panahi O (2025) Nanomedicine: Tiny Technologies, Big Impact on Health. Journal of Bio-Med and Clinical Research. RPC Publishers 2.
72. Panahi O, Amirloo A (2025) AI-enabled IT systems for improved dental practice management. On J Dent & Oral Health 8. OJDOH.MS.ID.000691. DOI: 10.33552/

OJDOH.2025.08.000691.
73. Panahi O (2013) Comparison between unripe Makopa fruit extract on bleeding and clotting time: P16-509. International Journal of Paediatric Dentistry 23: 205.
74. Panahi O, Eslamloo SF (2025) Periodontium: Structure, function, and clinical management. ISBN: 978-620-8-74560-8.
75. Panahi O, Eslamlou SF (2025) Artificial Intelligence in Oral Surgery: Enhancing Diagnostics, Treatment, and Patient Care. J Clin Den & Oral Care 3: 01-05.
76. Panahi O, Eslamlou SF, Jabbarzadeh M (2025) Digital dentistry and artificial intelligence. ISBN: 978-620-8-73913-3.
77. Omid P, Soren F (2025) The Digital Double: Data Privacy, Security, and Consent in AI Implants. Digit J Eng Sci Technol 2: 105.
78. Panahi O, Eslamlou SF, Jabbarzadeh M (2025) Medicina dentária digital e inteligência artificial. ISBN: 978-620-8-73915-7.
79. Panahi O. Stammzellen aus dem Zahnmark. ISBN: 978-620-4-05355-4.
80. Panahi O (2025) AI-Enhanced Case Reports: Integrating Medical Imaging for Diagnostic Insights. J Case Rep Clin Images 8: 1161.
81. Panahi O (2025) Navigating the AI Landscape in Healthcare and Public Health. Mathews J Nurs 7: 5.
82. Panahi O (2025) The Role of Artificial Intelligence in Shaping Future Health Planning. Int J Health Policy Plann 4: 01-05.
83. Panahi O, Falkner S (2025) Telemedicine, AI, and the Future of Public Health. Western J Med Sci & Res 2: 10.