



TIBBİ GÖRÜNTÜ İŞLEMEDE DERİN ÖĞRENME: TEORİ, MİMARİLER VE UYGULAMALAR

Özlem KARABİBER CURA¹

TIBBİ GÖRÜNTÜLEMENİN KRİTİK ROLÜ

Modern tıp pratiğinde tıbbi görüntüleme, hastalıkların teşhisi, tedavinin planlanması ve takibinde önemli rol oynar. Teknolojinin gelişmesiyle birlikte bu rol daha da genişlemiş ve sağlık hizmetlerinin kalitesi önemli ölçüde iyileşmiştir. Farklı görüntüleme teknikleri, çok çeşitli tıbbi rahatsızlıkların tespiti, teşhisi ve izlenmesi için farklı faydalar sağlamaktadır. X-ışını, Manyetik Rezonans Görüntüleme (MRI), Bilgisayarlı Tomografi (BT) ve ultrason görüntüleri de dahil olmak üzere birçok tıbbi görüntüleme tekniği bulunmaktadır (1,2).

Tanıdaki Kritik Rolü

Vücudun iç yapısının görsel olarak incelenmesine olanak tanıyan tıbbi görüntüleme, geleneksel klinik muayene yöntemlerinin sınırlarını aşmaktadır. Birçok hastalık, klinik semptomlar ortaya çıkmadan önce tıbbi görüntüleme ile teşhis edilebilir. Tıbbi görüntüler, hastalığın konumunu, boyutunu, yayılımını ve diğer özelliklerini net bir şekilde göstererek doğru teşhis koymayı kolaylaştırır.

¹ Dr. Öğr. Üyesi, İzmir Kâtip Çelebi Üniversitesi, Biyomedikal Mühendisliği Bölümü,
ozlem.karabiber@ikcu.edu.tr, ORCID iD: 0000-0001-8650-1137
DOI: 10.37609/akya.63.c667

KAYNAKLAR

1. Muhammad, D, & Bendeache, M. Unveiling the black box: a systematic review of Explainable Artificial Intelligence in medical image analysis. *Computational and structural biotechnology journal*. 2024.
2. Patel, B. C, & Sinha, G. R. Abnormality detection and classification in computer-aided diagnosis (CAD) of breast cancer images. *Journal of Medical Imaging and Health Informatics*. 2014; 4(6), 881-885.
3. Abut, S, Okut, H, & Kallail, K. J. Paradigm shift from Artificial Neural Networks (ANNs) to deep Convolutional Neural Networks (DCNNs) in the field of medical image processing. *Expert Systems with Applications*. 2024; 244, 122983.
4. Yang, Y, Xing, W, Liu, Y, Li, Y, Ta, D, Song, Y, & Hou, D. Medical Imaging-based Artificial Intelligence in Pneumonia: A Narrative Review. *Neurocomputing*. 2025; 129731.
5. Choi, B. I. The current status of imaging diagnosis of hepatocellular carcinoma. *Liver transplantation*. 2004; 10(S2), S20-S25.
6. emghouli, S, El Fahssi, M, Zerfaoui, M, Hadaoui, A, & Amaoui, B. Knowledge and perceptions of Moroccan medical physicists regarding the contribution of artificial intelligence in medical imaging and radiotherapy. *Radiation Medicine and Protection*. 2025; 6(2), 75-80.
7. Pesapane, F, Codari, M, & Sardanelli, F. Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine. *European radiology experimental*. 2018; 2, 1-10.
8. Cui, S, Tseng, H. H, Pakela, J, Ten Haken, R. K, & El Naqa, I. Introduction to machine and deep learning for medical physicists. *Medical physics*. 2020; 47(5), e127-e147.
9. Barragán-Montero, A, Javaid, U, Valdés, G, Nguyen, D, Desbordes, P, Macq, B, ... & Lee, J. A. Artificial intelligence and machine learning for medical imaging: A technology review. *Physica Medica*. 2021; 83, 242-256.
10. Rashidi, H. H, Pantanowitz, J, Hanna, M. G, Tafti, A. P, Sanghani, P, Buchinsky, A, ... & Pantanowitz, L. Introduction to Artificial Intelligence and Machine Learning in Pathology and Medicine: Generative and Nongenerative Artificial Intelligence Basics. *Modern Pathology*. 2025; 38(4).
11. Okut, H. Bayesian Regularized Neural Networks for Small n Big. *Artificial Neural Networks: Models and Applications*. 2016; 27.
12. Vasuki, A, & Govindaraju, S. Deep neural networks for image classification. In *Deep Learning for Image Processing Applications*. 2017; (pp. 27-49). IOS Press.
13. Ranschaert, E. R, Morozov, S, & Algra, P. R. (Eds.). *Artificial intelligence in medical imaging: opportunities, applications and risks*. Springer. 2019.
14. Subasi, A. (Ed.). *Applications of artificial intelligence in medical imaging*. Academic Press. 2022.
15. Uhmb, T. H, Hamada, Y, & Hirose, T. Relationships between fault friction, slip time, and physical parameters explored by experiment-based friction model: A Machine Learning Approach Using Recurrent Neural Networks (RNNs). *Applied Computing and Geosciences*. 2025; 25, 100231.
16. Salehi, A. W, Khan, S, Gupta, G, Alabdullah, B. I, Almjjaly, A, Alsolai, H, ... & Mellit, A. A study of CNN and transfer learning in medical imaging: Advantages, challenges, future scope. *Sustainability*. 2023; 15(7), 5930.
17. Chen, C, Isa, N. A. M, & Liu, X. A review of convolutional neural network based methods for medical image classification. *Computers in Biology and Medicine*. 2025; 185, 109507.
18. Kim, H. E, Cosa-Linan, A, Santhanam, N, Jannesari, M, Maros, M. E, & Ganslandt, T. Transfer learning for medical image classification: a literature review. *BMC medical imaging*. 2022; 22(1), 69.
19. Szegedy, C, Liu, W, Jia, Y, Sermanet, P, Reed, S, Anguelov, D, ... & Rabinovich, A. Going deeper with convolutions. In *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2015; (pp. 1-9).

20. Mahbod, A, Saeidi, N, Hatamikia, S, & Woitek, R. Evaluating pre-trained convolutional neural networks and foundation models as feature extractors for content-based medical image retrieval. *Engineering Applications of Artificial Intelligence*. 2025; 150, 110571.
21. Xin, Y, Tang, Y, & Yang, Z. Shoe Print Retrieval Algorithm Based on Improved Efficient-netV2. In *Chinese Conference on Biometric Recognition*. 2022, October; (pp. 444-454). Cham: Springer Nature Switzerland.
22. Souid, A, Sakli, N, & Sakli, H. Classification and predictions of lung diseases from chest x-rays using mobilenet v2. *Applied Sciences*. 2021; 11(6), 2751.
23. Zhang, Z, Wu, C, Coleman, S, & Kerr, D. DENSE-INception U-net for medical image segmentation. *Computer methods and programs in biomedicine*. 2020; 192, 105395.
24. Reddy, J, Mundra, S, & Mundra, A. Ensembling Deep Learning Models for Fake News Classification. *Procedia Computer Science*. 2024; 235, 2766-2774.
25. Uyar, K, Yurdakul, M, & Taşdemir, Ş. Abc-based weighted voting deep ensemble learning model for multiple eye disease detection. *Biomedical Signal Processing and Control*. 2024; 96, 106617.
26. Aljuaid, H, Alturki, N, Alsubaie, N, Cavallaro, L, & Liotta, A. Computer-aided diagnosis for breast cancer classification using deep neural networks and transfer learning. *Computer Methods and Programs in Biomedicine*. 2022; 223, 106951.
27. Abhishek, A, Jha, R. K, Sinha, R, & Jha, K. Automated detection and classification of leukemia on a subject-independent test dataset using deep transfer learning supported by Grad-CAM visualization. *Biomedical Signal Processing and Control*. 2023; 83, 104722.
28. Nahiduzzaman, M, Islam, M. R, & Hassan, R. ChestX-Ray6: Prediction of multiple diseases including COVID-19 from chest X-ray images using convolutional neural network. *Expert Systems with Applications*. 2023; 211, 118576.
29. Kc, K, Yin, Z, Wu, M, & Wu, Z. Evaluation of deep learning-based approaches for COVID-19 classification based on chest X-ray images. *Signal, image and video Processing*. 2021; 15(5), 959-966.
30. Chouhan, V, Singh, S. K, Khamparia, A, Gupta, D, Tiwari, P, Moreira, C, ... & De Albuquerque, V. H. C. A novel transfer learning based approach for pneumonia detection in chest X-ray images. *Applied Sciences*. 2020; 10(2), 559.
31. Mahbod, A, Schaefer, G, Wang, C, Dorffner, G, Ecker, R, & Ellinger, I. Transfer learning using a multi-scale and multi-network ensemble for skin lesion classification. *Computer methods and programs in biomedicine*. 2020; 193, 105475.
32. Narayan, V, Mall, P. K, Alkhayyat, A, Abhishek, K, Kumar, S, & Pandey, P. (Retracted) Enhance-Net: An Approach to Boost the Performance of Deep Learning Model Based on Real-Time Medical Images. *Journal of Sensors*. 2023(1), 8276738.
33. Anaraki, A. K, Ayati, M, & Kazemi, F. Magnetic resonance imaging-based brain tumor grades classification and grading via convolutional neural networks and genetic algorithms. *biocybernetics and biomedical engineering*. 2019; 39(1), 63-74.
34. Altaf, F, Islam, S. M, Akhtar, N, & Janjua, N. K. Going deep in medical image analysis: concepts, methods, challenges, and future directions. *IEEE Access*. 2019; 7, 99540-99572.
35. Fu, B, Peng, Y, He, J, Tian, C, Sun, X, & Wang, R. HmsU-Net: A hybrid multi-scale U-net based on a CNN and transformer for medical image segmentation. *Computers in Biology and Medicine*. 2024; 170, 108013.
36. Shinu, M. M, Pamela, D, Devadhas, G. G, & Isaac, J. S. AAMR-FCN myeloma cancer net: Adaptive and attention-based mask R-FCN for diagnosing myeloma cancer using cell microscopic images with hybrid heuristic strategy. *Biomedical Signal Processing and Control*. 2025; 100, 106987.
37. Kuang, H, Wang, Y, Tan, X, Yang, J, Sun, J, Liu, J, ... & Chen, Y. LW-CTrans: A lightweight hybrid network of CNN and Transformer for 3D medical image segmentation. *Medical Image Analysis*. 2025; 102, 103545.

38. Meng, M, Fulham, M, Feng, D, Bi, L, & Kim, J. Autofuse: Automatic fusion networks for deformable medical image registration. *Pattern Recognition*. 2025; 161, 111338.
39. Huang, J, Yang, L, Wang, F, Wu, Y, Nan, Y, Wu, W, ... & Yang, G. Enhancing global sensitivity and uncertainty quantification in medical image reconstruction with Monte Carlo arbitrary-masked mamba. *Medical Image Analysis*. 2025; 99, 103334.
40. Reale-Nosei, G, Amador-Domínguez, E, & Serrano, E. From vision to text: A comprehensive review of natural image captioning in medical diagnosis and radiology report generation. *Medical Image Analysis*. 2024; 103264.
41. Mir, A. N, & Rizvi, D. R. Advancements in deep learning and explainable artificial intelligence for enhanced medical image analysis: A comprehensive survey and future directions. *Engineering Applications of Artificial Intelligence*. 2025; 158, 111413.