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Artificial Intelligence and the Emerging Era of Precision Neurology

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Neurology, especially in the clinical setting, is built on the precise interpretation of complex information. From neuroimaging and clinical examinations to molecular biomarkers, understanding diseases of the nervous system requires integrating multiple layers of data. In recent years, artificial intelligence (AI) has begun to reshape the way this data is analyzed, offering new opportunities for more accurate diagnosis and clinical decision-making.[1]

One of the most prominent applications of AI in neuroscience is medical imaging. Advanced deep learning architectures now enable automated analysis of brain MRI with remarkable accuracy.[2] In this issue, the application of the Vision Transformer light architecture to brain tumor segmentation demonstrates how modern algorithms can improve the detection and localization of intracranial tumors, potentially helping clinicians plan treatment and monitor disease.

AI is also expanding into the molecular and genomic areas of neurology. Classification of molecular mutations in glioblastoma using metric-process and Siamese neural networks demonstrates how machine learning can aid in interpreting complex molecular datasets. With the increasing integration of genomic information in neuro-oncology, computational approaches can play an important role in refining tumor classification and supporting personalized treatment strategies.[3]

Beyond imaging and molecular data, data-driven approaches also influence clinical decision-making.[4] The retrospective analysis of the cervical spondylotic myelopathy cohort presented in this issue demonstrates how clustering techniques can help identify clinical pathways and potentially guide surgical management. Such approaches represent a broader move toward quantitative, evidence-based decision support in neurology.[5]

Collectively, the studies in this issue demonstrate a major shift in modern neuroscience: the gradual convergence of computational methods with molecular insights and clinical observation. As AI becomes more deeply integrated into neuroscience research and practice, its greatest value will likely lie not in replacing clinical expertise but in enhancing our ability to interpret the growing complexity of neuroscience data.

References

1. Isensee F, Jaeger PF, Kohl SA, Petersen J, Maier-Hein KH. nnU-Net: a self-configuring method for deep learning-based biomedical image segmentation. Nature Methods. 2021;18(2):203-11. doi: 10.1038/s41592-020-01008-z.

2. Yao Z, Wang H, Yan W, Wang Z, Zhang W, Wang Z, et al. Artificial intelligence-based diagnosis of Alzheimer's disease with brain MRI images. European Journal of Radiology. 2023;165:110934. doi: 10.1016/j.ejrad.2023.110934.

3. Khan P, Kader MF, Islam SR, Rahman AB, Kamal MS, Toha MU, et al. Machine learning and deep learning approaches for brain disease diagnosis: principles and recent advances. Ieee Access. 2021;9:37622-55. doi: 10.1109/ACCESS.2021.3062484

4. Rodríguez Ruiz N, Abd Own S, Ekström Smedby K, Eloranta S, Koch S, Wästerlid T, et al. Data-driven support to decision-making in molecular tumour boards for lymphoma: A design science approach. Frontiers in Oncology. 2022;12:984021. doi: 10.3389/fonc.2022.984021.

5. Roodsari SR, Zali A, Rahmati-Roudsari M, Forouzanmehr B. Will Artificial Intelligence Replace Physicians or Augment Their Capabilities? Novelty in Biomedicine. 2025;13(3). doi: 10.22037/nbm.v13i3.48195