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AI in Neurosurgery

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AI in Artificial intelligence (AI) is a branch of computer science that has found success in analyzing complex medical data and extracting meaningful relationships from datasets for a variety of clinical purposes. Specifically, in the field of brain care, several novel approaches have yielded impressive results and opened up new avenues for diagnosis, planning, and outcome prediction neurosurgery Artificial Neural Networks (ANNs) have climbed to the top of the list of most commonly used analytical tools. Support vector machines and random forests, for example, are also widely used machine learning techniques. Task-specific algorithms are created to solve specific issues. One of the most common data types is brain images. AI has the potential to help clinicians make better decisions. Hospitals and healthcare systems have generated a huge amount of unstructured data over the last three decades, including Medical Imaging (MI) data, genomic information, free text, and data streams from monitoring devices. Medical professionals and practitioners' approaches to identifying, understanding, and treating brain pathologies have changed dramatically as a result of the analysis of such data. MI and MI processing, in particular, ushered in a revolution in the field, paving the way for noninvasively studying, treating, managing, and forecasting illnesses. In addition, advances in image and image processing technologies have resulted in increasingly cost-effective and low-risk analysis. Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and Positron Emission Tomography (PET) However, “manually” processing medical data, particularly brain images, is time consuming, and the possibility of interpretation errors is not unimportant. Day-to-day error rates and inconsistencies in radiology, for example, are estimated to be higher than 5%. This necessitated the development of novel methods to assist doctors in efficiently and effectively analyzing data. The interest in using advanced algorithms has risen as more computational power has become available and the quality of medical data has improved. Despite the significant results obtained over time, many conventional computer-based methods and algorithms are no longer viable in real-world scenarios due to the increase in the complexity and volume of data. Objects such as lesions and organs in MI, for example, may be too complex to be accurately represented using conventional equations or models. Furthermore, defining exact rules to apply, such as for disease analysis and control, is not always easy for experts. As a result, the use of Artificial Intelligence (AI) methods in the field of brain imaging and Computation Technique is gaining popularity. Deep Learning (DL), a subfield of AI, has revolutionized a variety of neurosurgical tasks in recent year DL algorithms, in particular, have risen to prominence in computer vision, outperforming other techniques on a number of high-profile image analysis benchmarks. Unlike conventional machine learning models, useful representations and features are learned automatically and directly in DL. Nonetheless, it's worth noting that, due to the complexity and volume of brain data, ML methodologies typically require several steps to complete a task. Image pre-processing, feature selection and ranking, and dimensionality reduction, for example, are often needed as preliminary steps to raise algorithm performance to acceptable levels. Artificial intelligence techniques are gradually bringing effective theoretical solutions to a wide range of real-world clinical problems involving the brain. In particular, thanks to the accumulation of relevant data and the development of increasingly efficient algorithms, it has been possible to significantly improve understanding of complex brain mechanisms in recent years.

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