EDITORIAL

Artificial intelligence and pain: opportunities and challenges for research and clinical practice

Inteligência artificial e dor: oportunidades e desafios para pesquisa e prática clínica

The growing interest in artificial intelligence (AI) and its applications in various fields of knowledge, including health care, is possible due to the technological advances and the reduction of computational processing, storage, and real-time data acquisition costs[1]. Although there is no definition endorsed by the literature, AI can be understood as a technology with the ability to respond to information coming from new data, changing its operation to maximize performance by mimicking the problem-solving and decision-making capabilities of the human mind. Machine learning (ML), is a sub-field of AI that develops algorithms through mathematics, statistics, logic, and computer programming, with the goal of identifying patterns, improving predictions, or behaviors based on prior data and experience, without the need for an explicit programming to do something specific.

Artificial neural networks, a subfield of ML, are computer systems that are inspired by how the human brain works. They are composed of large numbers of interconnected basic processing units (artificial neurons) that learn from data through synaptic weights. These networks build their own rules of behavior, based on previous experiences, resulting in an autonomous system capable of performing specific tasks, such as classifying images or recognizing speech[2].

Current evidence recognizes that pain is a complex and multifactorial phenomenon, with a variety of clinical presentations[3]. In this sense, ML models emerge as a promising resource, both for pain research and for treatment. Specifically, these models can process large volumes of data simultaneously (including clinical and experimental data) in order to automatically detect patterns, rules and causal dependencies, predict or classify future data, extract information and identify subgroups in the data to gain new insights and help understand the complexity of pain[4].

Examples on the use of ML models in pain today include identifying subgroups (classification) using clustering techniques, diagnosis of pain patients using health data, identification of pain biomarkers, prediction of treatment response, self-management and monitoring, identification of risk and prognostic factors, automation, measurement of pain intensity, and identification of mechanisms involved in pain[4-6].

The large volume of health-related data (Big Data), coupled with an increased availability and use of technologies (smartphones, apps, and wearable devices), has the potential to drive the development of more accurate and effective ML models. This large volume and variety of data, which may include genetic, molecular, clinical, environmental, and lifestyle information of each patient, can be used in conjunction with highly accurate ML models to personalize diagnosis, treatment, and disease prevention, reducing risks and contributing to a more precise medicine. However, despite the presence of these technologies in several areas, the development and implementation of reliable ML models in health care still face challenges such as: (1) quality and availability of data, (2) the interpretability and transparency of the models, (3) generalizability (external validity) of the models, (4) data collection, storage, sharing, privacy and security, and (5) ethical and legal aspects of the use of models in clinical decision making[7].

AI is an emerging reality that can produce a paradigm shift in healthcare. ML models provide the opportunity to process large volumes of data as they are generated (in real time) and to analyze different types of data such as text, image, and voice. This combination of Big Data and ML models can significantly impact the future of research, clinical practice, and the lives of people suffering with pain. AI is likely to improve the quality of care by reducing the human error rate and decreasing practitioner fatigue from day to day clinical tasks. However, AI systems still have many limitations and raise operational and ethical questions. In any case, clinical decisions should not be made exclusively by applying an algorithm. It is necessary to integrate AI in a prudent and reasonable way into the professional's workflow, but we must emphasize that AI will not replace the importance of human features such as empathy, sheltering, qualified listening, and validation of the patient's complaint, which are essential in the management of individuals with pain.

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