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Will artificial intelligence shift the paradigm in pediatrics?

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Nowadays, the concept of artificial intelligence (AI) is in the public eye, partially due to the launch of ChatGPT (Chat Generative Pre-trained Transformer), a tool capable of generating human-like text, based on a search, that can be used by anyone without programming knowledge.[1] The massive use of AI is related to the fact that both processing power and data storage have grown rapidly, which allows a wide range of AI implementation in medicine, and which may be applied to the key aspects of human cognitive methodology: perception, decision-making, and action.[2,3]

However, as with all technologies, it is important to be aware of their scope and the effect their use can have on daily life. This becomes even more relevant because AI can be applied to the field of health and patient care, especially when considering that AI is capable of offering a wealth of tools that may be useful for health care providers. In recent decades, health care has been marked by trends such as increasing complexity, the availability of large volumes of data, and the incidence of burnout among health care providers, all of which help make AI particularly useful.[4] The tasks that can be performed with the help of AI include the interpretation of ECG signals or X-rays, the diagnosis of diseases, the selection of appropriate treatments, and interpretations for clinical reasoning. This leads to the fact that AI may be used in health care and that predictive and precision medicine may be included along with patient and health care services information management.[5]

In addition, new terms such as "machine learning" and "large language models" have emerged, so it is necessary to become aware of such basic AI-related concepts.

Concepts and definitions related to artificial intelligence

Artificial intelligence may be defined as a discipline that, from the field of computer science, seeks to create systems that perform tasks that are inherent to human intelligence, such as learning, pattern recognition, and decision-making. These systems are developed based on mathematical algorithms and statistical models that are capable of analyzing large databases to find patterns that help in decision-making.

AI may be used in pediatric care centers, such as intensive care units, where children are at risk of rapid decompensation, and the treating team may, with the help of AI, effectively process large volumes of medical data to diagnose and treat the patient in a timely manner.[6,7]

AI and machine learning (ML) are related terms, but they are not exactly the same. ML is a sub-discipline of AI that focuses specifically on the development of algorithms and models that enable systems to learn automatically from available data and improve their performance over time thanks to such "learning." ML is based

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on the use of statistical techniques and the identification of data patterns and relationships in order to generate useful information for making decisions or performing specific tasks.

There are three main categories of ML: ***supervised machine learning*** is the most commonly used in medicine for prognostic predictions and consists of training an algorithm using labeled data for their correct classification. This allows it to "learn" by comparing labeled data sets and thus know how to classify them correctly. For example, supervised ML is used to determine the risk of severe bacterial infection and the likelihood of benefit from an empirical treatment.

In contrast, ***unsupervised machine learning*** is used to find previously undetected patterns and clusters in unlabeled data. These previously undetected patterns may not be clinically useful because they require evaluation by physicians and contrast with their experience.

Finally, ***artificial neural networks*** are a type of ML model inspired by the structure and functioning of the human brain. They are basically networks composed of a series of nodes, called neurons, which are organized in interconnected layers to process information. Each neuron receives one or more inputs and yields an output, which may in turn be the input for other neurons. A "training" process is conducted, which adjusts the connections among neurons to improve the performance of the network to carry out a specific task, such as image classification or numerical value prediction. For example, these networks are used to define image patterns.[7,8]

This last category should also include the concept of ***deep learning***, which focuses on the training of artificial neural networks using models that are composed of multiple layers and have the ability to learn increasingly abstract representations of data that become part of the network as it deepens. Among other uses, deep learning is used in speech recognition, image processing, text classification, product recommendation, and autonomous vehicle driving apps.

Another concept that is important to know is ***large language models*** (LLM), which are designed to process huge text datasets (books, articles, websites, and online conversations) to learn linguistic patterns and structures and, from this, generate large quantities of natural text. The most widely known example is ChatGPT, which has been trained with large amounts of natural language data and has the ability to understand context in order to generate coherent and relevant responses.

LLM are able to understand human language in a more sophisticated manner than traditional language models because they use deep neural networks to analyze and synthesize linguistic information.

Nowadays, these models are already being used to create marketing and advertising content and in Internet search engines, translation systems, and chatbots or virtual assistants. As far as the health care field is concerned, LLM can be of great use because much of the clinical information is in the form of narrative text (which is not structured and, therefore, not "understandable" by computer systems). Notes in medical records, study reports, surgery reports, and discharge summaries are a clear example. LLM would also allow useful information to be extracted from the text in narrative form to support clinical decision-making.[9,10]

To sum up, the scope of AI use is broad. It seeks to develop systems that mimic human intelligence, whereas machine learning is a subdiscipline of AI that develops algorithms that enable systems to automatically "learn" from data and improve their performance over time.

It is worth mentioning ChatGPT, which uses deep learning techniques to generate human-like text, based on a given message or context, from LLM. ChatGPT has been trained with large amounts of natural language data; just testing it demonstrates its ability to understand context and generate consistent and relevant responses. It may be used potentially as a chatbot in health care to help in the creation of medical records from already defined models, such as writing a normal physical exam. It may engage in communication with patients (e.g., for patients with language barriers or disabilities that hinder communication and it may answer common patient questions and provide helpful information about diseases and treatments). It may also be applied in medical research, as it allows the analysis of large amounts of clinical data. However, there are limitations, as the quality of the responses depends on the quality of the data used by the LLM, and this may lead to biases and/or errors. Another critical issue is how it deals with the privacy, security, and confidentiality of patient information.[10]

Artificial intelligence and pediatricians

AI may be useful for pediatricians as it can facilitate and speed up processes due

to its operating modality. Let's see some examples:[4,8,11,12]

Accurate diagnosis: by analyzing available health data and patient symptoms, AI may help to identify conditions more rapidly and accurately. This is based on the fact that inferences about possible risks, diagnoses, treatments, and prognoses can be generated from a variety of data sources, such as genomics, images, patient-generated health data, textual and structured clinical data, and even speech.

Identification of rare diseases: AI has been used to diagnose rare diseases by means of algorithms that identify unique patterns of potentially related signs and symptoms.

Patient monitoring: by means of real-time analysis, AI studies data from vital signs monitoring, laboratory values, etc., and generates alerts about changes in the patient's condition.

Improved clinical effectiveness: reporting and administrative tasks may be delegated so that the health care provider better focuses on patient care.

As with all new technologies, AI offers not only benefits, but the risks and potential harm it may cause must also be taken into account:[9,12,13]

Failure in precision: this arises when the algorithm is fed with low quality or incomplete data, which may lead to errors in diagnosis and treatment.

Biases: these occur when the type of data used leaves vulnerable populations out of the analysis, thus leading to inequality.

Breach of confidentiality and privacy: as we have already mentioned in relation to ChatGPT, the collection and use of health information, which is highly sensitive data, may raise privacy and security concerns for patients.

Excessive reliance on AI: humans have a tendency to rely on technology, so an indiscriminate use of AI may result in the loss of professional skills and expertise.

Lack of regulations and ethics: as AI becomes increasingly integrated into health care, it is important that clear ethical standards and regulations are established to ensure its safe and appropriate use.

Currently, the use of AI is rather targeted at commercial products, but it is advancing in the health care field, which is very different from other areas; therefore, ethical, governance, and regulatory considerations are critical in the design, implementation, and integration of AI into health care. It is important for AI projects applied to health care to take into account previous experiences, implementations, and developments to prevent the fragmentation and proliferation of apps that jeopardize the safety and quality of care for patients. ■

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