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Opinion Article

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Promising Role of Machine learning and Artificial Intelligence in Pharmacy

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INTRODUCTION

Machine learning (ML), a subset of Artificial intelligence (AI), has seen explosive growth in healthcare applications during the last several decades. In pharmacology, for example, AI and ML methods are used to analyze a wide variety of data, including the drug's chemical structure, patient demographics, genetic information, and so on. The growing body of research on the use of AI in pharmacy is more evidence of this trend. Drug development and target identification are two areas where AI has been used effectively for some time now. Recently, however, AI models have emerged that can characterize patient populations and forecast an individual's treatment response, thereby spanning the full drug development to the personalized medicine process. The use of AI in clinical pharmacology was a hot topic in 2020. Many of these programs have continued success and widespread usage. Many advances, however, have occurred since then.[1]

The term "AI" or "Artificial Intelligence" is used to refer to any kind of machine intelligence. This includes anything from learning-based applications to language and reasoning-based processes. When it comes to medical applications of AI, ML is among the most popular options. ML is a subfield of artificial intelligence that, rather than relying on human judgment, places its faith in computers' inherent capacity to draw logical conclusions and anticipate future outcomes. To further categorize ML methods, we may distinguish between supervised learning, which aims to make predictions, and unsupervised learning, which primarily serves to explore and cluster data. Identifying subgroups of patients who have a positive response in a broader cohort is a common use of unsupervised learning. However, supervised learning is often used to create models that can reliably predict one or more clinical outcomes, such as how a given patient would react to a certain medicine.[2]

Neural networks are efficient at processing large volumes of data and excel at recognizing patterns in their training material. Because of this, they are widely used in many different contexts. Each ML model incorporates both a theoretical foundation for solving the issue at hand and an experimental component that is learned by the model during training. Black-box models become increasingly difficult to comprehend as their experimental components get bigger. While the inputs and outputs of the model may be described with reasonable accuracy, the model's underlying logic and weighting of elements remain opaque without further effort on the part of the user.[3]

In addition to ML, NLP is also becoming more commonplace. To "read" and handle the massive volume of (un)structured text, for example, you may utilize NLP, a branch of AI that focuses on processing and understanding natural human language. Data connected to pharmacology, such as clinical outcomes, may be gleaned from databases and electronic health records (EHRs) using natural language processing (NLP). The data may be interpreted with the use of advanced NLP techniques, which can also select the most significant things and organize the data for subsequent investigations.[4]

AI/ML IN PHARMACY

The widespread use of AI methods throughout the field of pharmacology, includes drug development, clinical evidence, and personalized medicine. AI has emerged as a prominent analytical tool in the pharmaceutical industry in recent years. This brings about several developments and enhancements to the state of pharmacological understanding. However, one has to be cautious while using AI models and aware of the potential hazards. For this reason, the quality of the data utilized to train an AI model is crucial. Data with inherent flaws (such as ethnic, gender, or illness bias, or measurement mistakes) used to train a model would result in a less universal and more difficult-to-apply model. As a result, it is essential to exercise caution before picking the information that will be utilized to train an AI model. The "accuracy-interpretability" trade-off is another obvious barrier to the widespread use of AI in healthcare. More precise AI models are, in general, more challenging to understand. Since no human subjects are engaged at this stage, this is less of an issue in preclinical pharmacology. Transparency and interpretability, however, take on more significance in the therapeutic arena. As a result of this tradeoff, healthcare professionals will have to decide between using a simpler model that is easier to read but less accurate and using a more complex model that is correct but harder to grasp what it accomplishes. However, if one is aware of the benefits and drawbacks of AI methods, the potential uses for these models are almost limitless. It may be anticipated the gradual replacement of present models by AI-based ones in the not-too-distant future. Additionally, *in silico* clinical trials and AI-based decision support systems that might be considered medical devices will begin to find their way into clinical pharmacology. In light of the impending widespread use of AI in healthcare, the US Food and Drug Administration (FDA) is drafting a guideline for the reliability of computational models employed in medical device and regulatory applications. This will enable us to better optimize pharmacological therapy for each individual patient and lead to more efficient drug discovery routes.[5]

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