Editorial

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Application of machine learning in surgery research: current uses and future directions – editorial

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In recent years, machine learning (ML) has become a buzzword in the field of medical research, and its applications in surgery are rapidly expanding[1,2]. With the development of more sophisticated algorithms and computational power, ML has the potential to revolutionize the surgical field. From predicting postoperative outcomes to enhancing surgical planning and decision-making, ML is transforming the way surgeons approach patient care.

One of the main applications of ML in surgery research is predicting postoperative outcomes[3]. By analyzing large datasets and using predictive models, ML algorithms can accurately predict the likelihood of complications, readmissions, and mortality rates following surgery. These predictions can help surgeons identify high-risk patients and implement interventions to improve outcomes. For example, a recent study used ML algorithms to identify the risk factors for postoperative acute pancreatitis in children with pancreaticobiliary maljunction by analyzing patient variables before surgery[4]. Another multicenter clinical study utilized a tongue image-based ML tool for diagnosing gastric cancer and found that tongue images and the microbiome of tongue coating can be valuable tools for diagnosis, with tongue images being more effective than conventional blood biomarkers[5]. By analyzing preoperative images and patient data, ML algorithms can provide surgeons with valuable information about the patient's anatomy and potential surgical risks. This information can help surgeons tailor their surgical approach and improve patient outcomes. For example, ML algorithms can identify critical anatomical landmarks and determine the optimal surgical trajectory, minimizing the risk of complications and improving surgical precision.

In addition to enhancing surgical planning and decision-making, ML can also aid in surgical training and education. By analyzing surgical videos and providing real-time feedback, ML algorithms can help surgeons improve their skills and reduce the learning curve. This technology can also provide a standardized approach to surgical training, ensuring that all surgeons receive the same level of education and training. This is particularly important in developing countries, where surgical training and resources may be limited.

Despite these promising applications, there are several challenges that must be addressed before ML can be fully integrated into surgical practise[6]. One of the main challenges is the lack of standardized datasets and protocols. Unlike other fields, such as radiology, there is no standard protocol for surgical imaging and data collection. This can lead to inconsistencies in data quality and limit the generalizability of ML algorithms. To address this challenge, researchers must develop standardized protocols for surgical data collection and imaging, allowing for more accurate and consistent data analysis.

Another challenge is the lack of interpretability of ML algorithms. Unlike traditional statistical models, ML algorithms often lack transparency and interpretability, making it difficult for surgeons to understand how the algorithm arrived at its conclusions. To address this challenge, researchers must develop more transparent and interpretable ML algorithms that can provide clinicians with actionable insights and improve decision-making.

Apart from the difficulties mentioned, ethical implications should also be considered while employing ML in surgical research[6]. For example, there is a risk that ML algorithms may perpetuate biases and inequalities in healthcare. This is particularly concerning in surgical research, where access to high-quality care may be limited for certain populations. To address this challenge, researchers must develop ML algorithms that are sensitive to these disparities and work to mitigate their effects.

The future of ML in surgery research looks bright[7]. As ML algorithms become more sophisticated and computational power continues to increase, the potential applications of this technology in surgery are vast. From predicting surgical outcomes to enhancing surgical planning and decision-making, ML has the potential to improve patient outcomes and revolutionize the field of surgery (Fig. 1).

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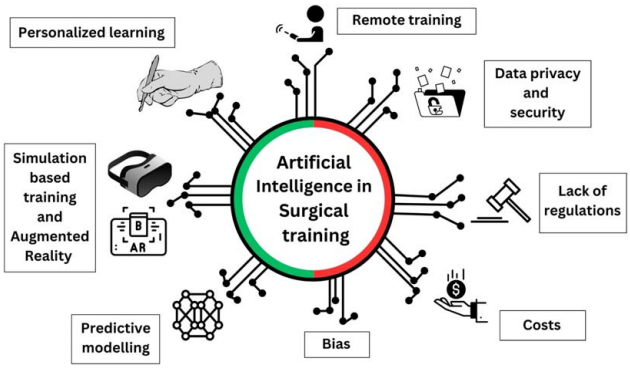

Figure 1. Schematic representation of the application of artificial intelligence in surgery research.

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Data availability statement

All data are included in the manuscript.

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