Pillars of Artificial Intelligence in Surgery

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Introduction

Surgeons express varied perspectives on the potential of artificial intelligence (AI), prompting our objective to elucidate AI's concepts and present its current applications and forthcoming prospects. AI is defined as the exploration of algorithms that empower machines to engage in reasoning and cognitive functions, encompassing problem-solving, object and word recognition, and decision-making. It can be broadly categorized into four main subfields: Machine Learning (ML), Natural Language Processing (NLP), Computer Vision (CV), and Neural Networks/Artificial Neural Networks (ANN).

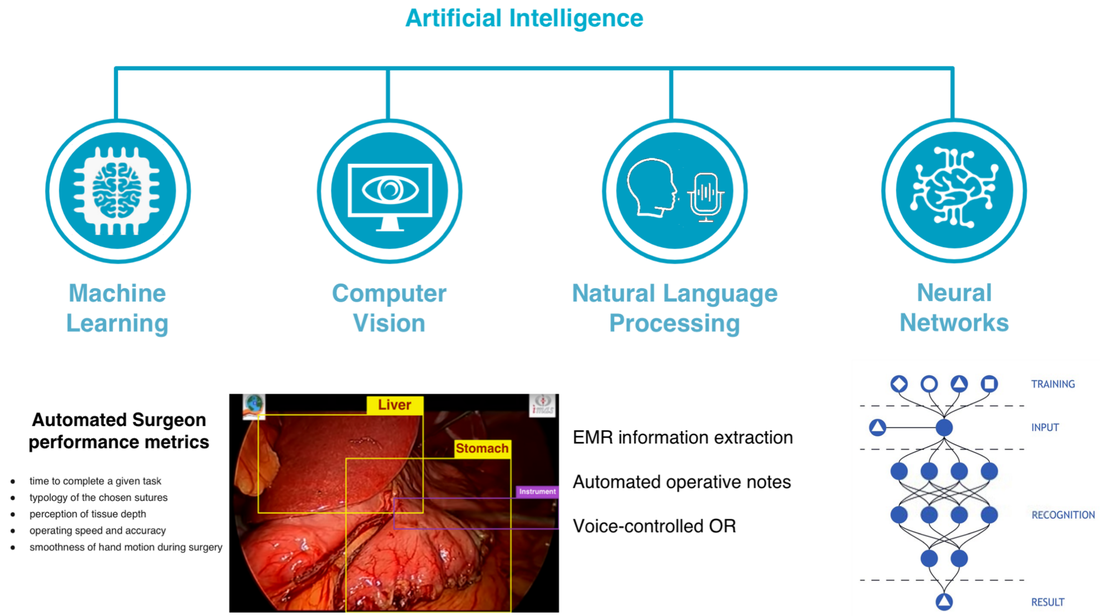
Machine Learning

Machine learning facilitates machines in learning and making predictions through subtle pattern recognition principles. Numerous studies have detailed its utilization in predicting patient outcomes based on pre-operative data and intra-operative performance metrics, such as the da Vinci Logger's economy of motion, instrument movement, clutch usage, and more.

Natural Language Processing

Natural Language Processing enables machines to comprehend spoken human language naturally, with consumer electronics companies like Apple, Amazon, and Google enhancing speech recognition accuracy beyond many human transcription and dictation services.

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Computer Vision

Computer Vision empowers machines to interpret images and videos, achieving near-human or even superior capabilities in recognizing objects and scenes. Various studies have demonstrated its accuracy in identifying instruments in laparoscopic videos and segmenting procedures in surgeries like Laparoscopic Sleeve Gastrectomy.

Neural Networks

Neural Networks, the most advanced form of AI, allow machines to predict data based on multiple computational units, akin to neurons in the human brain. Particularly promising in surgery is their role in clinical decision-making support, where machines analyze multiple data points from electronic medical records to recommend a suitable procedure.

Conclusion

In the context of studies linking surgical technique or skill to patient outcomes, AI emerges as a valuable tool to enhance surgical results. This includes providing decision-making support and automated risk feedback during deviations from standard procedures or gestures intra-operatively. Additionally, AI holds potential in advancing surgical education by interpreting extensive surgical video and performance metric data, augmenting current simulation technologies for more realistic models of various procedures.

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