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Short Communication

Introduction of Artificial Intelligence in the Field of Surgery

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ABSTRACT

The study of algorithms that give robots the ability to reason and perform cognitive processes such as problem solving, object and word recognition, and decision-making is known as Artificial Intelligence (AI). The increased technical development of imaging, navigation, and robotic intervention is increasingly transforming these practices of surgery. The utilization of pre and intra-operative imaging techniques such as ultrasound, computed tomography, and Magnetic Resonance Imaging (MRI) allows for complex surgical navigation and planning. To detect tumor cells in the body, technological advancements such as the use of robots in surgery have been used. Many robot improvements are now being researched and produced. By constructing non-linear models that combine numerous data sources, including diagnoses, treatments, and laboratory results, machine learning has exceeded logistic regression in the prediction of Surgical Site Infections (SSI). Artificial neural networks based on biological nerve systems have become increasingly important in many AI applications.

Keywords: Robotics; Machine learning; Surgery

INTRODUCTION

Artificial Intelligence (AI) is a broad term that refers to the study of algorithms that enable robots to reason and execute cognitive functions like problem solving, object and word recognition, and decision-making [1]. Advances in surgery have had a tremendous impact on the treatment of both acute and chronic disorders, extending the life and allowing it to be extended indefinitely. Continual technology advancements in diagnostic, imaging and surgical instrumentation underpin these advancements. The use of pre and intra-operative imaging techniques such as ultrasonography, Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) allows for complex surgical navigation and planning. Minimally Invasive Surgery (MIS), which is increasingly being combined with robotic assistance, can reduce surgical trauma. Post-operative care can also be improved by sophisticated wearable and implantable sensors that support early discharge after surgery improve patient recovery and detect post-surgical complications early [2].

In the last (15-20) years, there has been an exponential development in processing power and smaller and smaller form factors. In and out of the operating room, the usage of immersive technologies has become commonplace. The use of head tracking and motion control sets allows for better visualization both before and during surgery, and as network connections improve, the ability to do procedures remotely may become a reality. Not only does AI play a role in direct treatment and management, but it also helps to teach the future generation of surgeons by offering precise simulation scenarios [3].

Computer-assisted surgery is the name given to robotically aided surgery. This procedure is referred to as technological advancement. It can identify cancerous cells using sensors. Various disposable sensors are positioned externally from the body but come into contact with body fluids. If the application and characteristics that need to be monitored are well understood, selecting a sensor can be simple. Many robot improvements are now being researched and produced. Many people, as well as the next generation, will benefit greatly from this technology. Artificial Intelligence is the study of how to program computers to perform tasks that humans now perform better [4].

FIELDS OF ARTIFICIAL INTELLIGENCE IN SURGERY

Machine learning

Machine Learning (ML) allows machines to recognize patterns and learn and make predictions. Traditionally, computer programs are expressly coded to do a specific task (e.g., when the user clicks an icon, a new program opens). By constructing non-linear models that combine numerous data sources, including diagnoses, treatments, and laboratory results, machine learning has exceeded logistic regression in the prediction of Surgical Site Infections (SSI) [5]. ML with random forests, neural networks, and lasso regression can predict patient lung cancer staging by analyzing patterns of

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diagnostic and therapeutic data (including surgical resection) in the Surveillance, Epidemiology and End Results (SEER) cancer registry and comparing data to Medicare claims [1].

Natural language processing

Natural Language Processing (NLP) focuses on improving a computer's capacity to interpret human language and is critical for large-scale content analysis such as EMR data, particularly physicians' narrative documentation. NLP has been used to automatically sift through EMRs for words and phrases in operational reports and progress notes that predicted anastomotic leak after colorectal resections in surgical patients. As datasets get more representative of a patient group, algorithms' ability to self-correct can boost the utility of their predictions [1].

Artificial neural networks

An interconnected group of nodes, similar to the huge network of neurons in the human brain, is referred to as a neural network. Hebbian learning, Holographic associative memories, and the relatively new field of Hierarchical Temporal Memory, which models the architecture of the neocortex, are some of the strategies used to apply neural networks to the problem of learning [4]. They are inspired by biological nervous systems and have become of paramount importance in many AI applications. Artificial neural networks, in combination with other machine learning approaches, have predicted in-hospital mortality after open abdominal aortic aneurysm repair with a sensitivity of 87%, specificity of 96.1%, and accuracy of 95% using clinical variables such as patient history, medications, blood pressure, and length of stay [6].

Application of robotics

Robotics is being used in medicine because they enable unprecedented control and precision of surgical instruments in less invasive treatments. They aren't fully autonomous robots capable of doing surgical procedures on their own, but they do provide surgeons with a mechanical helping hand. These devices need to be operated and programmed by a human surgeon. These surgical robots are controlled via remote control and voice activation [4].

LIMITATIONS OF ARTIFICIAL INTELLIGENCE

Machine learning is a powerful tool for uncovering hidden patterns in data. It excels at spotting patterns and establishing relationships that older approaches may overlook, and investigators can utilize these findings to generate new clinical questions or hypotheses concerning surgical disorders and therapy. However, there are costs and risks associated with using machine learning inappropriately [7]. The types and accuracy of accessible data limit the outputs of machine learning and other AI analyses. The nature of patterns can be influenced by systematic biases in clinical data gathering. The interpretability of AI algorithms is a major concern because techniques like neural networks are based on a "black box" design. While the automated nature of neural networks allows for the detection of patterns that humans miss, human scientists are left with little ability to assess how or why such patterns were discerned by the computer [8].

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