CTIS Assignment – AI in surgery

## Technology / Topic Overview

Overview of AI, including Machine Learning, Neural Networks, Computer Vision. ML and NN are the current major technologies used in surgery and will be the main ones required for the expansion to the future opportunities here.

Artificial Intelligence, or the intelligence demonstrated by machines (Shi, Yang, Yang, & Zhou, 2022) is a complex asdfasdf. It has revolutionized IT and has begun to drastically shape the way that modern society lives and functions. As the technology behind has matured, AI has been adopted further and further within many fields, from industrial manufacturing to autonomous navigation to medicine and surgery. It is the final point, surgery, that this assignment aims to address, first examining AI and its main components, next investigating the opportunities given to surgery using AI. Following this we will look to see both what choices it gives, as well as the risks posed by early adoption. Finally, we will present an ethical reflection of the topic.

Artificial Intelligence itself is broken up into multiple sub-topics, but there are three main ones that will be studied today. The first topic, Machine Learning, refers to the system’s ability to learn and merge new information learned through large scale observations, improving and extending it’s knowledge base autonomously rather than being directly programmed (Woolf, 2009). This directly facilitates self-improvement of the system, with experienced surgeons being able to assist in manually training the system to increase accuracy by noting any defects in automated analysis as they occur. major way that machine learning self-improves is through the tutor – student principle. Through this, the system takes in a large quantity of surgical examples, learning directly off surgeons – observing, evaluating, and analysing their actions, creating a pool of experience to draw from.

The next sub-topic of note is that of neural networks. Neural network models are one type of AI model that imitates how the human brain functions (Casas, 2020). They were first created to solve geographic issues in the 1990s but have recently flourished with modern advancements in computing power, data availability and AI technology (Casas, 2020). One of the main benefits to using a neural network as opposed to a different model is their strong ability to “detect complicated trends in high-dimensional datasets” (Guenther, 2001). Because of this, neural network models are of particular interest within the medicinal and surgical field, where data is complex and highly specific.

Computer Vision is the final topic of interest. W

Wrapup

## Opportunities given by the technology

Current – pre-operative screening of patients, risk assessment for surgeons to assess during operation, tumor identification

Future – robotic assistance with difficult surgery

## Choices that the technology gives

Current – gives surgeons a second opinion on complication likelihood etc. Can help with more junior surgeons as well. Can provide real time risk analysis in surgery

Future – robotic surgery and assistance in surgery, particularly keyhole surgery (very difficult even for experienced surgeons)

## Risks presented by the technology

Risk of failure / unforeseen error, risk of bias from insufficient training data or imperfect algorithm

## Ethical Reflection

Who is at fault if the AI makes a mistake? Important to reflect that for the foreseeable future there must be a surgeon present to monitor all decisions and give the final ok

# Reference

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