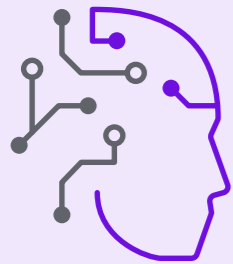


## 1. Artificial Intelligence<sup>1</sup>

### Artificial intelligence



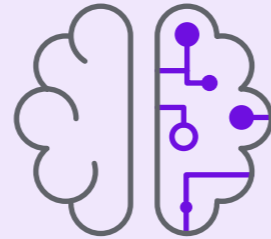
Any technique that enables machines to mimic human intelligence.

### Machine learning



A subset of AI that uses statistical methods to enable machines to 'learn' tasks without explicit programming.

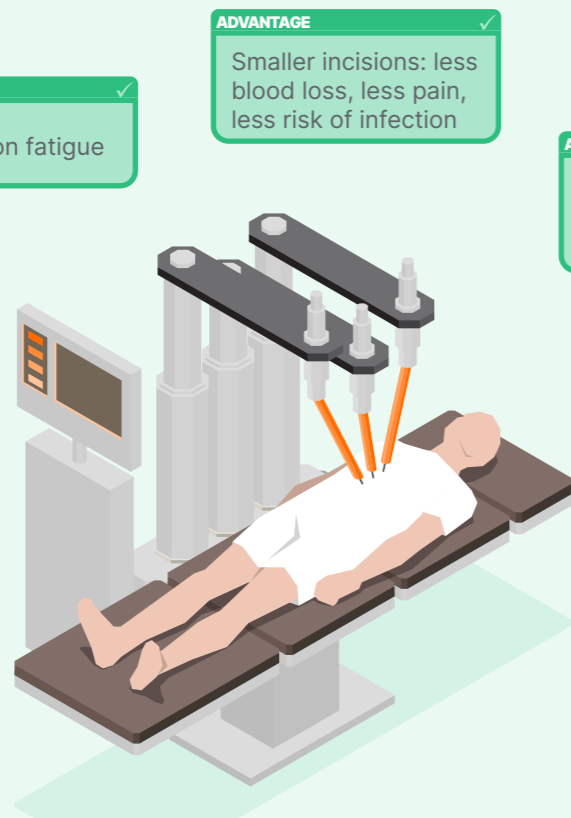
### Deep learning



A subset of machine learning that uses artificial neural networks to mimic the learning process of the human brain.

## 2. Robotic Urologic Surgery<sup>2-4</sup>

The da Vinci system™ remains the main robotic surgical system used since its first approval in 2000 by the US Food and Drug Administration (FDA).



**ADVANTAGE**  
Reduced surgeon fatigue

**ADVANTAGE**  
Smaller incisions: less blood loss, less pain, less risk of infection

**ADVANTAGE**  
Easier access to area being operated on

**ADVANTAGE**  
Faster recovery, shorter hospital stay, faster return to daily life

**ADVANTAGE**  
Enhanced visualisation: highly magnified, 3D high resolution image

**DISADVANTAGE**  
Lack of experienced robotic surgeons and appropriate training programmes can lead to adverse events during robotic procedures

**ADVANTAGE**  
Greater range of motion, dexterity, and precision

**DISADVANTAGE**  
High cost of robotic systems is a barrier in low- to middle-income countries

## 3. AI can overcome challenges in robotic surgery<sup>5-7</sup>

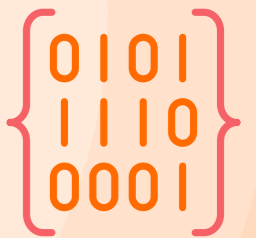
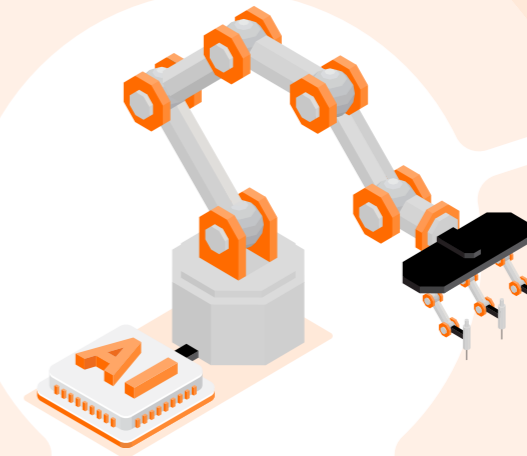
AI can be used as a **learning tool** for robotic surgeons at different stages of their careers (recording surgeries, stocking datasets, etc.).



AI can be used to **predict adverse events** during surgery, such as intra-operative bleeding, to improve patient safety, and evaluate risk of post-operative complications.



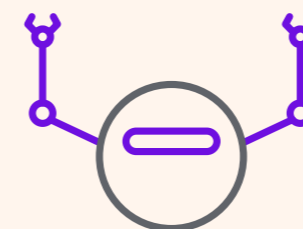
Integration of AI with **augmented reality** can boost the ability of surgical robotic systems to perceive complex *in vivo* environments, and perform tasks with higher precision, safety, and efficiency.



AI can also **provide algorithms** to identify patients in need of organ transplants, evaluate potential donors, and match donors and recipients, to improve transplant decisions, and optimally allocate donor organs.

**Intra-operative assistance** by AI can tailor a personalised approach for each patient, by analysing surgeries as they are performed, and providing decision support to surgeons in real-time. AI can anticipate the next 15-30 seconds of an operation, and suggest safe or less safe locations for incision.

## 4. What's Next for Robotic Surgery<sup>8</sup>

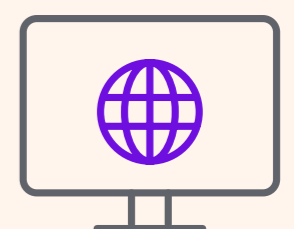


**Minimally invasive procedures:**

- Micro-robotics, for drug delivery, tissue repair, or exploratory surgery
- Single port robotic surgery



**Ethical and legal frameworks** for robotic automation, AI-driven decision-making, and safeguarding patient privacy.



**Telesurgery** to expand access to healthcare in remote, underserved, or disadvantaged regions.

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