

Artificial intelligence: a new frontier for anaesthesiology training

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Editor—There has been much research into the use of artificial intelligence (AI) in anaesthesiology recently, with an array of articles exploring the topic in *British Journal of Anaesthesia*.^{1,2} The technology is rapidly evolving and clinicians should remain aware of developments that may transform clinical practice in the next decade. Uses and limitations of deductive machine learning systems have been relatively well characterised. However, I would like to draw attention to generative AI systems, which are commonly overlooked in reviews since they are relatively new.

Deductive AI systems are capable of finding patterns in complex streams of existing data, patterns that may be unrecognisable to humans. This can be used to inform decision-making and improve interventions used in clinical practice. Generative systems, however, create novel datasets inspired by existing ones. Generative adversarial networks (GANs) are a specific type of machine learning system that have the potential to produce novel synthetic data when trained on existing datasets.³ They operate by combining two networks: a generator that learns from an existing dataset to produce data and a discriminator that then attempts to determine whether the data are novel or from the existing dataset. As the system practises, the quality of data improves. This may be used to create educational material to simulate clinical environments using data in the form of text, videos, or images. Case scenarios can be generated without patient data concerns, since the data are simulated. The ability of GANs to produce synthetic data is already well-proven, even in some medical contexts. For example, early research has produced GANs capable of creating artificial breast ultrasound images after learning from a pre-existing database.⁴ These artificially constructed scans were found to be indistinguishable from real data when tested by radiologists. Beyond healthcare uses, a remarkable range of applications has emerged, from modelling particle physics experiments to improving video games.

The potential of AI in monitoring and control of anaesthesia in practice is well documented.⁵ If we assume that, given a long enough timeframe, AI will eventually outperform human anaesthesiologists then these tasks would be more efficiently and more safely delegated to AI rather than the human. If practising trainee anaesthesiologists are no longer able to refine situational judgement, then this would severely impact their experiential learning. The use of simulated learning with real-time feedback on decisions offers an opportunity to provide an alternative source of clinical experience, with simulations already being well integrated within training curricula. Simulated environments allow trainees to refine their situational judgement and decision-making,

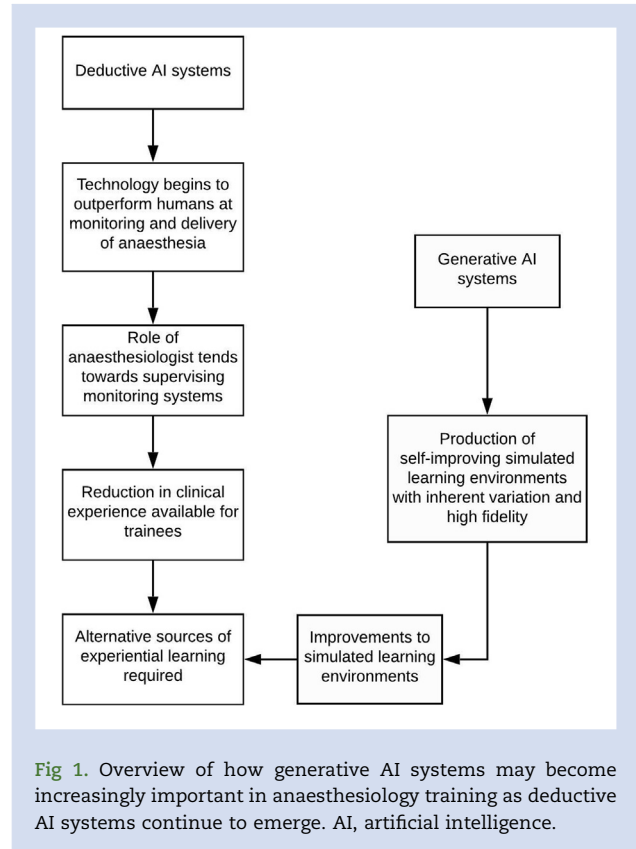


Fig 1. Overview of how generative AI systems may become increasingly important in anaesthesiology training as deductive AI systems continue to emerge. AI, artificial intelligence.

which are the limiting factors to career progression in anaesthesiology.

As depicted in [Figure 1](#), simulations may play an increasingly important role as machine learning systems begin to automate opportunities for experiential learning. However, to create simulations is a difficult process and ideally simulations should have in-built variation so that they can be reused. Simulations are also most useful when they learn from the operators' strengths and weaknesses. Integrating generative AI systems, such as GANs, with simulations, may enable us to overcome many of these limitations. In theory, the generative AI systems can create training material faster, with more variation and higher fidelity. Given the machine learning nature of the generative AI, the systems are inherently self-improving. In this way, GANs may be used not only to generate variations on previously written simulations, but also to improve them. This is a strong argument towards the development of generative AI systems for training purposes,

regardless of whether the experiential learning model is truly threatened.

Diffusion of technological innovation in healthcare is characteristically slow, which may partly be attributed to long periods of testing.⁵ However, if we assume any rate of improvement to AI systems, even if it is not the exponential rate predicted, it is difficult to envisage a future where the use of AI is not ubiquitous in clinical practice. As anaesthesiology practice evolves in the direction of AI, so must anaesthesiology training.

Declarations of interest

The author declares that they have no conflict of interest.

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Would you trust your loved ones to this trainee? Certification decisions in postgraduate anaesthesia training

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Editor—Postgraduate medical education culminates in the certification of trainees as medical specialists. Certification is a profession's self-regulation process to assure the public that specialists are qualified to deliver safe high-quality care.¹ The high-stakes decision to certify a trainee entails the credentialing of training and its assessment.¹ We recently observed considerable variation in assessment procedures and certification in postgraduate anaesthesia training across Europe.² With the aim to better understand the variation in certification processes and the basis of certification decisions, we performed an interview study and explored whether programmes meet the requirement of public accountability to deliver competent specialists. Ahead of a full report, the focus of this letter is on the competence of trainee anaesthetists at completion of training, framed as

entrustment of care for patients close to the supervisor and summarised as 'Would you trust your loved ones to each trainee you certify?'

This qualitative study used constructivist Grounded Theory principles and followed standards for reporting qualitative research.^{3,4} After approval by the ethics review board of the Netherlands Association for Medical Education (NERB file 847, March 2017) and obtaining informed consent, we conducted semi-structured interviews with 26 senior anaesthetists from 21 European countries. Each participant was directly involved in certification decisions, for example as programme director. We purposively sampled participants to represent the different assessment and certification practices, identified previously,² to ascertain divergent perspectives from a range of countries. Between June 2017 and December 2018, two