

## Medical science, technology and digital health - Need for holistic integration

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Artificial intelligence (AI) and machine learning (ML) are increasingly being integrated into medical practice, with many potential implications for patient outcomes.<sup>[1-4]</sup> Medical science emerged from the robust foundation of strong clinical acumen of a thorough history, examination, imaging and investigations to manage a clinical situation. A follow-up or a repeated evaluation was ascertained for the process of disease trajectory.

In recent times, active use of AI and ML has been found in various clinical domains.<sup>[1]</sup> AI has been incorporated for its ability to learn, reason, interpret and make decisions. Similarly, ML has found its usefulness in using data science to analyse data and thus make predictions from it. This has further progressed with deep learning, which involves creating and training neural networks on the machine, making it able to recognise and interpret patterns in the data.

The mathematical model, including complex mathematical algorithms, is developed based on available information and their interpretation. Data science remains an essential ingredient for it. Data is fed to it, and then only, it provides specific predefined outcomes.<sup>[2,3]</sup> This remains a significant limitation with an associated bias to active solo use of AI and ML.

In view of genetic and demographic variations, algorithmic models for AI need to have the ability to consider these aspects in the era of individualised/personalised medicine. This shall require a more robust collection of extensive data with comprehensive details. The integration of output from electronic health records and anaesthesia information management systems with ML algorithms needs to be refined further for the provision of individualised real-time patient management, including the prediction of outcomes. The assessment of black box data from ML also needs to be interpreted for better understanding of and improving patient outcomes in perioperative medicine.

Simulation-based learning is an essential aspect of anaesthesiology training.<sup>[4]</sup> It needs to include technology and deep ML as well to make it more physiological and have a better simulator-human interface. The integration of weaknesses and strengths of trainees during the simulations with AI and ML probably shall provide an individualised simulation strategy with higher fidelity. So, future simulators and simulation sessions need to have an integrated generative artificial system for better and personalised training.

With the development of various technologies in imaging and image recognition technologies, it is

imperative that AI be integrated with these modalities as well. With the advent of 3D computed tomographic reconstructions, virtual endoscopic pictures and 3D printing of the structures, it needs to be seen that integrated AI and ML provide a better strategy for safe and successful airway management, regional block procedures, etc.

Hence, it becomes essential not only to understand the model well but also to have suitable, filtered, authentic and relevant data. This requires a holistic integration of technologists/engineers and scientists with medical scientists and researchers. The understanding of cross-speciality between engineering and medical science is needed for the day. The close collaboration shall help in the development of various predictive models and the appropriate use of AI and ML in clinical practice. It is the right time for medical science to wed with technology to provide comprehensive, integrated AI and ML digital health to patients.

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