

## Abstract

### **Artificial intelligence and machine learning: A primer for perfusionists**

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Artificial intelligence (AI) and machine learning (ML) are increasingly influencing cardiovascular medicine and critical care, with growing relevance to clinical perfusion. Advances in cardiopulmonary bypass (CPB), extracorporeal life support (ECLS), and physiological monitoring have resulted in large volumes of high-frequency, multimodal, complex physiological and technical data that challenge real-time human interpretation. AI-driven tools offer the potential to augment perfusion practice through predictive analytics, intelligent decision support, and selective automation of extracorporeal technologies. Despite this promise, adoption remains limited by unfamiliarity with foundational concepts, concerns regarding transparency and bias, uncertainty surrounding professional accountability, and the scarcity of perfusion-specific, high quality, high frequency, machine-captured datasets. This narrative review provides a comprehensive, technically detailed primer tailored to perfusionists, covering core AI and ML concepts, data considerations, learning paradigms, deep learning architectures, large language models, clinical applications, ethical and regulatory issues, and future directions for extracorporeal care. By shifting the focus from "black-box" mathematics to "precision perfusion," we demonstrate how these technologies can be integrated into the modern cardiothoracic suite to improve patient safety.