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Artificial Intelligence and its Impact on Orthopaedic Surgery

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Abbreviations: AI: Artificial Intelligence; ML: Machine Learning.

Introduction

The evolvement of new technologies has made orthopaedic field grow in much faster pace compared to what it was a decade earlier. Now we have Real-time navigated, computer-guided [1] and robot-assisted [1,2] intraoperative input in major centres which helps in advanced management of surgery. Also virtual three-dimensional displays [3], and interactive digital, semi-automated or fully-automated preoperative planning and templating are widely available for both training and also in theatre settings.

The integration of artificial intelligence (AI) and machine learning (ML) algorithms are helping us to arrive in a proper decision-making path so that limitations of conscious human learning considerations can be overcome. AI-driven 'Google Search' engine function came into mainstream use nearly 25 years ago (1998), predicting search patterns and 'pre-empting' active searching. Nowadays we have more like 'Google Translate' Facebook's 'Phototagger' (2015), Uber's rideshare demand prediction, and Apple's well-known voice-responsive pocket assistant 'Siri' are all examples of mature AI algorithms with wide public application [4].

Artificial intelligence applications are already in widespread use in orthopedics. The areas involved are like in automated image based diagnosis, automated implant evolution, for clinical outcome prediction and designing newer implants [5]. So there is a great potential for further transformation of care given to the patients. The ability of refined algorithms to draw upon digital information readily stored in large database and registry repositories further improves the value, accuracy and practical relevance of the outcomes reported [6]. AI-based programs will add value to areas where human cognition and capacity stand as rate-limiting factors, the expense and effort required to establish such systems must be positively weighed against the perceivable benefit. Current generation AI algorithms, particularly deep convoluted CNNs, lend themselves to image feature recognition and multi-variate risk analysis/outcome prediction and these are the current areas of greatest research interest. Volumetric data management and prospective episode-of-care/payment model stratification are also being actively explored [7]. Using ML algorithms offers a clear benefit in terms of processing and interpreting complex, patient-specific data. For these uses, demonstrating a high degree of accuracy and having easy to understand outputs will be critical to get users to buy-in.

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