Medical Xpress

'Machine learning' may contribute to new advances in plastic surgery

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With an ever-increasing volume of electronic data being collected by the healthcare system, researchers are exploring the use of machine learning—a subfield of artificial intelligence—to improve medical care and patient outcomes. An overview of machine learning and some of the ways it could contribute to advancements in plastic surgery are presented in a special topic article in the May issue of *Plastic and Reconstructive Surgery*, the official medical journal of the American Society of Plastic Surgeons (ASPS).

"Machine learning has the potential to become a powerful tool in plastic surgery, allowing surgeons to harness complex clinical data to help guide key clinical decision-making," write Dr. Jonathan Kanevsky of McGill University, Montreal, and colleagues. They highlight some key areas in which machine learning and "Big Data" could contribute to progress in plastic and reconstructive surgery.

Machine Learning Shows Promise in Plastic Surgery Research and Practice

Machine learning analyzes historical data to develop algorithms capable of knowledge acquisition. Dr. Kanevsky and coauthors write, "Machine learning has already been applied, with great success, to process large amounts of complex data in medicine and surgery." Projects with healthcare applications include the IBM Watson Health cognitive computing system and the American College of Surgeons' National

Surgical Quality Improvement Program.

Dr. Kanevsky and colleagues believe that plastic surgery can benefit from similar "objective and data-driven machine learning approaches"—particularly with the availability of the ASPS's 'Tracking Operations and Outcomes for Plastic Surgeons' (TOPS) database. The authors highlight five areas where machine learning shows promise for improving efficiency and clinical outcomes:

- **Burn Surgery.** A machine learning approach has already been developed to predict the healing time of burns, providing an effective tool for assessing burn depth. Algorithms could also be developed to enable rapid prediction of percentage of body surface area burned—a critical piece of information for patient resuscitation and surgical planning.
- **Microsurgery.** A postoperative microsurgery application has been developed to monitor blood perfusion of tissue flaps, based on smartphone photographs. In the future, algorithms may be developed to aid in suggesting the best reconstructive surgery approach for individual patients.
- **Craniofacial Surgery.** Machine learning approaches for automated diagnosis of infant skull growth defects (craniosynostosis) have been developed. Future algorithms may be useful for identifying known and unknown genes responsible for cleft lip and palate.
- **Hand and Peripheral Nerve Surgery.** Machine learning approaches may be useful in predicting the success of tissue-engineered nerve grafts, developing automated controllers for hand and arm neuroprostheses in patients with high spinal cord injuries, and improving planning and outcome prediction in hand surgery.
- **Aesthetic Surgery.** Machine learning also has potential applications in cosmetic surgery—for example, predicting and

simulating the outcomes of aesthetic facial surgery and reconstructive breast surgery.

The authors also foresee useful applications of machine learning to improve plastic surgery training. However, they emphasize the need for measures to ensure the safety and clinical relevance of the results obtained by machine learning, and to remember than computer-generated algorithms cannot yet replace the trained human eye.

"These are tools that not only may help the decision-making process but also find patterns that might not be evident in analysis of smaller data sets or anecdotal experience," Dr. Kanevsky and coauthors conclude. "By embracing machine learning, modern plastic surgeons may be able to redefine the specialty while solidifying their role as leaders at the forefront of scientific advancement in surgery."

More information: Jonathan Kanevsky et al. Big Data and Machine Learning in Plastic Surgery, *Plastic and Reconstructive Surgery* (2016). DOI: 10.1097/PRS.0000000000002088

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