Editorial

Hack Your *Neurospine* !

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“Are you afraid of the new phenomenon of artificial intelligence (AI) being introduced to spine surgery?”

It is now time for us to find answers to the problems posed by the coming “technological singularity” that will affect the spine.

A few years ago, there was a series of major events involving a Go competition between a human and a computer. Go is an abstract, strategic board game that is considered to be an integral part of the intellectual heritage of East Asian countries (China, Korea, and Japan), with a history of more than 2,500 years. Go has artistic beauty in the simplicity of its rules, but the number of potential moves that a player can consider is virtually infinite, comparable to the number of atoms in the known universe.

Therefore, many scholars and aristocrats in East Asian countries enjoyed Go during high-level business meetings or psychologically intense negotiations, as a form of “hand communication” to understand the innermost thinking of their counterparts. Traditionally, it was believed that only a few Go masters could understand the beauty of the game’s intricacies, and that no machines could achieve this level of complexity and artful decision-making.

In 2016, this myth was disproven by AlphaGo, a computer program developed by Google DeepMind. AlphaGo beat Sedol Lee, a professional Go player from South Korea who was ranked 9-dan and one of the world’s top Go players. AlphaGo utilized a deep learning algorithm informed by sequences of moves from historical records and data from thousands of Go games played online. People were frightened and thrilled by the achievements of AI in that series of games, which showed not only the power of calculation, but also seemed to hint at the ability of AI to achieve something strikingly similar to human intuition. This led to the dawning realization that human intelligence and cognition are merely a complex set of algorithms, not a reasoning capacity that humans are uniquely endowed with by God’s blessing. Humans recognized that they should prepare for the new era of big data and AI, in order to promote the survival of the species.

Medical and health care systems are considered to be ideal areas for the application of AI and big data technology. What distinguishes AI technology from the traditional approach of medical science is the ability to obtain and process health care data information. AI algorithms act differently from humans. First, once a goal is established, an algorithm does not make adjustments; instead, it only performs what it has been ordered to do. Second, AI algorithms are black boxes. They may be very accurate, but we cannot identify the cause or the reason. To reduce the margin of error, AI algorithms must be tested repeatedly.

In health science, AI has been primarily applied to the analysis of relationships between treatments or preventive measures and the outcomes experienced by patients. Currently, applications of AI have widely extended to managing medical records or other health care data, diagnostic processes, development of treatment protocols, personalized medicine, digital consultations, drug development, and patient monitoring and care.

In the field of spine surgery, AI enables large amounts of complex data to be rapidly and

accurately interpreted, avoiding potential human error or bias during the surgical decision-making process. The analysis of complex physiological data via AI deep learning has been used in patients with spinal degenerative diseases. AI deep learning has proven influential in understanding spine biomechanics, implant design, prognostication of spine surgery, prediction of scoliosis progression and robotic surgery. The number of research papers on AI for spine surgery has increased explosively during the past few years.

In this issue of *Neurospine*, we publish an article on the application of AI to the spine. Prof. Samuel Cho MD, with other researchers at the Mount Sinai School of Medicine (NY, USA), wrote a manuscript titled “Predicting Surgical Complications in Adult Patients Undergoing Anterior Cervical Discectomy and Fusion using Machine Learning”.¹ In this article, the authors describe the development and validation of machine-learning algorithms to precisely predict complications after anterior cervical discectomy and fusion using a national database from the United States. These algorithms can continuously “learn” using newly generated information, thereby improving the quality and efficiency of care, and the success of these algorithms illustrates the potential of machine-learning models for predicting postoperative complications following spine surgery. Additionally, this article demonstrates that neural networks were more

sensitive than logistic regression for predicting mortality and wound complications. With future improvements in the ability to obtain high-quality patient data and increases in computing power, machine-learning techniques are likely to become increasingly commonplace in the hospital setting.

The “technological singularity” in the field of spine surgery will occur when technology knows the spine better than humans do. As upgradeable AI enters the “runaway reaction” of its self-improvement cycle, newer and more intelligent generations will emerge more and more rapidly, causing an intelligence explosion and resulting in a powerful superintelligence that would, qualitatively, far surpass all human spine doctors in understanding the spine and spine diseases. Therefore, the editors of *Neurospine* would like to propose that in 2019, spine surgeons should prepare strategies to make the upcoming superintelligent machines into our friends or secretaries, instead of replacing our jobs.

REFERENCE

1. Arvind V, Kim JS, Oermann EK, et al. Predicting surgical complications in adult patients undergoing anterior cervical discectomy and fusion using machine learning. *Neurospine* 2018;15:329-37.