ARTIFICIAL INTELLIGENCE IN FUTURISTIC MEDICINE

Dr Lalit Kumar Rajbanshi

Associate Professor
Department of Anesthesiology and Critical Care, Birat Medical College, Biratnagar
Email: lalitrajbanshi@gmail.com
https://orcid.org/0000-0001-7531-634X

The artificial intelligence (AI) is the branch of science and engineering dealing with the computational understanding of human mind and performing intelligent task.[1] The term is frequently applied to machine and computer related program that are powered with the intellectual processes characteristic of humans. The machines mimic and perform the complex cognitive behavior of human, discover meaning, generalize, or learn from past experiences that can be used for future task. The artificial intelligent systems are the programs which are used by the computers in way that looks like performed by human mind. The concept of artificial intelligent was developed in the early 1950s when British mathematician Alan Turing conceptualized the intelligent behavior of the machines that's mimics the human intelligence. He forwarded the concept of human level performance by the machine which was later on gained popularity as "Turing Test".[2] The artificial intelligence has made it possible to develop the systems that think and act rationally like human.

Modern medicine is faced with the challenges of acquiring, analysing and applying the large amount of knowledge necessary to solve complex clinical problems. The revolutionary development in the data processing in computer engineering and rapid growth in machine learning algorithms have made artificial intelligence a significant part of health care system. It is very obvious that applying AI in health care system gives better results compared with the existing technologies.[3,4] Broadly the artificial intelligence has two main branch; Virtual and Physical. Virtual branch is represented by the algorithm-based machine and deep learning process. The second form of application of AI in medicine i.e. physical, includes physical objects, medical devices and increasingly sophisticated robots taking part in the delivery of health care services.[5]

Machine learning and deep learning methods are collectively termed as virtual artificial intelligence which is represented by mathematical algorithms that improve learning through experience.[6] Machine learning refers to the concept that computer programs can automatically learn from the experiences applying mathematical approaches.[7] The automatic learning from the experiences enables the system to adapt to new set of data to perform a complex task. Deep learning incorporates algorithm based automatic learning system that learns by processing input data through artificial neural networks that mimic neurons in the biologic brain of human.[8] The neural networks in deep learning comprises of more than three layers inclusive of input, additional data and output and all of the components in the three layers are interconnected with each other so that the algorithms are understood from the past experiences.[9]

One of the finest uses of virtual AI is the electronic medical record (EMR)system. The conventional data recording mostly uses the format in the form of incomprehensive clusters of wasted information that has a very minimum use for the development of health care delivery system or drawing prognosis of the diseases or improvising the treatment of health problems. The virtual AI has allowed to capture the medical data in real-time in a systematic way which can be stored in a particular database or computational system via intelligible process. The new scientific and clinical findings can easily be identified from electronic data captured by the system and can be shared and displayed for open access by physicians and scientists and made automatically available as point-of-care information.[5] Electronic medical or health records are essential tools for personalized medicine and for early detection and targeted prevention of diseases.

Various intelligent technologies from different companies like IBM, Apple, Samsung and Google have brought a revolutionary change in the field of medical devices that can can assist in improving the user health by acquiring health information from daily life using a combination of Internet of Things (IoT) technologies and wearable devices.[10] In 2017, Apple launched a smart watch application based on deep learning algorithm that can detect the atrial fibrillation that got FDA approval also. The smart watch uses the photo plethysmography and accelerometer sensors to learn the user's usual heart rates at rest and at activity, and sends a warning sign if there is a significant difference from the expected values. Machine-learning algorithms are widely used for medical image analysis in the departments that use images for fields such as pathology, dermatology, cardiology, gastroenterology, and ophthalmology. Computerized tomography, magnetic resonance imaging, ultrasound, endoscopy, pathology image, fundoscopy are some of the examples where the artificial

intelligence has made the diagnosis and therapeutic intervention of the disease much easier and more precise.[11,12]

The physical branch of Artificial Intelligence includes the physical objects, medical devices and sophisticated robotic system specifically designed for the delivery of optimal and precision-based health care services.[5] The best use of the physical form of AI has been developed by an American company; Intuitive Surgical that was named as "Da Vinci" which has facilitated complex surgeries using a minimally invasive approach and can be controlled by a surgeon from a console. The robots are used as the helpers for the delivery of health care services in almost all the disciplines of medicine. The technology of AI incorporated robotics can be used as an assistant for surgeries or even as a solo performer.[13] Another area where AI might be helpfully employed is for monitoring the guided delivery of drugs to target organs, tissues or tumors. Nanorobotics which endorses highly sophisticated AI system has been extensively used for diagnosis of complex medical condition in oncology and for the delivery of therapeutic agent in to the core of the tumor.

The machine learning AI is taking over the conventional clinical practice in many ways. It is obvious that machine learning is drastically going to improvise the prognostication tools available in current practice. Current prognostic models (e.g., the Acute Physiology and Chronic Health Evaluation [APACHE] score and the Sequential Organ Failure Assessment [SOFA] score) have their own limitation interms of only crude variables, because humans must enter and tally the scores. But data could instead be drawn directly from EHRs or claims databases, allowing intelligent models to use thousands of rich predictor variables with more accuracy in prognostication.[14] In the same way AI incorporated machine learning improve the diagnostic accuracy. Algorithms will soon generate differential diagnoses, suggest high-value tests, and reduce overuse of testing in coming future. The increasing concern regarding patient safety and quality has demanded the inclusion of machine learning algorithms for better clinical monitoring and vigilance over human-after all, algorithms need no sleep, and their vigilance is the same at 2 a.m. as at 9 a.m. This implication of AI has been widely used in anesthesiology and critical care for monitoring and interpreting physiological data.[14]

The artificial intelligence in coming future is going to improvise the health care services in a dramatic way. Machine learning process will be an inevitable tool in medical practice for clinicians seeking to truly understand their patients. However even with all the expected benefits in health care system, the AI has been accepted with only less enthusiasm by the clinicians. Being dependent fully or even partially on the technologies, does not matter how intelligent it is, for clinical decision making is itself a greatest risk and most probably this could be the reason the clinicians are reluctant to accept the artificial intelligent system in their clinical practice. So, it is essential to seek the answer for the efficacy and reliability of artificial intelligence, hopefully, via more randomized controlled studies in upcoming days.

REFERENCES

1. Shapiro SC. Artificial intelligence. In: Shapiro SC. (ed) Encyclopedia of Artificial Intelligence, vol. 1, 2nd edn. New York: Wiley, 1992.

2. Turing AM. Computing machinery and intelligence. Mind 1950; 59: 433–60.

3. Cruz JA, Wishart DS. Applications of machine learning in cancer prediction and prognosis. Cancer Inform 2007;2:59–77

4. Ryu SM, Seo SW, Lee SH. Novel prognostication of patients with spinal and pelvic chondrosarcoma using deep survival neural networks. BMC Med Inform Decis Mak 2020;20(1):3.

5. Cornet G. Robot companions and ethics a pragmatic approach of ethical design. J Int Bioethique. 2013;24(4):49-58, 179-80.

6. Hamet, Pavel; Tremblay, Johanne (2017). Artificial intelligence in medicine. Metabolism, 69(), S36–S40.doi:10.1016/j.metabol.2017.01.011

7. Rajkomar A, Dean J, Kohane I. Machine learning in medicine. N Engl J Med 2019;380(14):1347–1358

8. Shimizu H, Nakayama KI. Artificial intelligence in oncology. Cancer Sci 2020;111(5):1452–1460.

9. Ramesh AN, Kambhampati C, Monson JR, Drew PJ. Artificial intelligence in medicine. Ann R Coll Surg Engl. 2004 Sep;86(5):334-8. doi: 10.1308/147870804290. PMID: 15333167; PMCID: PMC1964229.

10. Park, C. W., Seo, S. W., Kang, N., Ko, B., Choi, B. W., Park, C. M., Chang, D. K., Kim, H., Kim, H., Lee, H., Jang, J., Ye, J. C., Jeon, J. H., Seo, J. B., Kim, K. J., Jung, K. H., Kim, N., Paek, S., Shin, S. Y., Yoo, S., ... Yoon, H. J. (2020). Artificial Intelligence in Health Care: Current Applications and Issues. Journal of Korean medical science, 35(42), e379. https://doi.org/10.3346 /jkms.2020.35.e379

11. Ting DS, Cheung CY, Lim G, Tan GS, Quang ND, Gan A, et al. Development and validation of a deep learning system for diabetic retinopathy and related eye diseases using retinal images from multiethnic populations with diabetes. JAMA. 2017;318(22): 2211–2223.

12. Patel V, Armstrong D, Ganguli M, Roopra S, Kantipudi N, Albashir S, et al. Deep learning in gastrointestinal endoscopy. Crit Rev Biomed Eng. 2016;44(6):493–504.

13. Larson JA, Johnson MH, Bhayani SB. Application of surgical safety standards to robotic surgery: five principles of ethics for nonmaleficence. J Am Coll Surg. 2014;218(2):290-3

14. Obermeyer, Z., & Emanuel, E. J. (2016). Predicting the Future - Big Data, Machine Learning, and Clinical Medicine. The New England journal of medicine, 375(13), 1216–1219. https://doi.org/10.1056/NEJMp1606181