ISSN: 2640-4133

Short Communications

Advances in Bioengineering & Biomedical Science Research

Artificial Intelligence in Biomedical Science

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Submitted: 01 Nov 2019; **Accepted:** 12 Nov 2019; **Published:** 16 Nov 2019

Introduction

Biomedical Sciences has very broad range and deals with various disciplines of medical research such as genetics epidemiology, clinical epidemiology, clinical virology, medical microbiology. It also includes science disciplines whose fundamental aspect is biology of human health and diseases. It is also aims on relevant sciences that includes but not limited to anatomy, cell biology, biochemistry, microbiology, genetics, molecular biology, immunology, mathematics, statistics and bioinformatics. Biomedical sciences have wider range of research, academic and economic significance than that defined by hospital laboratory sciences [1].

Artificial Intelligence (AI) in biomedical is usage of software and complex structure of algorithms to mirror human intelligence in the analysis of composite medical data. Specifically, Artificial Intelligence is the capability for computer algorithms to estimate results without direct human interaction [2]. Some key features interest include but not limited to clinical text mining, patient centric information retrieval, biomedical text evaluation, diagnostic assistance, clinical event forecasting, data-driven prognostics, precision medicine, human computation [3].

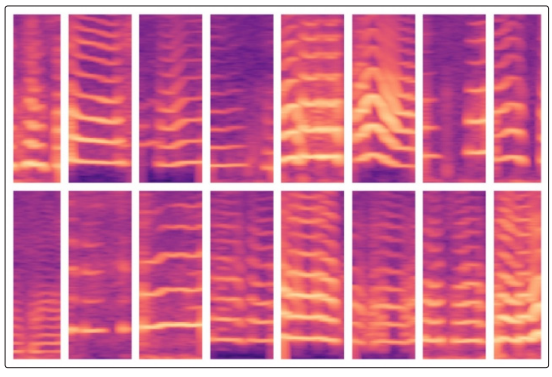

Figure 1: Illustrates a new MIT-developed model automates a critical step in using AI for medical decision making, where experts usually identify important features in massive patient datasets by hand.

The model was able to automatically identify voicing patterns of people with vocal cord nodules (shown here) and, in turn, use those features to predict which people do and don't have the disorder [4].

Biomedical Imaging through Artificial Intelligence

Academics at University of Zurich used various methods in machine learning to improve optoacoustic imaging. This medical technique can be used for studying brain activity, visualizing blood vessels, characterizing skin lesions and diagnosing cancer. Nevertheless, quality of rendered images are dependent on number of sensors distribution used by the apparatus. This new technique developed by the scientists allows for significant reduction of number of sensors without reducing quality of image. This makes it possible to reduce the cost of apparatus and therefore increasing imaging speed and improve diagnosis.

To accomplish this task researchers used self-developed high-end optoacoustic scanner which has around 512 sensors which conveyed superior quality images. Next scientists discarded majority of the sensors and around 128 to 32 sensors remained; with a detrimental effect on the quality of image. Due to insufficient data, various distortions appears in the images. However, previously trained neural network was able to correct for these distortions and conveying the quality of image closer to the measurements obtained with 512 sensors [5, 6].

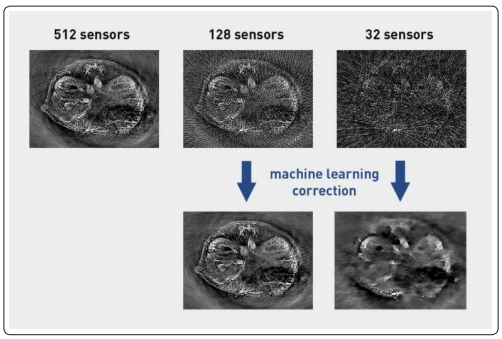

Figure 2: Illustrates Scientists use optoacoustic tomography to create cross-sectional images of a mouse. Using machine learning, they were able to largely restore quality of images recorded with fewer sensors. Image Credit: Davoudi N et al. Nature Machine Intelligence 2019 [7].

Artificial Intelligence to Detect Cancer Tumors

Scientists at University of Central Florida Computer Vision Center developed and taught a computer on how to detect tiny particles of lung cancer in CT scans, where radiologists cannot identify it

accurately. The accuracy of artificial system is around 95 percent compared to 65 percent when done by human eyes.

This approach is related to the algorithms that facial recognition software uses. It scans around thousands of faces looking for a particular pattern to match. Group delivered more than 1000 CT scans which were supported by the National Institutes of Health through collaboration with Mayo Clinic. They were able to develop software to identify cancer tumors. They used Machine Learning to ignore other tissue, nerves and other masses it encountered in the CT scans and analyze lung tissues.

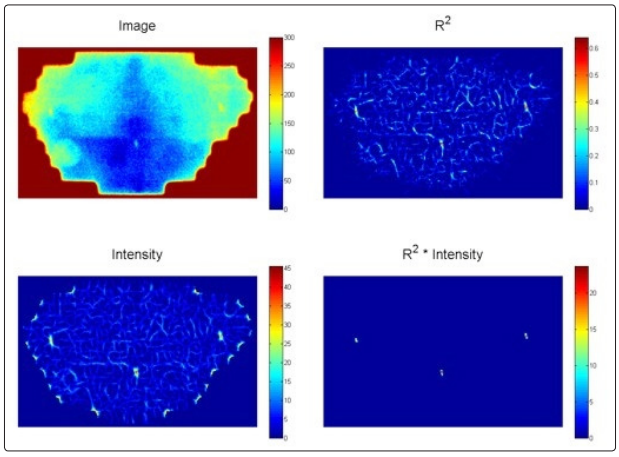

Figure 3: Illustrates Fast Fiducial Tracking Algorithm [10].

New Advances in Plastic Surgery with Machine Learning

With ever increasing of electronic data collected in the health care, scientists are considering the use of a sub field of artificial intelligence - Machine learning to improve medical care and patient outcomes. An analysis of machine learning can contribute to advancements in plastic surgery.

Machine learning analyzes historical data to evolve algorithms capable of knowledge acquisition. Projects with healthcare applications that includes IBM Watson Health cognitive computing system. Authors have five areas where machine learning can improve efficiency and clinical outcomes – Burn surgery, Micro surgery, craniofacial surgery, hand and peripheral nerve surgery, aesthetic surgery. Authors also expect useful applications of machine learning to improve plastic surgery training. Nevertheless, they concentrate the need for measures to make sure the safety and clinical relevance of the results collected by machine learning and also remember at the same time that computer generated algorithms cannot replace the trained human eye yet [11, 12].

Artificial Intelligence Improves Dementia Diagnosis

Machine Learning has identified one of the common causes of dementia and stroke in most widely used form of brain scan more accurately than current methods. Advanced software developed by experts at Imperial College London and the University of Edinburgh were able to detect and measure the sternness of small vessel disease one of the common cause of stroke and dementia.

Scientists asserts that this technology can help physicians to carry out the best treatment to patients more swiftly in emergency settings and can predict person's likelihood of developing dementia. This development also makes way for personalized medicine. [13, 14].

Artificial Intelligence Predicts Alzheimer's Before Diagnosis

Timely diagnosis Alzheimer's disease is very critical because treatments and interventions are more effective at early in the course of the disease. Yet, early diagnosis has proven to be very challenging.

A research group, multidisciplinary team of physicians and clinicians focusing on radiological data science. Dr. Franc was involved in applying deep learning, a type of AI in which machines learn like humans do, to find changes in brain metabolism of Alzheimer's disease. They trained the algorithm on special imaging technology known as 18-F-fluorodeoxyglucose positron emission tomography (FDG-PET). In this, radioactive glucose compound is injected into the blood, then PET scans and takes measure of metabolic activity [15, 16].

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