APPLICATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE: FROM DATA TO PERSONALISED MODELS

Tijana Šušteršič[1,2], Anđela Blagojević[1,2], Nenad Filipović[1,2]

[1] Faculty of Engineering, University of Kragujevac, Sestre Janjić 6, 34000 Kragujevac, Serbia
[2] Bioengineering Research and Development Center – BioIRC, Prvoslava Stojanovića 6, 34000 Kragujevac, Serbia
e-mail: tijanas@kg.ac.rs, andjela.blagojevic@kg.ac.rs, fica@kg.ac.rs

Abstract:

Artificial intelligence leverages sophisticated computation and inference to generate insights, enables the system to reason and learn, and empowers clinician decision making. Starting from data (medical images, biomarkers, patients' data) and using powerful tools such as convolutional neural networks, classification and regression models etc., it aims at creating personalized models, adapted to each patient, which can be applied in real clinical practice as a decision support system to doctors.

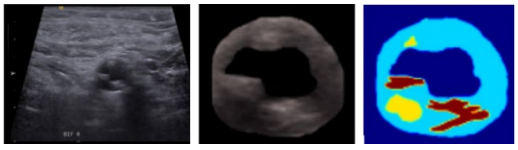
Keywords: image processing, deep learning, data mining, medical expert systems

1. Introduction

Advancements in computational power paired with massive amounts of data generated in healthcare systems make many clinical problems ready for implementation of artificial intelligence. Artificial intelligence has been successfully applied in the automation of the process of analysis of medical data, shortening the diagnosis period, as well as ensuring high accuracy and repeatability of the results. Algorithms can be applied to automatically diagnose diseases based on MRI/CT/X-ray images, predict patient survival rates more accurately, estimate treatment effects on patients using data from randomized trials, and automate the task of labeling medical datasets using natural language processing. Algorithms in medicine have so far demonstrated several potential benefits to both the physicians and the patients.

2. Application of Artificial Intelligence in Medicine

AI is already being utilized in several fields of medicine. One example is the stratification of patients with carotid artery disease where it analyzes clinical and personalized data, plaque and cerebral image processing and novel biomarkers [1]. The convolutional neural network U-net was used in plaque components segmentation (semantic segmentation) (Fig. 1).



a) b) c)

Fig. 1. Original ultrasound image (a), extracted carotid artery (b), annotated plaque (c)

Another interesting utilization of this AI application is the analysis of patient-specific data and the development of patient-specific models for monitoring and assessment of the patient's

condition with familiar cardiomyopathy [2]. Ultrasound images are processed in order to segment the Left ventricle and reconstruct the 3D model of the heart (**Fig. 2**).

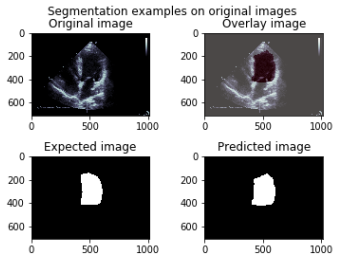


Fig. 2. Segmentation of Left Ventricle in apical view images performed by U-net

Other implementation methods include the integration of different machine learning algorithms into one multiscale platform to investigate cancer, cardiovascular diseases. Bone disorders and tissue engineering also fall into this category [3], as it can predict the coating thickness in order to increase the lifespan of the biomaterial susceptible to corrosion [4]. It might even contribute to developing drug-eluting devices to combat the burden of peripheral artery disease (PAD) [5]. Artificial intelligence also plays its role in the development of the personalized AI model for COVID-19 prediction for patients or epidemiological model for monitoring the number of people infected with the virus [6].

3. Conclusions

The astonishing capacity of artificial intelligence to analyze massive quantities of data, make sense of images, and discover patterns that even the most expert human eye misses, has inspired hope that the technology may improve medicine. Finally, AI holds the promise of "making health care human again" by bringing the physician closer to the patient by creating the personalized models.

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