

CONGRESS AND SCIENTIFIC MEETING REPORT
/ ИЗВЕШТАЈ СА КОНГРЕСА И НАУЧНОГ СКУПА

“Artificial Intelligence and Medicine” – joint symposium of the Academy of Engineering Sciences of Serbia and the Academy of Medical Sciences of the Serbian Medical Society

Ljubica Đukanović^{1,2}, Aleksandra Smiljanić^{3,4}

¹Serbian Medical Society, Academy of Medical Sciences of the Serbian Medical Society, Belgrade, Serbia;

²University of Belgrade, Faculty of Medicine, Belgrade, Serbia;

³Academy of Engineering Sciences of Serbia, Belgrade, Serbia;

⁴University of Belgrade, School of Electrical Engineering, Belgrade, Serbia



The Academy of Engineering Sciences of Serbia (AESS) and the Academy of Medical Sciences of the Serbian Medical Society (AMS-SMS) have successfully organized a joint symposium titled “Artificial Intelligence and Medicine” held in Belgrade on May 15, 2024.

At the opening of the symposium, Professor Dr. Miloš Nedeljković, president of AESS and Professor Dr. Svetolik Avramov, president of AMS-SMS greeted the gathering. Both presidents expressed their satisfaction that the cooperation between the two academies was established in 2020 by signing a cooperation protocol. Professor Nedeljković reminded the audience that the first joint meeting between the two academies was held in 2021 with a series of lectures from various fields in which engineers and doctors collaborate [1, 2]. He added that the proposal for the symposium on artificial intelligence (AI) and medicine was made by Professor Dr. Ljubica Đukanović, former president of the AMS-SMS, who with Professor Dr. Aleksandra Smiljanić, vice president of AESS, prepared the program of the symposium. He congratulated the professors on the rich program and interesting lectures that would be held by doctors and engineers. He also expressed his satisfaction that the audience included engineers, physicians, dentists, biochemists, and pharmacists and that the symposium was accredited by the Health Council of Serbia. Professor Avramov expressed his satisfaction that the cooperation between the two academies, which was slightly hindered by the COVID-19 pandemic, continues. He emphasized the importance of cooperation between engineers and doctors, which contributed to the incredible development of medicine in recent decades [3, 4]. He especially praised the actuality of the topic of the symposium and added that AI is already being applied in several branches of medicine. There is no doubt

that its application will lead to further and significant progress in medicine. Both presidents wished everyone a successful symposium and future joint scientific meetings between the two academies.

The program of the meeting consisted of 10 lectures covering different areas of medicine in which AI finds application.

Professor Dr. Vladan Devedžić (Faculty of Organizational Sciences, University of Belgrade), a corresponding member of the Serbian Academy of Sciences and Arts, gave the opening talk titled “If the band you are in starts playing different tunes: a tale about generative artificial intelligence.” Professor started his talk with the explanation of what generative AI is, and how large language models, large visual models, and other similar AI models allow for generating different kinds of content. There are numerous specific applications that use such models, like the famous ChatGPT chatbot, the Midjourney image generation app, or the AIVA app for generating music. After reviewing important terminology in the generative AI field, he presented its underlying algorithms, as well as several of its applications and systems. Through several examples of current applications and tools, Professor Devedžić illustrated how to work with them in practice.

Research Associate Professor Dr. Biljana Stanković, coworker of **Research Professor Dr. Sonja Pavlović**, member of AMS-SMS, presented the use of machine learning in the detection of inflammatory bowel disease molecular biomarkers in her lecture titled “Application of artificial intelligence in the analysis of genetic data obtained by new-generation sequencing.” She introduced the auditorium to the problem brought by modern high-throughput technologies such as next-generation sequencing that generate large amounts of biological data. The use of such extensive data requires advanced

Received • Примљено:
May 28, 2024

Revised • Ревизија:
June 5, 2024

Accepted • Прихваћено:
June 5, 2024

Online first: June 7, 2024

Correspondence to:

Ljubica ĐUKANOVIĆ
Pere Velimirovića 54/15
11 000 Belgrade, Serbia
ljubicadjukanovic@yahoo.com



Figure 1. Opening address by Prof. Miloš Nedeljković, President of the Academy of Engineering Sciences of Serbia (AESS) and Past Dean of the Faculty of Mechanical Engineering, University of Belgrade (FMEUB) at the symposium titled “Artificial Intelligence and Medicine” – joint symposium of the Academy of Medical Sciences of the Serbian Medical Society and the AESS held on May 15, 2024 (Ceremonial Hall, FMEUB, Belgrade, Serbia); courtesy of FMEUB, Ivana Subašić

bioinformatics and statistical methods. In the presented study, the authors used human genome data obtained by the next-generation sequencing method, as well as data from medical records, and by machine learning algorithms selected molecular biomarkers that more accurately predicted the onset and the course of inflammatory bowel disease. These biomarkers significantly help in the prevention, early detection, and treatment of this disease.

Two lectures, one by an electrical engineer and the other by a doctor, dealt with the application of AI methods in medical imaging.

Professor Dr. Ana Gavrovska (School of Electrical Engineering, University of Belgrade) in her lecture titled “Modern automated approaches in improving medical imaging with the aim of effective diagnostics, management and risk assessment” pointed out that automated approaches based on AI can significantly improve medical imaging. Research in the field of medical imaging includes image quality improvements, detection performance enhancement, advanced image classification, estimation of possible user states, etc. All this makes medical image-based methods more effective, personalized, accessible, and less expensive. While presenting the modern achievements and possibilities of machine learning in working with medical images, Professor Gavrovska referred to current research at the Laboratory for Image Processing, Telemedicine and Multimedia, School of Electrical Engineering.

Professor Dr. Ružica Maksimović (Faculty of Medicine, University of Belgrade) began her lecture titled “Artificial intelligence in radiology” by asserting that AI has significantly contributed to improving the quality of

diagnosis in various areas of radiology. However, she emphasized that radiologists should understand not only the value but also the pitfalls, weaknesses, and potential errors that may occur with the application of AI. Although AI algorithms are powerful, interpretation can lead to reduced diagnostic accuracy if tasked outside of its scope. This requires continuous training of radiologists and their close cooperation with software engineers and data scientists, because only such collaboration enables the correct choice of data analysis and processing methods to be used. This leads to reliable conclusions of key importance for the diagnosis and treatment of patients.

Ilija Tanasković, Master of Engineering (School of Electrical Engineering, University of Belgrade; The Institute for Artificial Intelligence Research and Development of Serbia) in his lecture titled “Application of artificial intelligence in the analysis of biomedical signals and images” introduced the audience to a large number of available trained models on large datasets that can be tailored to specific domains. Fine-tuning of the You Only Look Once (YOLO) model proved to be successful in the analysis of CT scans of patients with kidney tumors, enabling better detection and segmentation of the kidney tumor region (precision = 0.93, recall = 0.9). Analysis of biomedical electrocardiogram (ECG) signals using 12-channel ECG recordings showed success (93% area under the curve) for differentiating the normal signal from the signal of patients with myocardial hypertrophy, myocardial infarction, and ST/T changes. Additionally, ECG in combination with impedance cardiogram showed high accuracy in biometric identification.

Associate Professor Dr. Predrag Tadić (School of Electrical Engineering, University of Belgrade) held the lecture titled "Diagnosis of heart failure using machine and deep learning" co-authored by **Research Professor Dr. Jovana Petrović** (Vinča Institute of Nuclear Sciences, University of Belgrade). The lecturer first explained basic terms in the field of AI (expert system, machine/deep learning), and the principles on which their successful applications are based. Examples of successful applications of these techniques in medicine were then presented. Special attention was given to the SensSmart project funded by the Science Fund of the Republic of Serbia, whose goal is the development of a multi-sensor polycardiograph (stethoscope, ECG, accelerometer, photoplethysmography) and the accompanying algorithm based on machine and deep learning for the early diagnosis of heart failure. It was stated that within the SensSmart project, a database of recordings of sick and healthy subjects will be collected and made publicly available. This will contribute to solving one of the biggest obstacles in the wider application of machine learning in medicine, which the lack is of adequately annotated and publicly available medical data.

Professor Dr. Vladimir Mladenović (Faculty of Technical Sciences in Čačak, University of Kragujevac) presented in the lecture titled "Application of neural network models in predicting volume load in children on hemodialysis: an example of a case study of the application of artificial intelligence in medicine," the results of research conducted in cooperation with associate member of AMS-SMS **Professor Dr. Mirjana Kostić** (Faculty of Medicine, University of Belgrade) and their collaborators. Artificial neural networks were used in the study to obtain precise information about overhydration in children on regular hemodialysis. The obtained data on overhydration allows for the adjustment of dialysis parameters and the reduction of potential risks caused by excessive hydration. The example of the application of AI in hemodialysis illustrates how these technologies can improve the precision and efficiency of medical procedures, which contributes to improving the quality of life and patient outcomes.

Dr. Marina Popović Krneta (Faculty of Medicine, University of Belgrade), coworker of **Professor Dr. Dragana Šobić Šaranović**, full member of AMS-SMS, in the lecture titled "Fundamentals of supervised machine learning and their practical application in nuclear endocrinology" presented their experience with the application of machine learning in order to identify predictive factors for the diagnosis and treatment of patients with papillary thyroid carcinoma (PTC). Through the examples of patients with PTC, predictive models based on different types of supervised machine learning were considered, which would allow for increased effectiveness of applied therapy in high-risk patients with PTC. On the other hand, it would enable avoiding unnecessary therapeutic protocols in patients where there is no clinical benefit from their application. In addition, she presented how the application of explainable machine learning methods can improve the interpretation and reliability of predictive models in medical research.

Assistant Professor Dr. Sc. Marija Živković (Faculty of Dental Medicine, University of Belgrade) held the lecture titled "Artificial intelligence in dentistry: opportunities and challenges." Firstly, she briefly presented the benefits of digital dentistry, which made a perfect introduction to the application of AI in dentistry. AI methods enable image analysis, more efficient treatment planning, and prediction of treatment outcomes due to the possibility of analyzing a large amount of data. Specifically mentioned topics included the importance of AI in the field of orthodontics. AI is characterized by high precision in determining cephalometric points on X-ray images with the help of convolutional neural networks, assessing whether extractions are needed within orthodontic therapy, as well as determining skeletal maturity based on the cervical vertebral maturation method. Although AI algorithms can significantly help in the interpretation of complex data, the final decision on the course of the treatment should still be made by the clinician, based on the available data and their personal experience.

Professor Dr. Jelena Roganović (Faculty of Dental Medicine, University of Belgrade) held the lecture titled "Ethical application of artificial intelligence in dental practice" that rounded off the content of the symposium, since the application of AI opens up numerous ethical challenges. The application of AI in dentistry requires that two questions are always considered: first – if and when AI tool should be applied; and second – how to engage AI in clinical decision-making. Furthermore, dentists need to acquire specific and AI-use-related skills in order to apply AI safely and effectively to dental patients. The results of the recent survey conducted at the Faculty of Dental Medicine in Belgrade showed that undergraduates compared to postgraduate dental students were skeptic about whether they should use AI in the practice at all. This could be a consequence of the lack of basic and continuing education regarding this subject, as well as of fear of risk that AI will replace dentists. Professor Roganović emphasized that the rapid development and introduction of AI methods into dental practices requires equally rapid preparation of legal and ethical regulations on the application of AI.

In the discussions after the individual lectures, symposium participants expressed their interest in certain presented methods as well as in the possibility of their application in practice. They also shared their experience in the application of AI and gave interesting suggestions for further research and cooperation. Ethical issues related to AI were mentioned several times in lectures and discussions, especially the necessity of legal and ethical regulations on the application of AI both globally and in our country.

The first joint meeting between AMS-SMS and AESS held in 2021 aimed to show the wide range of fields in which engineers and doctors collaborate [1]. The symposium titled "Artificial intelligence in medicine" was the first thematic symposium and it showed that AI is successfully applied in health and scientific institutions in Serbia thanks to the cooperation of engineers and doctors. AI has found applications in various branches of medicine,

so it is proposed to organize scientific meetings on the application of AI in specific branches of medicine in the future. This would contribute to the exchange of experience and knowledge, to better cooperation between teams of different professions, and to the further progress of both engineering and medicine.

REFERENCES

1. Obradović B, Đukanović L. Digest of the round table titled "Medicine and engineering: An inexhaustible source of challenges for cooperation between medical doctors and engineers". *Srp Arh Celok Lek.* 2021;149(7–8):518–20. [DOI: 10.2298/SARH210802070O]
2. Ignjatović N. Overview of the round table "Medicine and engineering: An inexhaustible source of challenges for cooperation between medical doctors and engineers": Event Review. *Hemijaska Industrija (Chemical Industry).* 2021;75(3):185–8.
3. Stamenković D, Obradović-Đuričić, Stamenković D, Grbović A, Đorđević I. The Fourth Industrial Revolution's impact on dentistry. *Srp Arh Celok Lek.* 2021;149(7–8):503–10. [DOI: 10.2298/SARH210130037S]
4. Ignjatović N, Mitković M, Obradović B, Stamenković D, Dankuc D, Manić M, et al. Interdisciplinary crossover for rapid advancements - collaboration between medical and engineering scientists with the focus on Serbia. *Srp Arh Celok Lek.* 2021;149(3–4):229–35. [DOI: 10.2298/SARH210110021D]

ACKNOWLEDGMENT

We thank to the Faculty of Mechanical Engineering, University of Belgrade, Serbia, for providing us with the Ceremonial Hall and help in organizing this meeting. We thank Luka Mirčetić, biomedical engineering student, for his assistance in writing the report.

Ethics: This article was written in accordance with the ethical standards of the institutions and the journal.

Conflict of interest: None declared.