Title: Machine Learning Utilization for Data-Driven Empirical Therapy and Antimicrobial Resistance Management

Abstract: This lecture introduces the concept and key goals of an innovative national research initiative, “Machine Learning Utilization for Data-Driven Empirical Therapy and Antimicrobial Resistance Management (ML-ETAR),” developed within the broader agenda of digital transformation in medicine and submitted to the “Ideje” call of the Science Fund of the Republic of Serbia. It highlights how interdisciplinary collaboration and the use of artificial intelligence can deliver tangible progress in addressing antimicrobial resistance (AMR).

AMR is a major global health threat, increasing morbidity, mortality, and healthcare costs. It is fueled by antibiotic misuse and overuse, inappropriate prescribing, and insufficient infection prevention and control. Serbia faces particularly high antibiotic consumption and substantial resistance levels, especially to broad-spectrum agents. While hospitals have made serious efforts through antibiotic stewardship programs, progress is constrained by the absence of advanced tools that can consolidate relevant data and enable systematic analysis of resistance patterns. This project responds to that gap by combining state-of-the-art machine learning methods, nationwide epidemiological data, and the domain expertise of microbiologists and pharmacologists into a unified framework designed to improve empirical antibiotic therapy and strengthen AMR management in Serbia. A central innovation is the creation of a representative dataset by integrating geographically and demographically diverse healthcare data across the country. Data will be extracted from electronic health records using a dedicated software tool to ensure reliable, streamlined integration. The resulting clinical decision-support solution will deliver recommendations directly within routine clinical workflows.

By enabling more precise, reliable, and targeted antibiotic use, the project is expected to reduce overall antibiotic consumption, particularly broad-spectrum prescriptions, improve resource allocation, slow the escalation of AMR, and lower the costs associated with antibiotic-resistant infections. Fewer treatment failures, improved patient outcomes, shorter hospital stays, and reduced complications should translate into a measurable reduction in overall healthcare burden.

The consortium brings together microbiologists, pharmacologists, data scientists, and software developers to establish a robust foundation for long-term impact. Ultimately, the initiative aims to position Serbia as a regional leader in AMR management by leveraging innovation and digital technologies.

Keywords: antimicrobial resistance, microbiology, antibiotic consumption, artificial intelligence, machine learning,