

The Fourth Serbian International Conference on Applied Artificial Intelligence (SICAAI)

May 29-30, 2025, Zlatibor, Serbia

**The Fourth Serbian International Conference on Applied Artificial Intelligence,
Kragujevac – Book of Abstracts**

Editor

Professor Nenad Filipović

Technical assistants

Đorđe Ilić
Ognjen Pavić
Lazar Dašić

Proofreaders

Neda Vidanović Miletić
Milena Đorđević

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- **Data cloud technology**
- **Bioengineering Research and Development Center (BIOIRC)**



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Development and Innovation



Welcome Message

Dear colleagues and students,

On behalf of the Organizing Committee, it is a pleasure to welcome you at the Fourth Serbian International Conference on Applied Artificial Intelligence (AAI2025) which takes place at Zlatibor, Serbia, on May 29th-30th, 2025.

AAI2025 provides an exceptional Serbian and international forum to share the state-of-the-art research knowledge and results on the innovative theories, methodology and applications of artificial intelligence and its sub-domain like deep learning, machine learning in different areas such as medicine, economy, education, law, smart city, government, industry etc. Moreover, the conference aims to provide a platform for researchers and practitioners for both academia and industry to share the information about cutting-edge developments in the field of artificial intelligence.

It also aims to:

- provide early-stage researchers with an inspiring event allowing them to connect to relevant experts in related fields;
- provide an exciting venue for researchers to network and establish national and international collaborations;
- bring together leading experts from all relevant scientific domains to enhance the understanding of Artificial Intelligence;

Topics cover the following:

AI IN DOMAIN-SPECIFIC APPLICATIONS

- AI in Computational Biology, Medicine and Biomedical Applications
- AI in WWW, Communication, Social Networking, Recommender Systems, Games and E-Commerce
- AI in Finance and Risk Management

AI IN DATA ANALYTICS AND BIG DATA

- Visual Analytics for Big Data
- Computational Modeling for Big Data
- Large-scale Recommendation and Social Media Systems
- Cloud/Grid/Stream Data Mining for Big Velocity Data
- Semantic-based Big Data Mining

MACHINE LEARNING AND DATA MINING

- Pre-processing, Dimension Reduction and Feature Selection Computing, Bayesian and Neural Networks
- Learning Graphical Models and Complex Networks
- Active, Cost-Sensitive, Semi-Supervised, Multi-Instance, Multi-Label and Multi-Task Learning

- Transfer/Adaptive, Rational and Structured Learning

AAI2025 will host the following renowned plenary speakers in the area of applied artificial intelligence:

- **Prof. Borko Furht** – Florida Atlantic University, Boca Raton, Florida, USA; Title: *Collaborative Innovation in AI: Partnerships Between Academia, Industry, and Government*
- **Prof. David Naccache** – ENS' Information Security Group, Paris, France; Title: *Using AI to Discover Conjectures – The Balkans Continued Fraction Example*
- **Prof. Freddy Gabbay** – VLSI Research Lab, The Institute of Applied Physics, The Hebrew University of Jerusalem; Title: *AI at the Edge of Precision: Accelerating AI Efficiency with Approximate Computing*
- **Prof. Zoran Bosnić** – University of Ljubljana, Ljubljana, Slovenia; Title: *The Road to General AI in Medicine: The Promise and Challenges*
- **Prof. Naphtali Rishe** – The inaugural Outstanding University Professor, Florida International University, USA; Title: *Generative AI for Robust Map Generation from Satellite Imagery*
- **Prof. Hermann Maurer** – Fakultät für Informatik und Biomedizinisch Technik, Institut für Human-Centered Computing (HCC), Graz University of Technology, Austria; Title: *Large Documents Must Allow More than Passive Reading*
- **Prof. Alexander D. Stajković** – Dean's Professor in Business, University of Wisconsin-Madison, School of Business, USA; Title: *The Role of AI in Outdating Homo Sapiens*
- **Prof. Veljko Milutinović** – Life Fellow of the IEEE, Washington, D.C., USA Member, a Former Trustee and Treasurer, Academia Europaea, London, GBR Founding Member, Serbian National Academy of Engineering, Beograd, SRB Foreign Member, Montenegrin National Academy of Sciences and Arts, Montenegro; Title: *Digital Preservation of Family Heritage Enhanced Using Artificial Intelligence*
- **Prof. Kyoung Mu Lee** – Dept. of ECE, Seoul National University (SNU), Seoul, South Korea; Title: *3D Computer Vision: Reconstruction, Generation, and Manufacturing*
- **Prof. Panos Razis** – University of Cyprus, Nicosia, Cyprus; Title: *On the Mission of the Cosmos University in Data Science and Artificial Intelligence*
- **Prof. Gerhard Klimeck** – Purdue University, West Lafayette, USA; Title: *The Mission of NanoHUB*
- **Prof. Luca Benini** – University of Bologna, Bologna, Italy; Title: *Open Platforms for the Embodied AI era.*
- **Prof. Onut Mutlu** – ETH, Zurich, Switzerland; Title: *Fundamentally Accelerating Genome Analysis*
- **Prof. Jon Eckhardt** – University of Wisconsin, WI, USA; Title: *On the Mission of the University of Wisconsin in the Domain of Entrepreneurship and Discovery*

We have received more than 100 high-quality research papers. As a result of the strict review process and evaluation, the committee selected over 50 papers as extended abstracts.

After the review, full papers from the AAI2025 conference will be published by Springer Verlag in the series "Applied Artificial Intelligence 4: Medicine, Biology, Chemistry, Financial, Games, Engineering".

We must also admit that the conference certainly would not have been so successful without the efforts of many people who were actively engaged in organization of such a major academic event. We express gratitude to the members of the program and scientific review

committee as well as to all the chairs, organizers and committee members for their dedication and support.

On behalf of the Organizing Committee, we wish you all a pleasant stay at Zlatibor and a productive conference.

Prof. Nenad Filipović, Conference Program Chair

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- Miloš Kojić
- Veljko Milutinović

Technical Program

Thursday 29 May 2025

09:00 - 09:30	Opening Ceremony - Day I: Academician Bela Balint , Minister of Science, Technological Development and Innovation Prof. Vladimir Rankovic , Rector of the University of Kragujevac Prof. Nenad Filipovic , Chair of the AAI2025 conference
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09:30 - 10:30	Keynote speakers: <i>Large Documents Must Allow More than Passive Reading</i> Prof. Herman Maurer <i>Collaborative Innovation in AI: Partnerships Between Academia, Industry, and Government</i> Prof. Borko Furht Chair: Nenad Filipović
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10:30 - 11:00	Coffee Break
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11:00 - 12:00	Keynote speakers: <i>Fundamentally Accelerating Genome Analysis</i> Prof. Onur Mutlu <i>3D Computer Vision: Reconstruction, Generation, and Manufacturing</i> Prof. Kyoung Mu Lee Chair: Veljko Milutinovic
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Session T.1A 12:00-14:00

Energy, Transport and Environmental Science

Chair: Boban Stojanovic

T.1A.1 - Application of Neural Networks in Assessing Body Comfort During Driving – Igor B. Saveljić, Slavica D. Mačuzić Saveljić

T.1A.2 - Comparative Analysis of Expert-Based and AI-Driven Methodologies in Children's Traffic Safety Education – Aleksandar Trifunović, Aleksandar Senić, Nenad Filipović, Dragan Lazarević

T.1A.3 – Dynamic LSTM-Based Framework for Adaptation to Concept Drift in Energy Consumption Forecasting – Jelena Joksimović, Janez Povh

T.1A.4 – A CCGAN-Driven Method for Context-Aware Correction of River Flow Time Series – Boško Laković, Dušan Stefanović, Nenad Bogdanović, Boban Stojanović

T.1A.5 – The use of AI in Developing Architectural Designs/Expo Pavilion Project – Aleksandar Rudnik Milanović

T.1A.6 – Comparison of CNN Architectures for Earthquake Damage State Classification of Different Building Types – Miloš Kovačević, Filip Đorđević, Mladen Nikolić, Đorđe Nedeljković, Zoran Babović, Zoran Pucanović, Marija Ivanović, Nevena Simić, Marko Marinković

T.1A.7 – Crop Yield Prediction Using Sentinel-2 Satellite Imagery and Deep Learning Models – Karlo Bala, Marko Pavlović, Michele Bandecchi

T.1A.8 – Short Review of Machine Learning Support in the Development of Soft Piezoelectric Materials – Kristina Vasić, Marija Branković, Danilo Petrović, Ana Kaplarević Mališić, Nenad Grujović, Fatima Živić

Session T.1B 12:00-13:30

Signal and Image Processing

Chair: Tijana Geroski

T.1B.1 – Lung Cancer Classification from CT Images Using the DINOv2 Vision Transformer Architecture – Sylvester Agyapong, Tijana Geroski, Nenad Filipović

T.1B.2 – Unlocking Cardiographic-Based Biometric Potential: Insights from Feature Selection – Ilija Tanasković, Ljiljana B. Lazarević, Goran Knežević, Nikola Milosavljević, Olga Dubljević, Bojana Bjegojević, Nadica Miljković

T.1B.3 – Feature Subset Selection for Low Back Pain Prediction: Machine Learning Approach – Minja Vuković, Olivera Đorđević, Ljubica Konstantinović, Nadica Miljković

T.1B.4 – Human-AI Collaboration in Shaping Modern Survey Design: Opportunities and Challenges – Resulbegoviq Hakile, Stamatović Irina

T.1B.5 – Comparison of RFE and SHAP for PRV Feature Ranking in Cognitive Stress Scenario – Katarina Vujić, Marija Novičić, Milica M. Janković

T.1B.6 – Feature-Based Machine Learning and Deep Learning Networks for Real-Time Stress Classification from GSR and HR Signals – Tanja Vuković, Jovana Malešević, Matija Štrbac

14:00 - 15:00

Buffet Lunch

Session T.2 15:00-16:30

LLM models and Big Data

Chair: Zhou Liang

T.2.1 – The Possibilities and Limitation in Automatic Personality Trait Detection Based on Text Essays Written in Serbian – Miljan Đorđević, Veljko Milutinović

T.2.2 – Analysis and Forecasting of Electricity Consumption in the Data Center – Danilo B. Savić, Velibor Isailović, Vladimir Mladenović

T.2.3 – Enabling Robust Elderly Care Robotics: Task Decomposition and Self-Evaluation Frameworks Enhanced by Large Language Models – Jingzhen Guo, Liteng Liu, Wenlong Zhao, Liang Zhou

T.2.4 – Tackling Online Harassment Using Natural Language Processing and Metaheuristic Optimization – Nikola Novaković, Luka Jovanović, Miodrag Živković, Petar Spalević, Nebojša Bacanin, Vico Zeljković, Katarina Milojković

T.2.5 – Fuzzy C-Means over Node Embeddings Outperforms Leiden for Overlapping Community Detection in Large-Scale Customer Graphs – Miloš Jovičić, Nikola Prodanović, Aleksandra Vulović, Gordana Jovičić, Aleksandar Radaković, Nenad Filipović

T.2.6 – Fairness Through Synthesis: Bias Mitigation Through Probabilistic Modeling and Matching Techniques – Vasileios C. Pezoulas, Nikolaos S. Tachos, Stefanos Gkikas, Manolis Tsiknakis, Dimitrios I. Fotiadis

16:30 - 17:00	Coffee Break
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17:00 - 18:00	<p>Keynote speakers:</p> <p><i>Using AI to Discover Conjectures – The Balkans Continued Fraction Example</i> Prof. David Naccache</p> <p><i>Generative AI for Robust Map Generation from Satellite Imagery</i> Prof. Naphtali Rishe</p> <p>Chair: Tijana Geroski</p>
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Session T.3 18:00-20:00

Chemical and Biological applied AI

Chair: Zoran Markovic

T.3.1 – Using Agent-Based Models for Generation of Surrogate Model Virtual Population: Atherosclerosis Case Study – Lemana Spahić, Nenad Filipović

T.3.2 – Diabetes Mellitus and AI-Clinical Practice – Tamara Bošković, Nenad Filipović

T.3.3 – Machine Learning Based Prediction of Cell Death after Silver Nanoparticle Treatment – Safi Ur Rehman Qamar, Wasi Ur Rehman Qamar, Nenad Filipović

T.3.4 – Recognizing Patterns of Emerging Chronic Obstructive Pulmonary Disease in Heart Failure Patients Through the Use of Machine Learning Techniques – Ognjen Pavić, Lazar Dašić, Andela Blagojević, Tijana Geroski, Nenad Filipović

T.3.5 – Benefits of Using Genetic Algorithms in Estimation of Parameters of a Numerical Model for Prediction of Cancer Progression – Tijana Đukić, Nevena Milivojević Dimitrijević, Marko Živanović, Nenad Filipović

T.3.6 – Harnessing Artificial Intelligence for the Design of New Potential Inhibitors of the Lipoygenase – Tamara M. Mladenović, Dušica M. Simijonović, Edina H. Avdović, Dejan A. Milenković, Zoran S. Marković

T.3.7 – Smarter than Mutation: AI-Based Drug Modification Against Pharmacological Resistance – Kristina Milisavljević, Žiko Milanović, Marko Antonijević

20:00 - 24:00	Gala Dinner
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Friday 30 May 2025

9:00 - 9:30	Keynote speaker: <i>The Road to General AI in Medicine: The Promise and Challenges</i> Prof. Zoran Bosnić Chair: Borko Furht
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9:30 - 10:00	Coffee Break
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Session F.1A: 10:00-12:00

Financial, Marketing and Law applied AI

Chair: Marko Selakovic

F.1A.1 – Leveraging Deep Learning and Word Embeddings for Financial Sentiment Analysis with ChatGPT-Based Data Augmentation – Vesna M. Ranković, Ljiljana N. Matić, Zoran S. Kalinić

F.1A.2 – The Role of Artificial Intelligence in Marketing Strategies: Opportunities and Challenges – Ana Spasojević

F.1A.3 - Algorithmic Dependencies and Regulatory Gaps: Journalism in the Age of AI – Tanja Krešvan

F.1A.4 – Will AI Replace Humans in Strategizing Communications? Ethical Considerations – Marko Selaković, Nikolina Ljepava, Marija Gačić, Nenad Filipović

F.1A.5 – The Interplay of Artificial Intelligence and International Public Law: Principle of Non-Intervention – Dragan Dakić

F.1A.6 – Self-Driving Dilemmas: The Collision of Technology and Legal Responsibility – Žaklina Spalević, Aleksanda Stojnev Ilić, Petar Spalević, Miloš Ilić, Dobrivoje Dubljanin

F.1A.7 – International Science Olympiads in Artificial Intelligence: a Passing Trend, or Here to Stay? – Vladimir M. Milovanović

F.1A.8 – Economic Evaluation of Heart Failure Strategies in the StratifyHF Project – Marija Gačić, Milica Kaplarević, Lazar Velicki, Đorđe Jakovljević, Nenad Filipović

Session F1B: 11:00-12:00

Generative AI

Chair: Veljko Milutinovic

F.1B.1 – Gamifying Risk Management: a Generative AI-Driven Tetris-Inspired Simulation for Enhanced Decision-Making – Zoran Č. Keković, Tijana Z. Čomić, Dragan V. Vukmirović, Ozren Dzigurski

F.1B.2 – A Comparison of Six Selected Computing Paradigms – Veljko Milutinović, Nenad Korolija

F.1B.3 – A Rapid Review on Artificial Intelligence Algorithms in The Study of Benthic Ecosystems: Applications, Performance and Future Trends – Gabriel Rivas-Mena, Nenad Filipović

12:00 - 14:00	<p>Keynote speakers:</p> <p><i>AI at the Edge of Precision: Accelerating AI Efficiency with Approximate Computing</i> Prof. Freddy Gabbay</p> <p><i>Digital Preservation of Family Heritage Enhanced Using Artificial Intelligence</i> Prof. Veljko Milutinovic</p> <p><i>On the Mission of the Cosmos University in Data Science and Artificial Intelligence</i> Prof. Panos Razis</p> <p><i>The Mission of NanoHUB</i> Prof. Gerhard Klimeck</p> <p>Chair: Zoran Bosnic</p>
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14:00 - 15:00	Buffet Lunch
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<p>Session F.2: 15:00-16:30</p> <p>Heart Failure</p> <p>Chair: Bogdan Milicevic</p>	
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F.2.1 – Software Architecture for StratifyHF: Heart Failure Risk Stratification and Diagnosis – Bogdan Milićević, Miljan Milošević, Miloš Ivanović, Nenad Filipović

F.2.2 – Heart Failure Disease Progression Assessment in Patients Through the use of Traditional Machine Learning Approaches – Anđela Blagojević, Smiljana Tomašević, Ognjen Pavić, Lazar Dašić, Tijana Geroski, Andrej Preveden, Lazar Velicki, Nenad Filipović

F.2.3 – Impact of Different Biomarkers on the Prediction Capabilities of Machine Learning Models in the Diagnosis of Heart Failure – Lazar Dašić, Anđela Blagojević, Ognjen Pavić, Tijana Geroski, Nenad Filipović

F.2.4 – Prediction of Different Symptoms Emergence in Heart Failure Patients Using Machine Learning Approaches – Teodora Jeremić, Lazar Dašić, Ognjen Pavić, Anđela Blagojević, Nenad Filipović

F.2.5 – Assessment of Morbidity in Patients with Heart Failure Using Traditional Machine Learning Techniques – Đorđe Ilić, Ognjen Pavić, Lazar Dašić, Anđela Blagojević, Nenad Filipović

F.2.6 – Risk of Death Assessment in Patients Suffering from Heart Failure Using Regression Analysis Techniques – Filip Filipović, Lazar Dašić, Anđela Blagojević, Ognjen Pavić, Nenad Filipović

16:30 - 17:00	Coffee Break
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17:00 - 18:30	<p style="text-align: center;">Keynote speaker: <i>On the Mission of the University of Wisconsin in the Domain of Entrepreneurship and Discovery</i> Prof. Jon Eckhardt <i>The Role of AI in Outdating Homo Sapiens</i> Prof. Alexander D. Stajković <i>Open Platforms for the Embodied AI era</i> Prof. Luca Benini Chair: David Naccache</p>
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Session F3: 18:30-19:45 Biomedical and Sport Engineering Chair: Aleksandra Vulovic	
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F.3.1 – Predicting of Controlled Drug Release from Intraocular Lens Using a Genetic Algorithm – Ana N. Mirić, Strahinja P. Milenković, Nevena N. Milivojević, Marko N. Živanović, Nenad D. Filipović

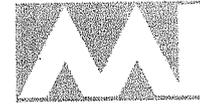
F.3.2 – Random-Forest Risk Classification in Hypertrophic Cardiomyopathy Patients – Jelena Pavić, Ognjen Pavić, Marko Živanović, Katarina Virijević, Tamara Mladenović, Nenad Filipović

F.3.3 – Explainable AI for Continuous Glucose Monitoring Data – Aleksandra I. Stojnev Ilić, Dragan H. Stojanović, Natalija M. Stojanović, Miloš N. Ilić

F.3.4 - Enhancing Robotic Grasping with Attention Mechanism and Slam-Based in the Dynamic Grasping Scenario – WL Zhao, JZ Guo, S Zhang, LT Liu, YM Jiang, JC Guo, L Zhou

F.3.5 - Multipurpose Wearable Sensory Device for Heart Failure Diagnosis and Biomarker Measurement - Nemanja Marković, Tijana Geroski, Ognjen Pavić, Lazar Dašić, Emil Jovanov, Nenad Filipović

19:45 - 20:00	Closing Ceremony
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LEVERAGING DEEP LEARNING AND WORD EMBEDDING FOR FINANCIAL SENTIMENT ANALYSIS WITH CHATGPT-BASED DATA AUGMENTATION

Vesna M. Ranković^{1*} [0000-0002-5445-9971], Ljiljana N. Matić² [0009-0002-0473-0214] and Zoran S. Kalinić² [0000-0001-8137-9005]

¹ Faculty of Engineering, University of Kragujevac, 6 Sestre Janjić Street, 34000 Kragujevac, Serbia
e-mail: vesnar@kg.ac.rs

² Faculty of Economics, University of Kragujevac, 3 Liceja Kneževine Srbije Street, 34000 Kragujevac, Serbia

e-mail: ljiljana.matic@ef.kg.ac.rs, zkalinic@kg.ac.rs

**corresponding author*

Abstract

Artificial Intelligence (AI) has a wide range of applications in business and finance, including the analysis of textual and unstructured documents and data. Financial Sentiment Analysis (FSA) is crucial for understanding the emotional tone and attitudes expressed in financial data presented in textual form. Financial sentiment classification models enable the automatic analysis of large market data volumes, identifying sentiment to recognize potential risks and opportunities, and can be useful tools for decision support for investors, managers, and traders. This study explores the effectiveness of combining word embedding techniques, such as Word2Vec and FastText, with deep learning architectures, including Bidirectional Long Short-Term Memory (BiLSTM) and Bidirectional Gated Recurrent Unit (BiGRU), to improve financial sentiment classification accuracy. A key challenge addressed is class imbalance in the financial sentiment dataset. To mitigate this, ChatGPT is used for data augmentation, generating synthetic samples to balance the dataset and enhance model performance. The proposed methodology is tested using the Financial PhraseBank dataset, where the class imbalance ratio between negative, positive, and neutral classes is 1:2.24:4.75. Simulation results suggest that augmenting the class with the fewest instances improved model performance. The cosine similarity between the actual and augmented samples is 0.908. The best results are achieved using a model based on Word2Vec vectorization with a BiGRU architecture, trained on both original and augmented data. The accuracy is 0.81, and the macro average F1 score is 0.79. The average F1 score for the minority classes increased by 12.2% compared to the model trained on the original data.

Keywords: financial sentiment analysis, deep learning, word embedding, data augmentation, ChatGPT.

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