ITAT 2026 Proceedings

26th Conference on
Information Technologies – Applications and Theory
Hotel Vršatec, Biele Karpaty, Slovakia

September 25 – 29, 2026

ITAT (Information Technologies – Applications and Theory) is an annual Czech-Slovak conference gathering scientists and experts working within a broad scope of computer science. The conference serves as a platform for workshops focused on results produced by senior scientists and young researchers fostering an exchange of ideas and informal discussions among participants.

ITAT 2026 took place in Hotel Vršatec, Biele Karpaty, Slovakia. ITAT 2026 hosted *Workshop on Computational Intelligence and Data Mining*, *Workshop on Natural Computing, Workshop on Automata, Formal and Natural Languages*, *Workshop on Applied Security* and *Workshop on Computational Aspects of Large-Scale Problems in Discrete Mathematics*. In summary, five international workshops provided an extensive overview of many interesting fields of computer science.

The first ITAT was organized in Zuberec in 2001. Accompanying workshops were introduced for the first time in 2013 in Donovaly. The popularity of such workshops has grown over time, attracting more international submissions. Based on this development, the ITAT steering committee in 2019 has decided to discontinue the main track of the conference and transform ITAT into a platform for hosting international workshops. By focusing on a smaller number of areas of interest, we are able to secure internationally recognized expert reviewers in workshop areas, which improve the papers under review and help to increase the quality of future papers by ITAT authors, whether submitting again to ITAT workshops or other international events. Despite its Czech-Slovak origin, workshop organizers open their workshops to participants from other countries.

The members of the steering committee of the ITAT series of conferences:

- Peter Gurský, Pavol Jozef Šafárik University in Košice, Slovakia
- Martin Holeňa, Czech Academy of Sciences, Czech Republic
- Tomáš Horváth, Edinburgh Napier University, Scotland, United Kingdom, and Pavol Jozef Šafárik University in Košice, Slovakia
- Markéta Lopatková, Charles University in Prague, Czech Republic
- Tomáš Vinař, Comenius University in Bratislava, Slovakia

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The organizing committee of ITAT 2026 worked in the following format:

- Peter Gurský, Pavol Jozef Šafárik University in Košice, Slovakia
- Martin Bača, Pavol Jozef Šafárik University in Košice, Slovakia
- Samuel Baran, Pavol Jozef Šafárik University in Košice, Slovakia
- Zoltán Szoplák, Pavol Jozef Šafárik University in Košice, Slovakia

We would like to thank members of the steering committee, the members of the program committees, the organizers of workshops and conference, the authors, the reviewers, and all the other people who significantly contributed to the successful ITAT 2026 conference.

The editors

14th International Workshop on Computational Intelligence and Data Mining – IWCIDM 2026 (Preface)

As a part of the workshop bundle ITAT 2026, the 14th International Workshop Computational Intelligence and Data Mining (IWCIDM 2026) has been organized. It is aimed at participants with research interests in any of these related areas, especially at PhD students and postdocs. Interested participants were invited to submit a paper in English, prepared according to the instructions at the ITAT 2026 web page.

This year, we received 16 papers by authors from 4 countries. Among them, 14 have been accepted for oral presentation and the 1 remaining for poster presentation. All 16 papers, however, have received a positive average evaluation by reviewers. Therefore, the final versions of all papers, reflecting the comments of reviewers, have been included in the CEUR proceedings.

A key factor influencing the overall quality of the workshop and of the final versions of the submitted papers is the workshop's program committee. The 14th International Workshop Computational Intelligence and Data Mining is grateful to the 24 reviewers from 8 who read the submitted papers and have provided competent, and in most cases very detailed, feedback to their authors. Most of them have a great international reputation witnessed by hundreds of WOS citations.

- Petr Berka, University of Economics, Prague
- Daniela Chudá, Kempelen Institute of Intelligent Technologies, Bratislava
- Jan Faigl, Czech Technical University, Prague
- Johannes Fürnkranz, Johannes Kepler University, Linz
- Pitoyo Hartono, University of Chukyo
- Martin Holeňa, Czech Academy of Sciences, Prague
- Tomáš Horváth, Edinburgh Napier University
- Ján Hric, Charles University, Prague
- Jan Kalina, Czech Academy of Sciences, Prague
- Jiří Kléma, Czech Technical University, Prague
- Tomas Krilavičius, Vytautas Magnus University, Kaunas
- Xiaoyi Jiang, University of Münster
- Věra Kůrková, Czech Academy of Sciences, Prague
- Johannes Lengler, ETH Zürich
- Antoni Ligęza, AGH University of Science and Technology, Krakow
- Rafael Gomes Mantovani, Federal Technology University of Paraná
- Mirko Navara, Czech Technical University, Prague
- Engelbert Mephu Nguifo, University of Clermont, Auvergne
- Irina Perfilieva, University of Ostrava
- Tomáš Pevný, Czech Technical University, Prague
- Jan Rauch, University of Economics, Prague

- Diederik Vermetten, Sorbonne Université, Paris
- Pascal Welke, Lancaster University Leipzig
- Filip Železný, Czech Technical University, Prague

7th Workshop on Automata, Formal and Natural Languages – WAFNL 2026 (Preface)

The Workshop on Automata, Formal and Natural Languages brought together researchers from automata theory, formal languages, natural language processing, and computational linguistics for its seventh edition, held as part of the Information Technologies – Applications and Theory (ITAT 2026) conference on September 25–26, 2026.

The workshop fostered collaboration among formal language researchers, NLP specialists, and linguists across Central Europe (and beyond). We welcomed and actively encouraged the participation of master's and doctoral students working in formal languages and computational linguistics, creating an inclusive environment where emerging researchers could connect with established experts.

We are delighted to thank Prof. Jernej Vičič (University of Primorska, Slovenia) for accepting our invitation and delivering an insightful invited talk on "AI text detection for under-resourced languages", which presented cutting-edge results from his recent research.

The regular paper track featured eight research and overview papers, each presenting novel scientific findings not published elsewhere. To ensure rigorous standards, every submitted paper underwent careful evaluation by at least two expert reviewers. We are pleased to include all papers accepted for presentation at WAFNL 2026 in the CEUR proceedings of ITAT 2026.

We thank the members of the WAFNL 2026 program committee for their thorough and thoughtful reviews of all submitted papers:

- Gabriela Andrejková, Pavol Jozef Šafárik University, Košice
- Markéta Lopatková, Charles University, Prague
- Peter Mlynárčik, Catholic University, Ružomberok
- František Mráz, Charles University, Prague (co-chair)
- Karel Oliva, Prague
- Dana Pardubská, Comenius University, Bratislava (co-chair)
- Martin Plátek, Charles University, Prague (co-chair)
- Martin Procházka, Prague
- Daniel Průša, Czech Technical University, Prague
- Rudolf Rosa, Charles University, Prague
- Alexandr Rosen, Charles University, Prague
- Peter Vojtáš, Charles University, Prague
- Marta Vomlelová, Charles University, Prague

Workshop on Natural Computing – WNC 2026 (Preface)

The Workshop on Natural Computing was held as part of the ITAT conference on September 25–29, 2026. The workshop provided a platform for researchers to present recent results, discuss emerging ideas, and exchange perspectives on various aspects of natural computing. Particular emphasis was placed on encouraging young researchers and PhD students to share their work and engage in scientific discussion within a collaborative and stimulating environment. The workshop was organized alongside four other workshops, creating opportunities for interaction across closely related and complementary research areas.

Natural computing encompasses both computational processes observed in natural systems and computational paradigms designed by humans and inspired by natural phenomena. The contributions presented at the workshop reflected the broad and interdisciplinary nature of the field and covered a range of topics, including:

- Molecular computing, including DNA computing,
- Cell-inspired computing, including membrane computing and amorphous computing,
- Cellular automata, swarm intelligence, and nature-inspired algorithms,
- Artificial immune systems and artificial life,
- Synthetic biology and biological networks, including genetic, protein-protein, and transport networks,
- Deep learning systems and their applications.

The workshop brought together researchers working across different areas of natural computing and provided an opportunity to discuss recent developments, exchange ideas, and explore potential connections between diverse computational approaches inspired by natural systems. We hope that the contributions collected in these proceedings will stimulate further research and collaboration within the natural computing community.

The seven regular papers included in these proceedings were selected through a peer-review process, with each submission evaluated by at least two independent anonymous reviewers. The scientific programme was complemented by an invited talk delivered by Alberto Leporati (University of Milan-Bicocca, Italy): *Spiking Neural P Systems: how to use them, and how to design them.*

The WNC 2026 Workshop Program Committee:

- Artiom Alhazov, Institute of Mathematics and Computer Science, Academy of Sciences of Moldova
- Lucie Ciencialová, Silesian University in Opava (co-chair)
- Luděk Cienciala, Silesian University in Opava
- Erzsébet Csuhaj-Varjú, Eötvös Loránd University, Budapest
- Marian Gheorghe, University of Bradford
- Jiří Kupka, IRAFM - Centre of Excellence IT4Innovations - University of Ostrava
- Alberto Leporati, Università degli Studi di Milano - Bicocca
- David Orellana Martín, University of Seville
- Agustín Riscos Núñez, University of Seville
- Petr Sosík, Silesian University in Opava

- Jose M. Sempere, Universitat Politècnica de València
- Sergey Verlan, University of Paris Est Créteil, IUT de Sénart-Fontainebleau
- Claudio Zandron, Dipartimento di Informatica, Sistemistica e Comunicazione, Universita' di Milano-Bicocca
- Gexiang Zhang, Chengdu University of Technology

The editors would like to express their sincere gratitude to the conference organizers, the members of the Programme Committee, the invited speaker, the authors of the contributions, the reviewers, and all participants for their valuable contributions to the success of the Workshop on Natural Computing and ITAT 2026. Their support, expertise, and active participation were essential to creating a stimulating and productive environment for scientific exchange.

Workshop on Computational Aspects of Large-Scale Problems in Discrete Mathematics – CADM 2026 (Preface)

CADM 2026 workshop was a continuation of a series of workshops held under the same name at ITAT 2023 and ITAT 2024. The 2026 workshop took place in hotel Vršatec from September 26 through September 27, 2026.

All workshops in the series aim to bring together young researchers in Discrete Mathematics whose work has a significant computational component or includes problems of significant computational complexity. The majority of participants included those who attended one or both of the previous workshops, but the workshop also attracted some attending for the first time; providing simultaneously continuity and novelty of the topics and approaches; with one of the new approaches being - not surprisingly - the use of Artificial Intelligence in large scale problems.

Participants were invited to prepare a short article about the specific computational aspects of problems they consider in their research, accompanied by a 25 minute presentation based on their article. Of the submitted articles, four have been selected for this option. Talks not accompanied by an article were also allowed, with seven participants selecting this path. The workshop also included participants not presenting a talk. On-site collaboration and exchange of ideas, techniques, tricks or hints were encouraged, and doctoral students presenting preliminary reports on their work, wishing to learn more about problems of computational character, or simply looking for inspiration, were particularly welcome.

All topics involving computational aspects or actual use of computers in Discrete Mathematics were considered. Each submitted contribution was reviewed by two members of the Programme Committee and evaluated with regard to the relevance of the topic, the originality of the use of the computing techniques, and the contribution's potential in becoming a topic of shared interest among the participants of the workshop. All published articles were refereed and recommended by at least two anonymous referees.

Jorik Jooken from Leiden University, the Netherlands, and KU Leuven, Belgium, accepted our invitation and presented an invited talk entitled *How can computers help in obtaining new results in graph theory?* also attended by participants of ITAT 2026 not belonging to the CADM community.

The Program Committee of the workshop consisted of the following researchers:

- Marien Abreu, Università degli Studi della Basilicata, Italy
- Grahame Erskine, Open University, UK
- Jan Goedgebeur, KU Leuven, Belgium
- Štefan Gyürki, Slovak Technical University, Slovakia
- Tatiana Jajcayová, Comenius University, Slovakia, co-chair
- Robert Jajcay, Comenius University, Slovakia, co-chair
- Jan Karabáš, Slovak Technical University, Slovakia
- František Kardoš, Comenius University, Slovakia & Université de Bordeaux and LaBRI
- Petr Kovář, Technical University of Ostrava, Czech Republic
- Tereza Kovářová, Technical University of Ostrava, Czech Republic
- Martin Mačaj, Comenius University, Slovakia
- Edita Máčajová, Comenius University, Slovakia

Workshop on Applied Security – WAS 2026 (Preface)

The Workshop on Applied Security was hosted as part of the ITAT conference on September 27 – 28th, 2026. The workshop created an opportunity for researchers and their students in the wide and complex field of computer systems security to come together and discuss current topics and trends in a welcoming environment. All submitted papers and extended abstracts were refereed by two independent anonymous reviewers. During the workshop, contributions were presented as 11 regular papers and 1 abstract. Topics included, e.g.:

- Theoretical and applied cryptography
- Security of hardware devices
- Network security and protocols
- Intrusion detection and prevention systems
- Malware analysis and detection techniques
- Privacy-enhancing technologies
- Mobile and IoT device security
- Machine learning threats, attacks, and risks
- Applications of Artificial Intelligence in Security
- Digital Forensics and Incident Response

The WAS 2026 Program Committee:

- Václav Bartoš (CESNET)
- Dušan Bernát (Comenius University)
- Milan Čermák (Masaryk University)
- Ladislav Hudec (Slovak University of Technology)
- Martin Husák (Masaryk University)
- Daniela Chudá (Slovak University of Technology)
- Matúš Jókay (Slovak University of Technology)
- Rastislav Krivoš-Belluš (Pavol Jozef Šafárik University)
- Richard Ostertág (Comenius University), main organizer, co-chair
- Pavol Sokol (Pavol Jozef Šafárik University)
- Martin Stanek (Comenius University), co-chair