ITAT 2022 Proceedings

22nd Conference on
Information Technologies – Applications and Theory
Hotel Tatrawest, Zuberec, Západné Tatry, Slovakia

September 23 – 27, 2022

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 2022 took place in Hotel Tatrawest, Zuberec, Západné Tatry, Slovakia. ITAT 2022 hosted *Workshop on Computational Intelligence and Data Mining*, *Workshop on Natural Computing*, *Workshop on Automata, Formal and Natural Languages*, and *Workshop on Computer Aided Constructions in Graph Theory*. In summary, four 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 to other international events. Despite its Czech-Slovak origin, workshop organizers open their workshops for participants from other countries.

The members of 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, ELTE University, Budapest, Hungary, and Pavol Jozef Šafárik University in Košice, Slovakia

- Markéta Lopatková, Charles University in Prague, Czech Republic

- Tomáš Vinař, Commenius University in Bratislava, Slovakia

The organizing committee of ITAT 2022 worked in the following format:

- Peter Gurský, Pavol Jozef Šafárik University in Košice, Slovakia

- Dávid Varga, Pavol Jozef Šafárik University in Košice, Slovakia

- Zoltán Szoplák, Pavol Jozef Šafárik University in Košice, Slovakia

- Ľubomír Antoni, 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 2022 conference.

The editors

10th International Workshop on Computational Intelligence and Data Mining – WCIDM 2022 (Preface)

The 10th International Workshop on Computational Intelligence and Data Mining (WCIDM 2022) has been organized as a part of the ITAT 2022 conference. The workshop is aimed at participants with research interests in any of these areas, but especially at PhD students and postdocs. Interested participants were invited to submit a paper in English, prepared according to the instructions at the ITAT 2022 web page.

At the start of this workshop series, nine years ago, we had only seven regular submissions from two countries. However, the interest in the computational intelligence and data mining workshops has grown over time. This year, we received 14 papers from 4 countries, among which 12 have been accepted for oral presentation and inclusion into 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. We are grateful to 32 reviewers from 14 countries who read the submitted papers and have provided competent, and in most cases very detailed, feedback to their authors. Each paper was reviewed by at least two anonymous reviewers. Most of reviewers have a great international reputation witnessed by hundreds of citations in the Web of Science.

The Program Committee:

- Dirk Arnold, Dalhousie University, Halifax

- Petr Berka, University of Economics, Prague

- Humberto Bustince, Public University of Navarra

- Carola Doerr, Sorbonne University, Paris

- Fabrizio Durante, Free University of Bozen-Bolzano

- Hans Engler, University of Georgetown

- Jan Faigl, Czech Technical University, Prague

- Johannes Fürnkranz, Johannes Kepler University, Linz

- Pitoyo Hartono, University of Chukyo

- Martin Holeňa, Czech Academy of Sciences, Prague

- Andreas Honlzinger, University of Technology, Graz

- Tomáš Horváth, Eötvös Loránd University, Budapest

- Ján Hric, Charles University, Prague

- Giovanni Iacca, University of Trento

- Arne Johanssen, University of Hamburg

- Jan Kalina, Czech Academy of Sciences, Prague

- Jiří Kléma, Czech Technical University, Prague

- Georg Krempl, University of Utrecht

- Tomas Krilavičius, Vytautas Magnus University, Kaunas

- Věra Kůrková, Czech Academy of Sciences, Prague

- Philippe Lenca, IMT Atlantique, Brest

- Johannes Lengler, ETH Zürich

- Antoni Ligęza, AGH University of Science and Technology, Krakow

- Rafael Gomes Mantovani, Federal Techonology University of Paraná

- Mirko Navara, Czech Technical University, Prague

- Engelbert Memphu Nguifo, Blaise Pascal University, Clermont-Ferrand

- Ostap Okhrin, Technical University of Dresden

- Irina Perilieva, University of Ostrava

- Petr Pošík, Czech Technical University, Prague

- Jan Rauch, University of Economics, Prague

- Tingting Zhang, Mid-Sweden University, Sundsvall

- Filip Železný, Czech Technical University, Prague

3rd Workshop on Automata, Formal and Natural Languages – WAFNL 2022 (Preface)

The Workshop on Automata, Formal and Natural Languages was focused on automata, formal languages, natural language processing, as well as on computational linguistics. It was held for the second time as a part of the Information Technologies – Applications and Theory (ITAT 2022) conference from September 25 to September 26, 2022. The workshop's main aim was to encourage cooperation among researchers in formal languages and natural language processing in Middle Europe. In order to attract young researchers, master and doctoral students of formal languages and computational linguistics were invited to participate.

The workshop consisted of an invited lecture, regular papers track, and an open session.

We thank Rudolf Rosa (Charles University, Prague, Czech Republic) for accepting our invitation and presenting recent results in his invited talk "THEaiTRE: Automatically generating theatre play scripts".

The regular papers track comprised research papers as well as overview and work-in-progress papers. All such contributions presented new scientific results not published elsewhere. Each submitted paper was reviewed by at least two reviewers. Five papers accepted for the presentation at WAFNL 2022 are included in the proceedings of ITAT 2022.

The poster and open session was organized in order to encourage further cooperation and sharing of information among investigators in automata and natural language processing. This offered an opportunity for anyone to present her/his work without writing a paper. Nevertheless, the text or at least the abstract of all open session contributions are published in separate proceedings available online on the web page of ITAT 2022.

We also thank the members of the program committee of WAFNL 2022 for reviewing the submitted papers:

- Gabriela Andrejková (Pavol Jozef Šafárik University, Košice, Slovakia),

- Jaroslava Hlaváčová (Charles University, Prague, Czech Republic),

- Tatiana Jajcayová (Comenius University, Bratislava, Slovakia),

- Markéta Lopatková (Charles University, Prague, Czech Republic),

- David Mareček (Charles University, Prague, Czech Republic),

- Peter Mlynárčik (University of Prešov, Prešov, Slovakia),

- František Mráz (Charles University, Prague, Czech Republic), co-chair,

- Friedrich Otto (University Kassel, Kassel, Germany),

- Dana Pardubská (Comenius University, Bratislava, Slovakia), co-chair,

- Martin Plátek (Charles University, Prague, Czech Republic), co-chair,

- Daniel Průša (Czech Technical University, Prague, Czech Republic),

- Rudolf Rosa (Charles University, Prague, Czech Republic),

- Jana Straková (Charles University, Prague, Czech Republic),

- Alexander Szabari (Pavol Jozef Šafárik University in Košice, Slovakia),

- Peter Vojtáš (Charles University, Prague, Czech Republic).

František Mráz, Prague
Dana Pardubská, Bratislava
Martin Plátek, Prague

Workshop on Natural Computing – WNC 2022 (Preface)

The Workshop on Natural Computing was hosted as part of the ITAT conference on September 23 – 27, 2022 and encouraged especially young researchers and PhD students to present their work and exchange ideas in a collaborative environment of four workshops with inspiring thematic overlaps. During the workshop, contributions were presented in the field of natural computation, i.e. computational processes observed in nature, and human-designed computation inspired by nature. Topics included e.g.:

- Cell-inspired computing (membrane computing)

- Biologically inspired grammatical models of complex systems (e.g., grammatical systems, reaction systems, Lindenmayer systems)

- Deep learning systems and applications

All published papers were referred by at least two anonymous reviewers. Four regular papers were complemented by an invited talk by Andrej Lúčny (Comenius University in Bratislava), entitled "Towards one-shot Learning via Attention".

The WNC 2022 Workshop Program Committee:

- Luděk Cienciala, Silesian University in Opava

- Lucie Ciencialová, Silesian University in Opava (co-chair)

- Erzsébet Csuhaj-Varjú, Eötvös Loránd University

- Marian Gheorghe, University of Bradford

- Alberto Leporati, Università degli Studi di Milano-Bicocca

- Andrei Paun, University of Bucharest

- Mario J. Pérez Jiménez, University of Seville

- Agustín Riscos-Núñez, University of Seville

- Jose M. Sempere, Universitat Politècnica de València

- Petr Sosík, Silesian University in Opava

- György Vaszil, University of Debrecen

- Gexiang Zhang, Chengdu University of Technology

The editors express their gratitude to the conference organizers, the program committee, the invited speaker, the authors of the papers, the reviewers, and all the participants for their contributions to the success of WNC and ITAT 2022.

Computer Aided Constructions in Graph Theory 2022 – CGT2022 (Preface)

CGT 2022 workshop was part of the ITAT conference, which took place in hotel Tatrawest, Zuberec, Západné Tatry, Slovakia, from September 23rd to September 27th, 2022. The aim of the workshop was to bring together young researchers in Graph Theory whose work includes a significant computational component. On site collaboration and exchange of ideas, techniques, tricks or hints were particularly encouraged. Doctoral students presenting preliminary reports on their work, wishing to learn more about the use of computers in other areas of Graph Theory, or simply looking for inspiration, were specifically encouraged to apply.

All topics involving the use of computers in Graph Theory (or even broadly, in Combinatorics) 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.

We thank Jan Goedgebeur (KU Leuven, Belgium) for accepting our invitation and presenting recent results in his invited talk "An introduction to computational graph theory and generation algorithms".

The Program Committee:

- Marien Abreu, Universita degli Studi della Basilicata, Italy

- Grahame Erskine, Open University, UK

- Geoffrey Exoo, Indiana State University, USA

- Slobodan Filipovski, University of Primorska, Slovenia

- Štefan Gyurki, Slovak Technikal University, Slovakia

- Tatiana Jajcayová Comenius University, Slovakia, co-chair

- Robert Jajcay, Comenius University, Slovakia, co-chair

- Jan Karabáš, Matej Bel University, Slovakia

- Petr Kovář, Technical University of Ostrava, Czech Republic

- Tereza Kovářová, Technical University of Ostrava, Czech Republic

- Rastislav Kráľovič, Comenius University, Slovakia

- Robert Lukoťka, Comenius University, Slovakia

- Martin Mačaj, Comenius University, Slovakia

- Ján Mazák, Comenius University, Slovakia

- Primož Šparl, University of Ljubljana, Slovenia

- James Tuite, Open University, UK