Advances in Databases and Information Systems - 26th European Conference, ADBIS 2022, Turin, Italy, September 5-8, 2022, Proceedings

Lecture Notes in Computer Science 13389

More information about this series at https://link.springer.com/bookseries/558

Silvia Chiusano · Tania Cerquitelli ·
Robert Wrembel (Eds.)

Advances in Databases and Information Systems

26th European Conference, ADBIS 2022 Turin, Italy, September 5–8, 2022 Proceedings

Springer

Editors
Silvia Chiusano
Politecnico di Torino
Turin, Italy

Tania Cerquitelli
Politecnico di Torino
Turin, Italy

Robert Wrembel
Poznań University of Technology
Poznań, Poland

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-031-15739-4 ISBN 978-3-031-15740-0 (eBook)
https://doi.org/10.1007/978-3-031-15740-0

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This year ADBIS – the European Conference on Advances in Databases and Information Systems – celebrated its 26th anniversary.

The first ADBIS conference was held in Saint Petersburg, Russia (1997). Since then, ADBIS has taken place annually, with previous editions held in Poznan, Poland (1998); Maribor, Slovenia (1999); Prague, Czech Republic (2000); Vilnius, Lithuania (2001); Bratislava, Slovakia (2002); Dresden, Germany (2003); Budapest, Hungary (2004); Tallinn, Estonia (2005); Thessaloniki, Greece (2006); Varna, Bulgaria (2007); Pori, Finland (2008); Riga, Latvia (2009); Novi Sad, Serbia (2010); Vienna, Austria (2011); Poznan, Poland (2012); Genoa, Italy (2013); Ohrid, North Macedonia (2014); Poitiers, France (2015); Prague, Czech Republic (2016); Nicosia, Cyprus (2017); Budapest, Hungary (2018); Bled, Slovenia (2019); Lyon, France (2020); and Tartu, Estonia (2021).

The official ADBIS portal – http://adbis.eu – provides up to date information on all ADBIS conferences, committees, publications, and issues related to the ADBIS community.

The 26th ADBIS conference was held in Turin, Italy, during September 5–8, 2022, as a hybrid event. It received significant attention from both the research and industrial communities, as 90 papers were submitted to the conference. In total, 280 authors from 32 different countries submitted their research contributions to ADBIS 2022. The submitted papers had, on average, 3.1 authors each, and most of them were the outcome of international cooperation. The papers were reviewed by an international Program Committee (PC) consisting of 85 members.

The Program Committee selected 23 regular research papers for inclusion in this volume (an acceptance rate of 25%). The selected papers span a wide spectrum of topics related to the ADBIS conference from different areas of research in database and information systems, including graph processing, time series and data streams, data quality, OLAP, advanced querying, performance, and machine learning. The Program Committee also selected 28 short papers (an acceptance rate of 42%), which were included in CCIS, volume 1652.

ADBIS 2022 featured the following four keynote speakers:

- Sihem Amer-Yahia (CNRS, University of Grenoble Alpes, France) - AI-Powered Data-driven Education
- Daniele Quercia (King's College London and Nokia Bell Labs, UK) - Insider Stories: Analyzing Stress, Depression, and Staff Welfare at Major US Companies from Online Reviews
- Carlo Curino (Microsoft, USA) - Tensor Query Processing: Neural Network $$ to speed up Databases and Classical ML!

– Bruno Lepri (Bruno Kessler Foundation, Italy) - Understanding and rewiring cities and societies: a computational social science perspective

ADBIS 2022 was also accompanied by the following tutorials:

– Mirjana Ivanović (University of Novi Sad, Serbia) - AI approaches in processing and using data in personalized medicine
– Rosa Meo (University of Turin, Italy) - Explainable, Interpretable, Trustworthy, Responsible, Ethical, Fair, Verifiable AI... What's Next?
– Johann Gamper (Free University of Bozen-Bolzano) - What's New in Temporal Databases?
– Stefano Rizzi (University of Bologna, Italy) - OLAP and NoSQL: Happily Ever After

Thanks to the reputation of ADBIS, selected best papers of ADBIS 2022 will be invited for a special issue of the following Q1 journals: Information Systems (Elsevier) and Information Systems Frontiers (Springer). Therefore, the PC chairs would like to express their sincere gratitude to the Information Systems Editors-in-Chief: Dennis Shasha, Gottfried Vossen, and Matthias Weidlich, as well as the Information Systems Frontiers Editors-in-Chief: Ram Ramesh and H. Raghav Rao, for their approval of these special issues.

Finally, we would like to thank everyone who contributed to ADBIS 2022:

– the authors for submitting their research papers to the conference;
– the keynote speakers and tutorial presenters who honored us with their insightful talks;
– members of the Program Committee and external reviewers for dedicating their time and expertise to build the conference program;
– members of the ADBIS Steering Committee for their trust and support, and especially its chair Yannis Manolopoulos;
– all members of the Organizing Committee; and
– our partners:

  • Politecnico di Torino for hosting and supporting the event;
  • the Department of Control and Computer Engineering and the SmartData center at Politecnico di Torino for supporting the event; and
  • Springer for publishing the proceedings and constant support for the conference over years.

The ADBIS 2022 Organizing Committee supported diversity and inclusion by offering some grants, supporting a few researchers to participate in the conference and become part of the ADBIS community. All grants were assigned based on the underrepresented community, gender, and role/position. The grants included:

– two free regular registrations, assigned to researchers from Argentina and Brazil,
– three regular registration fee discounts of 200 Euros, assigned to researchers from Estonia, Lebanon, and Italy, and

– four regular registration fee discounts of 150 Euros, assigned to researchers from Croatia, France, and Italy.

July 2022

Silvia Chiusano
Tania Cerquitelli
Robert Wrembel

Organization

General Chair

Silvia Chiusano	Polytechnic University of Turin, Italy

Program Committee Chairs

Tania Cerquitelli	Polytechnic University of Turin, Italy
Robert Wrembel	Poznan University of Technology, Poland

Workshop Chairs

Kjetil Nørvåg	Norwegian University of Science and Technology, Norway
Barbara Catania	University of Genoa, Italy

Doctoral Consortium Chairs

Genoveva Vargas Solar	CNRS, LIRIS, France
Ester Zumpano	University of Calabria, Italy

Local Organization Committee Chairs

Luca Cagliero	Polytechnic University of Turin, Italy
Paolo Garza	Polytechnic University of Turin, Italy
Bartolomeo Vacchetti	Polytechnic University of Turin, Italy
Giovanni Malnati	Polytechnic University of Turin, Italy

Publicity Chair

Oscar Romero	Polytechnic University of Catalonia - BarcelonaTech, Spain

Proceedings Chair

Khalid Belhajjame	Paris Dauphine University - PSL, France

Special Issue Chair

Ladjel Bellatreche	ISAE-ENSMA, France

Diversity and Inclusion Chair

Jérôme Darmont	University of Lyon 2, France

Steering Committee

Andreas Behrend	TH Köln, Germany
Ladjel Bellatreche	ISAE-ENSMA, France
Maria Bielikova	Kempelen Institute of Intelligent Technologies, Slovakia
Barbara Catania	University of Genoa, Italy
Jérôme Darmont	University of Lyon 2, France
Johann Eder	Universität Klagenfurt, Austria
Johann Gamper	Free University of Bozen-Bolzano, Italy
Tomáš Horváth	Eötvös Loránd University, Hungary
Mirjana Ivanović	University of Novi Sad, Serbia
Marite Kirikova	Riga Technical University, Latvia
Manuk Manukyan	Yerevan State University, Armenia
Raimundas Matulevicius	University of Tartu, Estonia
Tadeusz Morzy	Poznan University of Technology, Poland
Kjetil Nørvåg	Norwegian University of Science and Technology, Norway
Boris Novikov	National Research University, Higher School of Economics, Saint Petersburg, Russia
George Papadopoulos	University of Cyprus, Cyprus
Jaroslav Pokorný	Charles University in Prague, Czech Republic
Oscar Romero	Polytechnic University of Catalonia - BarcelonaTech, Spain
Sergey Stupnikov	Russian Academy of Sciences, Russia
Bernhard Thalheim	University of Kiel, Germany
Goce Trajcevski	Iowa State University, USA
Valentino Vranić	Slovak University of Technology in Bratislava, Slovakia
Tatjana Welzer	University of Maribor, Slovenia
Robert Wrembel	Poznan University of Technology, Poland
Ester Zumpano	University of Calabria, Italy

Program Committee

Alberto Abelló	Polytechnic University of Catalonia - BarcelonaTech, Catalonia
Cristina D. Aguiar	University of São Paulo, Brasil
Syed Muhammad Fawad Ali	IBM, Germany
Bernd Amann	Sorbonne University, France
Witold Andrzejewski	Poznan University of Technology, Poland
Daniele Apiletti	Polytechnic University of Turin, Italy
Costin Badica	University of Craiova, Romania
Sylvio Barbon Junior	University of Trieste, Italy
Andreas Behrend	University of Bonn, Germany
Khalid Belhajjame	Paris Dauphine University - PSL, France
Ladjel Bellatreche	ISAE-ENSMA, France
András Benczúr	Eötvos Loránd University, Hungary
Fadila Bentayeb	University of Lyon 2, France
Maria Bielikova	Kempelen Institute of Intelligent Technologies, Slovakia
Sandro Bimonte	INRAE, France
Pawel Boiński	Poznan University of Technology, Poland
Zoran Bosnić	University of Ljubljana, Slovenia
Omar Boussaid	University of Lyon 2, France
Drazen Brdjanin	University of Banja Luka, Bosnia and Herzegovina
Damiano Carra	University of Verona, Italy
Jérôme Darmont	University of Lyon 2, France
Claudia Diamantini	Marche Polytechnic University, Italy
Christos Doulkeridis	University of Piraeus, Greece
Johann Eder	University of Klagenfurt, Austria
Markus Endres	University of Passau, Germany
Javier A. Espinosa-Oviedo	University of Lyon, France
Georgios Evangelidis	University of Macedonia, Greece
Flavio Ferrarotti	Software Competence Centre Hagenberg, Austria
Alessandro Fiori	Polytechnic University of Turin, Italy
Flavius Frasincar	Erasmus University Rotterdam, The Netherlands
Johann Gamper	Free University of Bozen-Bolzano, Italy
Matteo Golfarelli	University of Bologna, Italy
Marcin Gorawski	Silesian University of Technology, Poland
Jānis Grabis	Riga Technical University, Latvia
Francesco Guerra	University of Modena and Reggio Emilia, Italy
Giancarlo Guizzardi	Federal University of Espirito Santo, Brazil
Tomas Horvath	Eötvös Loránd University, Hungary
Mirjana Ivanović	University of Novi Sad, Serbia

Stefan Jablonski	University of Bayreuth, Germany
Aida Kamišalić	University of Maribor, Slovenia
Zoubida Kedad	University of Versailles, France
Attila Kiss	Eötvös Loránd University, Hungary
Julius Köpke	University of Klagenfurt, Austria
Dejan Lavbič	University of Ljubljana, Slovenia
Yurii Litvinov	St. Petersburg State University, Russia
Audrone Lupeikiene	Vilnius University, Lithuania
Federica Mandreoli	University of Modena and Reggio Emilia, Italy
Yannis Manolopoulos	Open University of Cyprus, Cyprus
Patrick Marcel	University of Tours, France
Sara Migliorini	University of Verona, Italy
Angelo Montanari	University of Udine, Italy
Lia Morra	Polytechnic University of Turin, Italy
Tadeusz Morzy	Poznan University of Technology, Poland
Boris Novikov	National Research University, Higher School of Economics, Russia
Kjetil Nørvåg	Norwegian University of Science and Technology, Norway
Andreas Oberweis	Karlsruhe Institute of Technology, Germany
George Papadopoulos	University of Cyprus, Cyprus
András Pataricza	Budapest University of Technology and Economics, Hungary
Jan Platos	Technical University of Ostrava, Czech Republic
Jaroslav Pokorný	Charles University in Prague, Czech Republic
Giuseppe Polese	University of Salerno, Italy
Alvaro E. Prieto	University of Extremadura, Spain
Elisa Quintarelli	University of Verona, Italy
Miloš Radovanović	University of Novi Sad, Serbia
Franck Ravat	University of Toulouse, France
Stefano Rizzi	University of Bologna, Italy
Oscar Romero	Polytechnic University of Catalonia, Spain
Gunter Saake	University of Magdeburg, Germany
Kai-Uwe Sattler	TU Ilmenau, Germany
Milos Savic	University of Novi Sad, Serbia
Claudia Steinberger	University of Klagenfurt, Austria
Sergey Stupnikov	Russian Academy of Sciences, Russia
Bernhard Thalheim	University of Kiel, Germany
Goce Trajcevski	Iowa State University, USA
Raquel Trillo-Lado	University of Zaragoza, Spain
Genoveva Vargas Solar	CNRS, LIRIS, France

Goran Velinov	Ss. Cyril and Methodius University, North Macedonia
Peter Vojtas	Charles University in Prague, Czech Republic
Isabelle Wattiau	ESSEC and Cnam, France
Marek Wojciechowski	Poznan University of Technology, Poland
Vladimir Zadorozhny	University of Pittsburgh, USA
Ester Zumpano	University of Calabria, Italy

Additional Reviewers

Stylianos Argyrou	Joseph Giovanelli
Paul Blockhaus	Nicolas Labroche
Miroslav Blšták	Christos Mettouris
Andrea Brunello	Simone Monaco
Gabriel Campero Durand	Federico Motta
Andrea Chiorrini	Uchechukwu Njoku
Francesco Del Buono	Thomas Photiadis
Chiara Forresi	Matúš Pikuliak
Marco Franceschetti	Nicola Saccomanno
Matteo Francia	Vladimir A. Shekhovtsov
Verena Geist	Emanuele Storti

Abstracts of the Keynote Talks

Toward AI-Powered Data-Driven Education

Sihem Amer-Yahia

CNRS, Univ. Grenoble Alpes, France

Abstract. Educational platforms are increasingly becoming AI-driven. Besides providing a wide range of course filtering options, personalized recommendations of learning material and teachers are driving today's research. While accuracy plays a major role in evaluating those recommendations, many factors must be considered including learner retention, throughput, upskilling ability, equality of learning opportunities, and satisfaction. This creates a tension between learner-centered and platform-centered approaches. I will describe research at the intersection of data-driven recommendations and education theory. This includes multi-objective algorithms that leverage collaboration and affinity in peer learning, studying the impact of learning strategies on platforms and people, and automating the generation of sequences of courses. I will end the talk with a discussion of the central role data management systems could play in enabling holistic educational experiences.

Insider Stories: Analyzing Stress, Depression, and Staff Welfare at Major US Companies from Online Reviews

Daniele Quercia

King's College London, and Nokia Bell Labs in Cambridge, UK

Abstract. We mined 440K company reviews published during twelve successive years on GlassDoor, and developed state-of-the-art deep-learning frameworks to accurately extract mentions of:

1. Stress [1, 2]. There are two types of stress: distress refers to harmful stimuli, while eustress refers to healthy, euphoric stimuli that create a sense of fulfillment and achievement. Telling the two types of stress apart is challenging, let alone quantifying their impact across corporations. We scored each company to be either a low stress, passive, negative stress, or positive stress company. We found that (former) employees of positive stress companies tended to describe high-growth and collaborative workplaces in their reviews, and that such companies' stock evaluations grew, on average, 5.1 times in 10 years (2009–2019) as opposed to the companies of the other three stress types that grew, on average, 3.7 times in the same time period. We also found that the four stress scores aggregated every year – from 2008 to 2020 – closely followed the unemployment rate in the U.S.: a year of positive stress (2008) was rapidly followed by several years of negative stress (2009–2015), which peaked during the Great Recession (2009–2011).
2. Internal Sustainability Efforts (ISEs) [3], which reflect whether a company supports gender equality, diversity, and general staff welfare. Commitment to ISEs manifested itself not only at micro-level (companies scoring high in ISEs enjoyed high stock growth) but also at macro-level (states hosting these companies were economically wealthy and equal, and attracted the so-called creative class).

References

1. Pressure Test: Good Stress for Company Success. https://arxiv.org/abs/2107.12362
2. Sen, I., et al.: Depression at Work: Exploring Depression in Major US Companies from Online Reviews. In: Proceedings of the ACM on Human-Computer Interaction, 2022
3. Insider Stories: Analyzing Internal Sustainability Efforts of Major US Companies from Online Reviews. https://arxiv.org/abs/2205.01217

Tensor Query Processing: Neural Network $$ to speed up Databases and Classical ML!

Carlo Curino

Microsoft, USA

Abstract. Massive market interest in AI has driven unprecedented investments in Special HW and runtimes for Neural Networks. Tensor computations are emerging as the de-facto API for all these special HW and runtimes. In this talk, we show how we can automatically transform and optimize relational queries and Classical ML pipelines into tensor computations, and run on special hardware. Interestingly the performance we obtain significantly outperform classical systems and even custom-build GPU DBMSs. At the same time, this approach retains very low engineering costs, thanks to a minute code footprint (<10 k LoC) and free portability—as we piggyback on tensor runtimes getting ported to all the new HW coming out. We conclude touching on further research directions that emerge once both queries and ML models are uniformly represented as tensors computations.

Understanding and Rewiring Cities and Societies: A Computational Social Science Perspective

Bruno Lepri

Bruno Kessler Foundation, Italy

Abstract. The almost universal adoption of mobile phones, the exponential growth in the usage of Internet services and social media platforms, and the proliferation of digital payment systems, wearable devices, and connected objects has led to the existence of unprecedented amounts of data about human behavior. Thus, we live in an unprecedented historic moment where the availability of vast amounts of behavioral data, combined with advances in machine learning, are enabling us to build predictive computational models of human behavior. In my talk, I will show examples of how those computational models of human behavior can be used to better understand and to design more efficient companies, cities, and societies, For example, I will present some works where we have leveraged mobile phone data, credit card transactions, Google Street View images, and social media data in order (i) to infer how vital and livable a city is, (ii) to find the urban conditions that magnify and influence urban life, (iii) to study their relationship with societal outcomes such as urban crime and segregation, and (iv) to model the impact of migrations and pandemic shocks such as COVID-19, etc. Finally, I will also discuss key human-centric requirements for a positive disruption of these novel approaches including a fundamental renegotiation of user-centric data ownership and management, the development of tools and participatory infrastructures towards increased algorithmic transparency and accountability, and the creation of living labs for experimenting and co-creating data-driven policies.

Contents

Machine Learning

Data Science Methods