

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

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# Advances in Databases and Information Systems

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

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# 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  
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# **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.

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