

## Founding Editors

Gerhard Goos

*Karlsruhe Institute of Technology, Karlsruhe, Germany*

Juris Hartmanis

*Cornell University, Ithaca, NY, USA*

## Editorial Board Members

Elisa Bertino

*Purdue University, West Lafayette, IN, USA*

Wen Gao

*Peking University, Beijing, China*

Bernhard Steffen

*TU Dortmund University, Dortmund, Germany*

Gerhard Woeginger 

*RWTH Aachen, Aachen, Germany*

Moti Yung

*Columbia University, New York, NY, USA*

More information about this series at <http://www.springer.com/series/7409>


Chiara Ghidini · Olaf Hartig ·  
Maria Maleshkova · Vojtěch Svátek ·  
Isabel Cruz · Aidan Hogan ·  
Jie Song · Maxime Lefrançois ·  
Fabien Gandon (Eds.)

# The Semantic Web – ISWC 2019

18th International Semantic Web Conference  
Auckland, New Zealand, October 26–30, 2019  
Proceedings, Part II

### Editors


Chiara Ghidini   
Fondazione Bruno Kessler  
Trento, Italy

Maria Maleshkova   
University of Bonn  
Bonn, Germany


Isabel Cruz  
University of Illinois at Chicago  
Chicago, IL, USA


Jie Song  
Memect Technology  
Beijing, China

Fabien Gandon   
Inria Sophia Antipolis - Méditerranée  
Sophia Antipolis, France

Olaf Hartig   
Linköping University  
Linköping, Sweden

Vojtěch Svátek   
University of Economics Prague  
Prague, Czech Republic

Aidan Hogan   
University of Chile  
Santiago, Chile

Maxime Lefrançois   
Mines Saint-Etienne  
Saint-Etienne, France

ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-030-30795-0

ISBN 978-3-030-30796-7 (eBook)

<https://doi.org/10.1007/978-3-030-30796-7>

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI

© Springer Nature Switzerland AG 2019

The chapter “The SEPSES Knowledge Graph: An Integrated Resource for Cybersecurity” is Open Access. This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>). For further details see license information in the chapter.

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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

# Preface

*Knowledge graphs, linked data, linked schemas and AI ... on the Web.*

Now in its 18th edition, the ISWC conference is the most important international venue to discuss and present latest advances and applications of the Semantic Web, Linked Data, Knowledge Graphs, Knowledge Representation, and Intelligent Processing on the Web. At the beginning of the 2000s this research community was formed, starting with the first international Semantic Web Working Symposium (SWWS), a workshop held in Stanford, Palo Alto, held during July 30 to August 1, 2001. The following year the symposium became the International Semantic Web Conference (ISWC) series in Sardinia, Italy, and at that time the website was predicting that it would be a major international forum at which research on all aspects of the Semantic Web would be presented. And indeed, as in previous editions, ISWC 2019 brought together researchers and practitioners from all over the world to present fundamental research, new technologies, visionary ideas, new applications, and discuss experiences. It featured a balanced mix of fundamental research, innovations, scientific artefacts such as datasets, software, ontologies, or benchmarks, and applications that showcase the power and latest advances of semantics, data, and artificial intelligence on the Web.

In 2019 we celebrated the 30th anniversary of the Web [2]. Happy birthday to you, Web! But our community also remembers that 25 years ago, Tim Berners-Lee et al. were already proposing in an article of the Communications of the ACM August 1994, to provide on the Web “more machine-oriented semantic information, allowing more sophisticated processing” [1]. And since the beginning, the Semantic Web community in general, and ISWC participants in particular, have always been interested in providing intelligent processing of the linked data and linked schemata of the Web, starting with querying, reasoning, and learning [3, 4]. This remains a core challenge of our community, tackling problems in using open data of very different sources and quality, as well as ensuring the best results possible and scaling the methods so they can face the real World Wide Web. For these reasons, and to explore the links between the Semantic Web and the latest advances in AI and knowledge graphs, the motto for ISWC 2019 was “knowledge graphs, linked data, linked schemas and AI on the Web.”

Several facets of this topic were addressed in three distinguished keynote talks and a panel. Dougal Watt’s keynote is entitled “Semantics: the business technology disruptor of the future” and defends the role of semantics in bringing meaning to business data. The keynote of Jérôme Euzenat is entitled “For Knowledge” and defends the grand goal of formally expressing knowledge on the Web and supporting its evolution, distribution, and diversity. After this keynote, a panel entitled “How Much Semantics Goes How Long a Way?” continued the discussion on linked knowledge, schemas, and ontologies on the Web. Finally, in her keynote entitled “Extracting Knowledge from the Data Deluge to Reveal the Mysteries of the Universe,” Melanie Johnston-Hollitt

introduced us to one of the most data-intensive research fields (radio astronomy) that requires many innovations to achieve scalability and the “big data” regime.

The proceedings of ISWC 2019 are presented in two volumes: the first one containing the research track papers and the second one the resource track and in-use track papers. All these papers were peer reviewed. Combined, these tracks received a total of 283 submissions of which 443 reviewers accepted 74 papers: 42 in the research track, 11 in the in-use track, and 21 in the resource track. Beyond these three tracks and at the moment of writing this preface, this edition of the international conference ISWC already involved more than 1,300 authors of submitted papers, demos, posters, etc. and more than 660 reviewers for all the tracks, amounting to them being of 44 different nationalities. This year again, the number of papers in the resources category attests the commitment of the community to sharing and collaboration.

The excellent reputation of ISWC as a prime scientific conference was confirmed again this year. The research track received 194 valid full paper submissions, out of which 42 papers were selected, leading to an acceptance rate of 21.6%. This year, a double-blind approach was applied to the reviewing process; that is, the identity of the submission authors was not revealed to the reviewers and vice versa. The Program Committee (PC) comprised 26 Senior PC members and 270 regular PC members. In addition, 70 sub-reviewers were recruited to help with the review process. The PC chairs thank all these committee members for the time and energy they have put into the process. ISWC has very rigorous reviewing criteria. The papers were assessed for originality, novelty, relevance and impact of the research contributions, soundness, rigor and reproducibility, clarity and quality of presentation, and grounding in the literature. This year, the vast majority of papers were reviewed by a team comprising four reviewers and a senior PC member, who engaged in a discussion phase after the initial reviews were prepared and the authors responses were made available. Each paper was then discussed among the research track PC chairs and the senior PC members, so as to reach a consensus on the final list of accepted papers.

For the first time in the history of ISWC, we organized a specific initiative to evaluate the reproducibility of research papers. This innovative track was led by Alejandra Gonzalez-Beltran and Michael Cochez. Authors of accepted papers were invited to share their experimental setup and code for evaluation. We received 11 submissions which were assessed in their varying degrees of reproducibility by a member of the Reproducibility Committee. The ‘reproducer’, rather than reviewer, interacted with the authors and aimed to execute the code and obtain results similar to what was reported in the paper. If the results were reproducible, the paper received the reproducibility label.

The resources track promoted the sharing of high-quality information artifacts that have contributed to the generation of novel scientific work. Resources could be datasets, ontologies, vocabularies, ontology design patterns, benchmarks, crowdsourcing designs, software frameworks, workflows, protocols, or metrics, among others. This track demonstrates how important it is for our community to share reusable resources in order to allow other researchers to compare new results, reproduce experimental

research, and explore new lines of research, in accordance with the FAIR principles for scientific data management. All published resources address a set of requirements: persistent URI, indicator for impact, support for reuse, license specification, to mention a few. This year the track chairs Maria Maleshkova and Vojtěch Svátek received 64 submissions, of which 21 were accepted (a 33% acceptance rate), covering a wide range of resource types such as benchmarks, ontologies, datasets, and software frameworks, in a variety of domains such as music, health, scholar, drama, and audio, and addressing multiple problems such as RDF querying, ontology alignment, linked data analytics, or recommending systems. The reviewing process involved 87 PC members and 7 sub-reviewers, supported by 8 senior PC members. The average number of reviews per paper was 3.1 (at least three per paper), plus a meta-review provided by a senior PC member. Papers were evaluated based on the availability of the resource, its design and technical quality, impact, and reusability; owing to the mandatory dereferenceability and community-visibility of the resources (precluding the author anonymity), the papers were reviewed in a single-blind mode. The review process also included a rebuttal phase and further discussions among reviewers and senior PC members, who provided recommendations. Final decisions were taken following a detailed analysis and discussion of each paper conducted by the program chairs and the senior PC.

The in-use track aimed to showcase and learn from the growing adoption of Semantic Web and related technologies in real-world settings, in particular to address questions such as: where are such technologies being used, what are their benefits, and how can they be improved with further research? The track chairs Isabel Cruz and Aidan Hogan received 25 paper submissions and 11 papers were accepted, giving an acceptance rate of 44%; this reflects a significant increase in papers accepted over previous years, indicative of a growing maturation and adoption of Semantic Web and related technologies. In the in-use track, 39 PC members contributed three reviews per paper and took part in an extensive discussion on each paper, to ensure a high-quality program. The accepted papers describe successful applications of technologies including ontologies, knowledge graphs, linked data, and RDB2RDF. The results described by these papers were developed in whole, or with collaboration from, both large companies (e.g., Pinterest, Springer Nature, IBM, and JOT Internet Media), start-ups (Capsenta), as well as public organizations (e.g., Norwegian Institute for Water Research and European Commission).

The industry track provided an opportunity for industry adopters to highlight and share the key learnings and challenges faced by real world implementations. This year, the track chairs Anna Lisa Gentile and Christophe Guéret received 24 submissions from a wide range of companies of different sizes and 16 submissions were accepted. The submissions were assessed in terms of: quantitative and/or qualitative value proposition provided; amount of discussion of innovative aspects, experiences, impact, lessons learned, and business value in the application domain; and degree to which semantic technologies are critical to the offering. Each paper received 3 assigned reviewers from a panel of academic and industry Semantic Web experts.

The main conference program was complemented by presentations from the journal, industry, and posters and demos tracks, as well as the Semantic Web Challenge and a panel on future trends in knowledge graphs.

The journal track was intended as a forum for presenting significant Semantic Web-related research results that have been recently published in well-known and well-established journals but that have not been presented at a Semantic Web-related conference. The goal was to highlight these results at ISWC and promote discussions potentially leading to meaningful multi-disciplinary collaborations. Traditionally only articles published in the *Journal of Web Semantics* (JWS) and the *Semantic Web Journal* (SWJ) were considered for the ISWC journal track. However, with the goal of enabling cross-fertilization with other related communities, this year our two chairs Claudia d'Amato and Lalana Kagal included additional journals such as: the *Journal of Network and Computer Applications*, *IEEE Transactions on Neural Networks and Learning Systems*, the *Journal of Machine Learning Research*, the *Data Mining and Knowledge Discovery Journal*, *ACM Transactions on the Web*, *ACM Computing Surveys*, *IEEE Transactions on Knowledge and Data Engineering*, *ACM Transactions on Computer-Human Interaction*, *Artificial Intelligence Journal*, *Proceedings of the Very Large Database Endowment*, and the *Journal of Information Science*. Papers that fell within the ISWC topics which had been published within the listed journals starting from January 1, 2017, were considered eligible for submission to the journal track. We received 24 extended abstract submissions, out of which 13 were accepted and collected as CEUR proceedings. Each submission was reviewed by at least two members of the PC in order to assess how interesting it was as well as its novelty, relevance, and attractiveness for the ISWC audience. Also taken into consideration was the quality of the extended abstracts and the diversity of the topics, spanning from scalable reasoning and triple storage, machine translation, fact predictions on (probabilistic) knowledge graphs, modeling linked open data for different domains, and semantic sensor networks.

The conference included several events appreciated by the community, which created more opportunities to present and discuss emerging ideas, network, learn, and mentor. Thanks to H. Sofia Pinto and 武田 英明 (Hideaki Takeda), the workshops and tutorials program included a mix of established topics such as ontology matching, ontology design patterns, and semantics-powered data mining, as well as analytics alongside newer ones that reflect the commitment of the community to innovate and help create systems and technologies that people want and deserve, including semantic explainability or blockchain enabled Semantic Web. Application-centric workshops ranged from solutions for large-scale biomedical data analytics to health data management. The tutorials covered topics such as scalable sustainable construction of knowledge bases, linked data querying, reasoning and benchmarking, GraphQL, solid and comunica, blockchain and Semantic Web, provenance for scientific reproducibility, and an historical perspective and context on the roots of knowledge graphs.

The conference also included a Doctoral Consortium (DC) track, which was chaired by 乔淼 (Miao Qiao) and Mauro Dragoni. The DC afforded PhD students from the Semantic Web community the opportunity to share their research ideas in a critical but



supportive environment, where they received feedback from both the senior members of the community and the other students. Indeed, students participated also in the review process in order to have a first tangible experience of it. This year the PC accepted 13 papers for oral presentation out of the 16 submissions received. All student participants were paired with mentors from the PC who provided guidance on improving their research, producing slides and giving presentations.

This program was complemented by activities put together by our student coordinating chairs ඔෂානි සෙනෙවිරත්න (Oshani Seneviratne) and 岑超榮 (Bruce Sham), who secured funding for travel grants, managed the grants application process, and organized the mentoring lunch alongside other informal opportunities for students and other newcomers to get to know the community.

Posters and demos are one of the most vibrant part of every ISWC. This year, the track was chaired by Mari Carmen Suárez-Figueroa and 程龚 (Gong Cheng). For the first time, poster submissions were subject to double-blind review, whereas demo submissions were single-blind as in previous years due to the possible inclusion of online demos. We received 59 poster and 43 demo submissions. We had to remove four poster and one demo submissions, as they exceeded the page limit. The PC, consisting of 41 members for posters and 44 members for demos, accepted 39 posters and 37 demos. Decisions were mainly based on relevance, originality, and clarity. Additionally, we conditionally accepted one poster that was transferred from the industry track.

The Semantic Web Challenge has now been a part of ISWC for 16 years. The 2019 edition of the challenge followed a new direction started in 2017: all challenges define fixed datasets, objective measures, and provide their participants with a benchmarking platform. In contrast to 2017 and 2018, this year the challenges were open. This means that a call for challenge was issued and potential challenge organizers submitted proposals for challenges, which were reviewed by the organizers. Two challenges made the cut. The aim of the first challenge was to evaluate the performance of matching systems for tables. The participants were to devise means to link entries in tables to classes, resource, or relations from a predefined knowledge graph. The second challenge evaluated the performance of fact validation systems. For each fact in the benchmark data, the participants were to return a score which expressed how likely said fact was to be true. The best solutions were then presented and discussed at the conference in a dedicated challenge session and during the poster session.

Newly reintroduced last year after an initial showing in 2011, the outrages ideas track solicits visionary ideas, long term challenges, and opportunities for the Semantic Web. This track was chaired by Maria Keet and Abraham Bernstein and it featured a special award funded by the Computer Community Consortium's Blue Sky Ideas initiative. We received nine submissions of which two were accepted.

Finally, the Minute Madness is a tradition at the International Semantic Web Conference that started back in 2011. It usually provides conference participants with a quick and fun overview of the presented works at the conference, since each speaker is allowed to pitch his/her work with a 60 second speech. This year, the two chairs Irene Celino and Armin Haller split the Minute Madness into two separate sessions, both in

plenary: the traditional slot for poster and demo authors, to generate interest and traction for the following dedicated event, and a stand-alone session, open to all conference participants, allowed to submit their contribution proposal through the dedicated Minute Madness call.

Organizing a conference is so much more than assembling a program. An international event of the scale and complexity of ISWC requires the commitment, support, resources, and time of hundreds of people, organizers of satellite events, reviewers, volunteers, and sponsors. We are very grateful to our local team at the University of Auckland, and in particular to the local chairs, 孙敬 (Jing Sun) and Gill Dobbie as well as their Conference Coordinator Alex Harvey. They expertly managed the conference logistics down to every detail and make it a splendid event that we want to attend every year. This year again, they helped us grow this exciting scientific community and connect with the local scientific community of the venue.

Our thanks also go to Valentina Ivanova and فؤاد زبليط (Fouad Zabliith), our proactive publicity chairs, and นชา ชลดำรงกุล (Nacha Chondamrongkul) our hyper-responsive Web chair - they played a critical role in ensuring that all conference activities and updates were communicated and promoted on the Web and across mailing lists and on social media. Maribel Acosta and Andrea Giovanni Nuzzolese were the metadata chairs this year and their ensured that all relevant information about the conference was available in a format that could be used across all applications, continuing a tradition established at ISWC many years ago. Also, we are especially thankful to our proceedings chairs, 宋劼 (Jie Song) and Maxime Lefrançois, who oversaw the publication of these volumes.

Sponsorship is crucial to realize the conference in its current form. We had a highly committed trio of sponsorship chairs, 彭麗姬 (Lai Kei Pang), Cédric Pruski, and Oktie Hassanzadeh, who went above and beyond to find new ways to engage with sponsors and promote the conference to them. Thanks to them, the conference now features a social program that is almost as exciting as the scientific one.

Finally, our special thanks go to the Semantic Web Science Association (SWSA) for their continuing support and guidance and to the organizers of the conference from 2017 and 2018 who were a constant inspiration, role models, and source of knowledge, advice, and experience.

August 2019

Chiara Ghidini  
Olaf Hartig  
Maria Maleshkova  
Vojtěch Svátek  
Isabel Cruz  
Aidan Hogan  
宋劼 Jie Song  
Maxime Lefrançois  
Fabien Gandon

## References

1. T. Berners-Lee, R. Cailliau, A. Luotonen, H. F. Nielsen, and A. Secret. The World-Wide Web. *Commun. ACM*, 37(8):76–82, Aug. 1994.
2. F. Gandon. For everything: Tim Berners-Lee, winner of the 2016 Turing award for having invented... the Web. *1024: Bulletin de la Société Informatique de France*, (11):21, Sept. 2017.
3. F. Gandon. A Survey of the First 20 Years of Research on Semantic Web and Linked Data. *Revue des Sciences et Technologies de l'Information - Série ISI: Ingénierie des Systèmes d'Information*, Dec. 2018.
4. F. Gandon, M. Sabou, and H. Sack. Weaving a Web of Linked Resources. *Semantic Web Journal Special Issue*, 2017.

# Organization

## Organizing Committee

### General Chair

Fabien Gandon

Inria, Université Côte d'Azur, CNRS, I3S Sophia  
Antipolis, France

### Local Chairs

孙敬 (Jing Sun)

The University of Auckland, New Zealand

Gill Dobbie

The University of Auckland, New Zealand

### Research Track Chairs

Chiara Ghidini

Fondazione Bruno Kessler (FBK), Italy

Olaf Hartig

Linköping University, Sweden

### Resources Track Chairs

Maria Maleshkova

SDA, University of Bonn, Germany

Vojtěch Svátek

University of Economics in Prague, Czech Republic

### In-Use Track Chairs

Isabel Cruz

University of Illinois at Chicago, USA

Aidan Hogan

DCC, Universidad de Chile, Chile

### Reproducibility Track Chairs

Alejandra Gonzalez-Beltran

Science and Technology Facilities Council, UK

Michael Cochez

Fraunhofer Institute for Applied Information

Technology, RWTH Aachen University, Germany,  
and University of Jyväskylä, Finland

### Industry Track Chairs

Anna Lisa Gentile

IBM Research, USA

Christophe Guéret

Accenture Labs Dublin, Ireland

### Journal Track Chairs

Claudia d'Amato

University of Bari, Italy

Lalana Kagal

MIT, USA

### Workshop and Tutorial Chairs

H. Sofia Pinto	INESC-ID, Instituto Superior Técnico, Universidade de Lisboa, Portugal
武田 英明 (Hideaki Takeda)	National Institute of Informatics, Japan

### Semantic Web Challenges Track Chairs

Gianluca Demartini	The University of Queensland, Australia
Valentina Presutti	STLab-ISTC, National Research Council, Italy
Axel Ngonga	Paderborn University, Germany

### Poster and Demo Track Chairs

Mari Carmen Suárez-Figueroa	Universidad Politécnica de Madrid (UPM), Ontology Engineering Group (OEG), Spain
程龚 (Gong Cheng)	Nanjing University, China

### Doctoral Consortium Chairs

乔淼 (Miao Qiao)	The University of Auckland, New Zealand
Mauro Dragoni	Fondazione Bruno Kessler, Italy

### Student Coordination Chairs

ශානි සෙනෙවිරත්න (Oshani Seneviratne)	Oshani Rensselaer Polytechnic Institute, USA
岑超榮 (Bruce, Chiu-Wing Sham)	The University of Auckland, New Zealand

### Minute Madness Chairs

Irene Celino	Cefriel, Italy
Armin Haller	Australian National University, Australia

### Outrageous Ideas Track Chairs

Maria Keet	University of Cape Town, South Africa
Abraham Bernstein	University of Zurich, Switzerland

### Proceedings Chairs

宋劼 (Jie Song)	Memect Technology, China
Maxime Lefrançois	MINES Saint-Étienne, France

### Metadata Chairs

Maribel Acosta	Karlsruhe Institute of Technology, Germany
Andrea Giovanni Nuzzolese	STLab, ISTC-CNR, Italy

## Publicity Chairs

Valentina Ivanova	RISE Research Institutes of Sweden, Sweden
فؤاد زبليط (Fouad Zabliith)	American University of Beirut, Lebanon

## Sponsorship Chairs

彭麗姬 (Lai Kei Pang)	University of Auckland Libraries and Learning Services, New Zealand
Cédric Pruski	Luxembourg Institute of Science and Technology, Luxembourg
Oktie Hassanzadeh	IBM Research, USA

## Web Site Chair

นชา ชลดำรงค์กุล (Nacha Chondamrongkul)	The University of Auckland, New Zealand
---	---

## Program Committee

### Senior Program Committee – Research Track

Lora Aroyo	Google
Paul Buitelaar	Insight Centre for Data Analytics, National University of Ireland Galway
Emanuele Della Valle	Politecnico di Milano
Gianluca Demartini	The University of Queensland
Armin Haller	Australian National University
Annika Hinze	University of Waikato
Katja Hose	Aalborg University
Andreas Hotho	University of Wuerzburg
Wei Hu	Nanjing University
Mustafa Jarrar	Birzeit University
Sabrina Kirrane	Vienna University of Economics and Business
Markus Luczak-Roesch	Victoria University of Wellington
David Martin	Samsung Research America
Tommie Meyer	University of Cape Town, CAIR
Matteo Palmonari	University of Milano-Bicocca
Jorge Pérez	Universidad de Chile
Achim Rettinger	Trier University
Marco Rospocher	Università degli Studi di Verona
Hideaki Takeda	National Institute of Informatics
Valentina Tamma	University of Liverpool
Kerry Taylor	Australian National University and University of Surrey
Tania Tudorache	Stanford University
Axel Polleres	WU Wien
Maria Esther Vidal	Universidad Simon Bolivar
Paul Groth	University of Amsterdam
Luciano Serafini	Fondazione Bruno Kessler

**Program Committee – Research Track**

Maribel Acosta	Karlsruhe Institute of Technology
Harith Alani	The Open University
Jose Julio Alferes	Universidade NOVA de Lisboa
Muhammad Intizar Ali	Insight Centre for Data Analytics, National University of Ireland Galway
Marjan Alirezaie	Orebro University
Tahani Alsubait	Umm Al-Qura University
José Luis Ambite	University of Southern California
Renzo Angles	Universidad de Talca
Mihael Arcan	Insight @ NUI Galway
Manuel Atencia	Université Grenoble Alpes
Maurizio Atzori	University of Cagliari
Payam Barnaghi	University of Surrey
Pierpaolo Basile	University of Bari
Valerio Basile	University of Turin
Srikanta Bedathur	IIT Delhi
Zohra Bellahsene	LIRMM
Ladjel Bellatreche	LIAS/ENSMA
Maria Bermudez-Edo	University of Granada
Leopoldo Bertossi	Relational AI Inc., Carleton University
Eva Blomqvist	Linköping University
Fernando Bobillo	University of Zaragoza
Alex Borgida	Rutgers University
Stefano Borgo	Laboratory for Applied Ontology, ISTC-CNR (Trento)
Loris Bozzato	Fondazione Bruno Kessler
Alessandro Bozzon	Delft University of Technology
John Breslin	NUI Galway
Carlos Buil Aranda	Universidad Técnica Federico Santa Maria
Marut Buranarach	NECTEC
Aljoscha Burchardt	DFKI
Elena Cabrio	Université Côte d’Azur, CNRS, Inria, I3S
Jean-Paul Calbimonte	HES-SO University of Applied Sciences and Arts Western Switzerland
David Carral	TU Dresden
Vinay Chaudhri	Independent Consultant, San Francisco Bay Area
Huajun Chen	Zhejiang University
Huiyuan Chen	Case Western Reserve University
Gong Cheng	Nanjing University
Philipp Cimiano	Bielefeld University
Michael Cochez	Fraunhofer Institute for Applied Information Technology
Jack G. Conrad	Thomson Reuters

Olivier Corby	Inria
Oscar Corcho	Universidad Politécnica de Madrid
Francesco Corcoglioniti	Fondazione Bruno Kessler
Luca Costabello	Accenture Labs
Fabio Cozman	University of São Paulo
Isabel Cruz	University of Illinois at Chicago
Philippe Cudre-Mauroux	University of Fribourg
Olivier Curé	Université Paris-Est, LIGM
Claudia d'Amato	University of Bari
Mathieu D'Aquin	Insight Centre for Data Analytics, National University of Ireland Galway
Jérôme David	Inria
Jeremy Debattista	Trinity College Dublin
Thierry Declerck	DFKI GmbH and University of Saarland
Daniele Dell'Aglia	University of Zurich
Elena Demidova	L3S Research Center
Chiara Di Francescomarino	FBK-irst
Stefan Dietze	GESIS – Leibniz Institute for the Social Sciences
Mauro Dragoni	FBK-irst
Jianfeng Du	Guangdong University of Foreign Studies
Michel Dumontier	Maastricht University
Shady Elbassuoni	American University of Beirut
Lorena Etcheverry	Instituto de Computación, Universidad de la República
Jérôme Euzenat	Inria, Université Grenoble Alpes
Stefano Faralli	University of Rome Unitelma Sapienza
Alessandro Faraotti	IBM
Catherine Faron Zucker	University Nice Sophia Antipolis
Anna Fensel	Semantic Technology Institute (STI) Innsbruck, University of Innsbruck
Alba Fernandez	Universidad Politécnica de Madrid
Miriam Fernandez	Knowledge Media Institute
Javier D. Fernández	Vienna University of Economics and Business
Besnik Fetahu	L3S Research Center
Valeria Fionda	Università della Calabria
Antske Fokkens	Vrije Universiteit Amsterdam
Flavius Frasincar	Erasmus University Rotterdam
Fred Freitas	Universidade Federal de Pernambuco (UFPE)
Francesca Frontini	Université Paul-Valéry Montpellier 3, Praxiling UMR 5267 CNRS
Naoki Fukuta	Shizuoka University
Michael Färber	University of Freiburg
Luis Galárraga	Aalborg University
Raúl García-Castro	Universidad Politécnica de Madrid
Daniel Garijo	Information Sciences Institute
Anna Lisa Gentile	IBM
Aurora Gerber	CAIR, University of Pretoria



Jose Manuel Gomez-Perez	ExpertSystem
Rafael S. Gonçalves	Stanford University
Guido Governatori	CSIRO
Jorge Gracia	University of Zaragoza
Dagmar Gromann	TU Dresden
Tudor Groza	The Garvan Institute of Medical Research
Claudio Gutierrez	Universidad de Chile
Peter Haase	metaphacts
Andreas Harth	University of Erlangen-Nuremberg, Fraunhofer IIS-SCS
Bernhard Haslhofer	AIT Austrian Institute of Technology
Oktie Hassanzadeh	IBM
Pascal Hitzler	Wright State University
Rinke Hoekstra	University of Amsterdam
Aidan Hogan	DCC, Universidad de Chile
Geert-Jan Houben	Delft University of Technology
Wen Hua	The University of Queensland
Eero Hyvönen	Aalto University and University of Helsinki (HELDIG)
Luis Ibanez-Gonzalez	University of Southampton
Ryutaro Ichise	National Institute of Informatics
Nancy Ide	Vassar College
Oana Inel	Delft University of Technology
Prateek Jain	Nuance Communications Inc.
Krzysztof Janowicz	University of California
Caroline Jay	The University of Manchester
Ernesto Jimenez-Ruiz	The Alan Turing Institute
Lucie-Aimée Kaffee	University of Southampton
Evangelos Kalampokis	University of Macedonia
Maulik R. Kamdar	Stanford Center for Biomedical Informatics Research, Stanford University
Megan Katsumi	University of Toronto
Tomi Kauppinen	Aalto University School of Science
Takahiro Kawamura	Japan Science and Technology Agency
Maria Keet	University of Cape Town
Mayank Kejriwal	Information Sciences Institute
Thomas Kipf	University of Amsterdam
Matthias Klusch	DFKI
Stasinos Konstantopoulos	NCSR Demokritos
Roman Kontchakov	Birkbeck, University of London
Dimitris Kontokostas	University of Leipzig
Manolis Koubarakis	National and Kapodistrian University of Athens
Kouji Kozaki	Osaka University
Adila A. Krisnadhi	University of Indonesia
Tobias Kuhn	Vrije Universiteit Amsterdam
Tobias Käfer	Karlsruhe Institute of Technology
Jose Emilio Labra Gayo	Universidad de Oviedo

Patrick Lambrix	Linköping University
Christoph Lange	University of Bonn, Fraunhofer IAIS
Danh Le Phuoc	TU Berlin
Roy Lee	Singapore Management University
Maxime Lefrançois	MINES Saint-Étienne
Maurizio Lenzerini	Università di Roma La Sapienza
Juanzi Li	Tsinghua University
Yuan-Fang Li	Monash University
Chunbin Lin	Amazon AWS
Alejandro Llaves	Fujitsu Laboratories of Europe
Thomas Lukasiewicz	University of Oxford
Carsten Lutz	Universität Bremen
Gengchen Mai	University of California
Ioana Manolescu	Inria Saclay, LRI, Université Paris Sud-11
Miguel A. Martinez-Prieto	University of Valladolid
John P. McCrae	National University of Ireland Galway
Fiona McNeill	Heriot Watt University
Christian Meilicke	University of Mannheim
Albert Meroño-Peñuela	Vrije Universiteit Amsterdam
Pasquale Minervini	University College London
Daniel Miranker	Institute for Cell and Molecular Biology, The University of Texas at Austin
Dunja Mladenic	Jožef Stefan Institute
Aditya Mogadala	Universität des Saarlandes
Pascal Molli	University of Nantes, LS2N
Elena Montiel-Ponsoda	Universidad Politécnica de Madrid
Gabriela Montoya	Aalborg University
Takeshi Morita	Keio University
Regina Motz	Universidad de la República
Hubert Naacke	Sorbonne Université, UPMC, LIP6
Sven Naumann	University of Trier
Axel-Cyrille Ngonga Ngomo	University of Paderborn
Andriy Nikolov	metaphacts GmbH
Leo Obrst	MITRE
Alessandro Oltramari	Bosch Research and Technology Center
Magdalena Ortiz	Vienna University of Technology
Francesco Osborne	The Open University
Ankur Padia	UMBC
Jeff Z. Pan	University of Aberdeen
Peter Patel-Schneider	Samsung Research America
Terry Payne	University of Liverpool
Tassilo Pellegrini	University of Applied Sciences St. Pölten
Catia Pesquita	LaSIGE, Faculdade de Ciências, Universidade de Lisboa

Giulio Petrucci	Google
Rafael Peñaloza	University of Milano-Bicocca
Patrick Philipp	Forschungszentrum Informatik (FZI)
Reinhard Pichler	TU Wien
Giuseppe Pirrò	Sapienza University of Rome
Alessandro Piscopo	BBC
Dimitris Plexousakis	FORTH
María Poveda-Villalón	Universidad Politécnica de Madrid
Guilin Qi	Southeast University
Yuzhong Qu	Nanjing University
Alexandre Rademaker	IBM Research Brazil, EMap/FGV
Maya Ramanath	IIT Delhi
David Ratcliffe	Defence
Simon Razniewski	Max Planck Institute for Informatics
Blake Regalia	University of California
Georg Rehm	DFKI
Juan L. Reutter	Pontificia Universidad Católica
Martin Rezk	DMM.com
Giuseppe Rizzo	LINKS Foundation
Mariano Rodríguez Muro	Google
Dumitru Roman	SINTEF
Gaetano Rossiello	University of Bari
Ana Roxin	University of Burgundy, UMR CNRS 6306
Sebastian Rudolph	TU Dresden
Anisa Rula	University of Milano-Bicocca
Harald Sack	FIZ Karlsruhe – Leibniz Institute for Information Infrastructure, KIT Karlsruhe
Angelo Antonio Salatino	The Open University
Muhammad Saleem	AKSW, University of Leipzig
Kai-Uwe Sattler	TU Ilmenau
Simon Scerri	Fraunhofer
Ralph Schaefermeier	University of Leipzig
Bernhard Schandl	mySugr GmbH
Ralf Schenkel	University of Trier
Stefan Schlobach	Vrije Universiteit Amsterdam
Andreas Schmidt	University of Kassel
Giovanni Semeraro	University of Bari
Juan F. Sequeda	Capsenta Labs
Gilles Serasset	LIG, Université Grenoble Alpes
Yanfeng Shu	CSIRO
Gerardo Simari	Universidad Nacional del Sur, CONICET
Hala Skaf-Molli	University of Nantes, LS2N
Sebastian Skritek	TU Wien
Dezhao Song	Thomson Reuters

Steffen Staab	Institut WeST, University Koblenz-Landau and WAIS, University of Southampton
Armando Stellato	University of Rome
Simon Steyskal	Siemens AG Austria
Markus Stocker	German National Library of Science and Technology (TIB)
Audun Stolpe	Norwegian Defence Research Establishment (FFI)
Umberto Straccia	ISTI-CNR
Heiner Stuckenschmidt	University of Mannheim
York Sure-Vetter	Karlsruhe Institute of Technology
Pedro Szekely	USC – Information Sciences Institute
Mohsen Taheriyani	Google
Naoya Takeishi	RIKEN Center for Advanced Intelligence Project
Sergio Tessaris	Free University of Bozen-Bolzano
Andrea Tettamanzi	University Nice Sophia Antipolis
Kia Teymourian	Boston University
Harsh Thakkar	University of Bonn
Andreas Thalhammer	F. Hoffmann-La Roche AG
Ilaria Tiddi	Vrije University
David Toman	University of Waterloo
Yannick Toussaint	Loria
Sebastian Tramp	eccenca GmbH
Cassia Trojahn	UT2J, IRIT
Anni-Yasmin Turhan	TU Dresden
Takanori Ugai	Fujitsu Laboratories Ltd.
Jürgen Umbrich	Vienna University of Economy and Business
Joerg Unbehauen	University of Leipzig
Jacopo Urbani	Vrije Universiteit Amsterdam
Dmitry Ustalov	University of Mannheim
Alejandro A. Vaisman	Instituto Tecnológico de Buenos Aires
Marieke van Erp	KNAW Humanities Cluster
Jacco van Ossenbruggen	CWI, VU University Amsterdam
Miel Vander Sande	Ghent University
Ruben Verborgh	Ghent University – imec
Serena Villata	CNRS – Laboratoire d’Informatique, Signaux et Systèmes de Sophia-Antipolis
Boris Villazon-Terrazas	Majorel
Piek Vossen	Vrije Universiteit Amsterdam
Domagoj Vrgoc	Pontificia Universidad Católica de Chile
Simon Walk	Graz University of Technology
Kewen Wang	Griffith University
Xin Wang	Tianjin University
Zhichun Wang	Beijing Normal University
Grant Weddell	University of Waterloo
Gregory Todd Williams	Hulu

Frank Wolter	University of Liverpool
Josiane Xavier Parreira	Siemens AG Österreich
Guohui Xiao	KRDB Research Centre, Free University of Bozen-Bolzano
Fouad Zablit	American University of Beirut
Ondřej Zamazal	University of Economics in Prague
Veruska Zamborlini	University of Amsterdam
Amrapali Zaveri	Maastricht University
Sergej Zerr	L3S Research Center
Kalliopi Zervanou	Eindhoven University of Technology
Lei Zhang	FIZ Karlsruhe – Leibniz Institute for Information Infrastructure
Wei Emma Zhang	Macquarie University
Xiaowang Zhang	Tianjin University
Ziqi Zhang	Sheffield University
Jun Zhao	University of Oxford
Lihua Zhao	Accenture
Antoine Zimmermann	MINES Saint-Étienne
Amal Zouaq	University of Ottawa

### **Additional Reviewers – Research Track**

Dimitris Alivaniotis	Elsevier
Andrea Bellandi	Institute for Computational Linguistics
Mohamed Ben Ellefi	Aix-Marseille University, Lis-Lab
Nabila Berkani	ESI
Federico Bianchi	University of Milan-Bicocca
Zeyd Boukhers	University of Siegen
Marco Brambilla	Politecnico di Milano
Janez Brank	Jožef Stefan Institute
Angelos Charalambidis	University of Athens
Marco Cremaschi	Università di Milano-Bicocca
Ronald Denaux	ExpertSystem
Dimitar Dimitrov	GESIS
Monireh Ebrahimi	Wright State University
Cristina Feier	University of Bremen
Oliver Fernandez Gil	TU Dresden
Giorgos Flouris	FORTH-ICS
Jorge Galicia Auyon	ISAE-ENSMA
Andrés García-Silva	ExpertSystem
Genet Asefa Gesese	FIZ Karlsruhe
Pouya Ghiasnezhad Omran	Griffith University and Australian National University
Simon Gottschalk	L3S Research Center
Jonas Halvorsen	Norwegian Defence Research Establishment (FFI)
Dave Hendricksen	Thomson Reuters
Annika Hinze	University of Waikato

Yuncheng Hua	Southeast University
Gao Huan	Southeast University
John Hudzina	Thomson Reuters
Robert Isele	eccenca GmbH
Chen Jiaoyan	University of Oxford
Anas Fahad Khan	Istituto di Linguistica Computazionale Antonio Zampolli
Haris Kondylakis	FORTH
George Konstantinidis	University of Southampton
Cedric Kulbach	FZI - AIFB
Artem Lutov	University of Fribourg
Andrea Mauri	Delft University of Technology
Sepideh Mesbah	Delft University of Technology
Payal Mitra	.
Piero Molino	Università di Bari Aldo Moro
Anna Nguyen	Karlsruhe Institute of Technology
Kristian Noullet	University of Freiburg
Erik Novak	Jožef Stefan Institute
Inna Novalija	Jožef Stefan Institute
Wolfgang Otto	GESIS
Romana Pernischová	University of Zurich
Freddy Priyatna	Universidad Politécnica de Madrid
Joe Raad	Vrije Universiteit Amsterdam
Jan Rörden	AIT Austrian Institute of Technology
Leif Sabellek	University of Bremen
Filipe Santana Da Silva	Fundação Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSA)
Lukas Schmelzeisen	University of Koblenz-Landau
Miroslav Shaltev	L3S
Cogan Shimizu	Wright State University
Lucia Siciliani	University of Bari
Alisa Smirnova	University of Fribourg
Blerina Spahiu	Università degli Studi di Milano Bicocca
Nicolas Tempelmeier	L3S Research Center
Elodie Thieblin	IRIT
Riccardo Tommasini	Politecnico di Milano
Philip Turk	SINTEF
Rima Türker	FIZ Karlsruhe
Roman Vlasov	IDA GmbH, RSM Intelligence
Zhe Wang	Griffith University
Kemas Wiharja	University of Aberdeen
Bo Yan	University of California
Dingqi Yang	eXascale Infolab, University of Fribourg
Lingxi Yue	Shandong University
Rui Zhu	University of California
Thomas Zielund	Thomson Reuters

Sarah de Nigris	Institute WeST, Koblenz-Landau Universität
Remzi Çelebi	Ege University

### **Senior Program Committee – Research Track**

Anna Lisa Gentile	IBM
Sebastian Rudolph	TU Dresden
Heiko Paulheim	University of Mannheim
Maria Esther Vidal	Universidad Simon Bolivar
Agnieszka Lawrynowicz	Poznan University of Technology
Stefan Dietze	GESIS – Leibniz Institute for the Social Sciences
Steffen Lohmann	Fraunhofer
Francesco Osborne	The Open University

### **Program Committee – Resources Track**

Muhammad Intizar Ali	Insight Centre for Data Analytics, National University of Ireland
Ghislain Auguste Atemezing	Mondeca
Maurizio Atzori	University of Cagliari
Elena Cabrio	Université Côte d’Azur, CNRS, Inria, I3S
Irene Celino	CEFRIEL
Timothy Clark	University of Virginia
Francesco Corcoglioniti	Fondazione Bruno Kessler
Victor de Boer	Vrije Universiteit Amsterdam
Daniele Dell’Aglia	University of Zurich
Emanuele Della Valle	Politecnico di Milano
Anastasia Dimou	Ghent University
Ying Ding	Indiana University Bloomington
Mauro Dragoni	FBK-irst
Mohnish Dubey	University of Bonn
Marek Dudáš	University of Economics in Prague
Fajar J. Ekaputra	Vienna University of Technology
Ivan Ermilov	Universität Leipzig
Diego Esteves	Fraunhofer
Michael Färber	University of Freiburg
Michael Galkin	Fraunhofer IAIS University of Bonn and ITMO University
Aldo Gangemi	Università di Bologna, CNR-ISTC
Raúl Garcia-Castro	Universidad Politécnica de Madrid
Daniel Garijo	Information Sciences Institute
Jose Manuel Gomez-Perez	ExpertSystem
Alejandra Gonzalez-Beltran	University of Oxford
Rafael S. Gonçalves	Stanford University
Alasdair Gray	Heriot-Watt University
Tudor Groza	The Garvan Institute of Medical Research

Amelie Gyrard	Kno.e.sis – Ohio Center of Excellence in Knowledge-enabled Computing
Armin Haller	Australian National University
Karl Hammar	Jönköping University
Rinke Hoekstra	University of Amsterdam
Antoine Isaac	Europeana, VU University Amsterdam
Ernesto Jimenez-Ruiz	The Alan Turing Institute
Simon Jupp	European Bioinformatics Institute
Tomi Kauppinen	Aalto University School of Science
Elmar Kiesling	Vienna University of Technology
Tomáš Kliegr	University of Economics in Prague
Jakub Klímek	Charles University
Adila A. Krisnadhi	University of Indonesia
Markus Krötzsch	TU Dresden
Christoph Lange	University of Bonn, Fraunhofer IAIS
Maxime Lefrançois	MINES Saint-Étienne
Ioanna Lytra	Enterprise Information Systems, University of Bonn
Simon Mayer	University of St. Gallen and ETH Zurich
Jim McCusker	Rensselaer Polytechnic Institute
Fiona McNeill	Heriot Watt University
Nicole Merkle	FZI Forschungszentrum Informatik am KIT
Nandana	Universidad Politécnica de Madrid
Mihindukula-sooriya	
Raghava Mutharaju	IIIT Delhi
Lionel Médini	LIRIS, University of Lyon
Giulio Napolitano	Fraunhofer Institute, University of Bonn
Mojtaba Nayyeri	University of Bonn
Martin Nečaský	Charles University
Vinh Nguyen	National Library of Medicine, NIH
Andrea Giovanni Nuzzolese	University of Bologna
Alessandro Oltramari	Bosch Research and Technology Center
Bijan Parsia	The University of Manchester
Silvio Peroni	University of Bologna
Guilin Qi	Southeast University
Mariano Rico	Universidad Politécnica de Madrid
German Rigau	IXA Group, UPV/EHU
Giuseppe Rizzo	LINKS Foundation
Mariano Rodríguez Muro	Google
Edna Ruckhaus	Universidad Politécnica de Madrid
Anisa Rula	University of Milano-Bicocca
Michele Ruta	Politecnico di Bari
Satya Sahoo	Case Western Reserve University
Miel Vander Sande	Ghent University
Marco Luca Sbodio	IBM
Stefan Schlobach	Vrije Universiteit Amsterdam
Gezim Sejdiu	University of Bonn



Nicolas Seydoux	LAAS-CNRS, IRIT
Ruben Taelman	Ghent University – imec
Harsh Thakkar	University of Bonn
Allan Third	The Open University
Krishnaprasad Thirunarayan	Wright State University
Konstantin Todorov	LIRMM, University of Montpellier
Priyansh Trivedi	University of Bonn
Cassia Trojahn	UT2J, IRIT
Federico Ulliana	Université Montpellier
Natalia Villanueva-Rosales	University of Texas at El Paso
Tobias Weller	Karlsruhe Institute of Technology
Fouad Zabith	American University of Beirut
Ondřej Zamazal	University of Economics in Prague
Amrapali Zaveri	Maastricht University
Jun Zhao	University of Oxford

### **Additional Reviewers – Resources Track**

Pierre-Antoine Champin	Universite Claude Bernard Lyon 1
Nathan Elazar	Australian National University
Kuldeep Singh	Fraunhofer IAIS
Blerina Spahiu	Bicocca University
Xander Wilcke	Vrije Universiteit Amsterdam
Tianxing Wu	Nanyang Technological University
Hong Yung Yip	Wright State University

### **Program Committee – In-Use Track**

Renzo Angles	Universidad de Talca
Sonia Bergamaschi	University of Modena
Carlos Buil-Aranda	Universidad Técnica Federico Santa María
Irene Celino	Cefriel
Oscar Corcho	Universidad Politécnica de Madrid
Philippe Cudre-Mauroux	University of Fribourg
Brian Davis	National University of Ireland Maynooth
Mauro Dragoni	Fondazione Bruno Kessler
Achille Fokoue	IBM
Daniel Garijo	Information Sciences Institute, University of Southern California
Jose Manuel Gomez-Perez	ExpertSystem
Rafael Gonçalves	Stanford University
Paul Groth	University of Amsterdam
Tudor Groza	The Garvan Institute of Medical Research
Peter Haase	metaphacts
Armin Haller	Australian National University
Tomi Kauppinen	Aalto University
Sabrina Kirrane	Vienna University of Economics and Business

Craig Knoblock	USC Information Sciences Institute
Freddy Lecue	CortAix, Canada, and Inria, Sophia Antipolis
Vanessa Lopez	IBM Research Ireland
Andriy Nikolov	metaphacts GmbH
Francesco Osborne	The Open University
Matteo Palmonari	University of Milan-Bicocca
Jeff Z. Pan	University of Aberdeen
Josiane Xavier Parreira	Siemens AG Österreich
Catia Pesquita	LASIGE, University of Lisbon
Artem Revenko	Semantic Web Company GmbH
Mariano Rico	Universidad Politécnica de Madrid
Dumitru Roman	SINTEF AS, University of Oslo
Anisa Rula	University of Milan-Bicocca
Juan F. Sequeda	Capsenta Labs
Dezhao Song	Thomson Reuters
Thomas Steiner	Google
Ilaria Tiddi	VU Amsterdam
Anna Tordai	Elsevier
Raphaël Troncy	EURECOM
Benjamin Zepilko	GESIS – Leibniz Institute for the Social Sciences
Matthäus Zloch	GESIS – Leibniz Institute for the Social Sciences

#### **Additional Reviewers – In-Use Track**

Akansa Bhardwaj	eXascale Infolab, University of Fribourg
Luca Gagliardelli	Università degli Studi di Modena e Reggio Emilia
Elena Montiel-Ponsoda	Universidad Politécnica de Madrid
Nikolay Nikolov	University of Oxford
Joe Raad	Vrije Universiteit Amsterdam
Giovanni Simonini	MIT
Ahmet Soylu	Norwegian University of Science and Technology

## Sponsors

### Gold Plus Sponsor

**IBM Research**

<http://www.research.ibm.com>

### Gold Sponsor



**metaphacts**

<https://metaphacts.com>

### Silver Sponsors

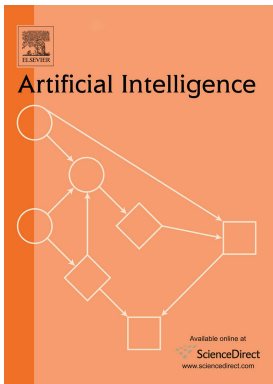


GE Global Research

<https://www.ge.com/research>



<https://www.google.com>



<https://www.journals.elsevier.com/artificial-intelligence>

**100% PURE  
NEW ZEALAND**

<https://www.tourismnewzealand.com>

**Bronze Sponsors**

<https://www.springer.com>



**THE UNIVERSITY  
OF AUCKLAND**  
FACULTY OF SCIENCE

<https://www.auckland.ac.nz/en/science.html>



**Auckland  
Convention  
Bureau**

<http://aucklandconventions.co.nz>



<http://cs.auckland.ac.nz>

**Other Sponsors**

<https://franz.com>



<https://www.inria.fr/en>

**Student Travel Award Sponsors**

<http://swsa.semanticweb.org>



<https://www.nsf.gov>

## Contents – Part II

### Resources Track

The KEEN Universe: An Ecosystem for Knowledge Graph Embeddings with a Focus on Reproducibility and Transferability . . . . .	3
<i>Mehdi Ali, Hajira Jabeen, Charles Tapley Hoyt, and Jens Lehmann</i>	
VLog: A Rule Engine for Knowledge Graphs. . . . .	19
<i>David Carral, Irina Dragoste, Larry González, Cerial Jacobs, Markus Krötzsch, and Jacopo Urbani</i>	
ArCo: The Italian Cultural Heritage Knowledge Graph . . . . .	36
<i>Valentina Anita Carriero, Aldo Gangemi, Maria Letizia Mancinelli, Ludovica Marinucci, Andrea Giovanni Nuzzolese, Valentina Presutti, and Chiara Veninata</i>	
Making Study Populations Visible Through Knowledge Graphs . . . . .	53
<i>Shruthi Chari, Miao Qi, Nkechinyere N. Agu, Oshani Seneviratne, Jamie P. McCusker, Kristin P. Bennett, Amar K. Das, and Deborah L. McGuinness</i>	
LC-QuAD 2.0: A Large Dataset for Complex Question Answering over Wikidata and DBpedia. . . . .	69
<i>Mohnish Dubey, Debayan Banerjee, Abdelrahman Abdelkawi, and Jens Lehmann</i>	
SEO: A Scientific Events Data Model . . . . .	79
<i>Said Fathalla, Sahar Vahdati, Christoph Lange, and Sören Auer</i>	
DBpedia FlexiFusion the Best of Wikipedia > Wikidata > Your Data . . . . .	96
<i>Johannes Frey, Marvin Hofer, Daniel Obraczka, Jens Lehmann, and Sebastian Hellmann</i>	
The Microsoft Academic Knowledge Graph: A Linked Data Source with 8 Billion Triples of Scholarly Data. . . . .	113
<i>Michael Färber</i>	
The RealEstateCore Ontology . . . . .	130
<i>Karl Hammar, Erik Oskar Wallin, Per Karlberg, and David Hälleberg</i>	

<b>FoodKG: A Semantics-Driven Knowledge Graph for Food Recommendation . . . . .</b>	<b>146</b>
<i>Steven Haussmann, Oshani Seneviratne, Yu Chen, Yarden Ne'eman, James Codella, Ching-Hua Chen, Deborah L. McGuinness, and Mohammed J. Zaki</i>	
<b>BTC-2019: The 2019 Billion Triple Challenge Dataset . . . . .</b>	<b>163</b>
<i>José-Miguel Herrera, Aidan Hogan, and Tobias Käfer</i>	
<b>Extending the YAGO2 Knowledge Graph with Precise Geospatial Knowledge . . . . .</b>	<b>181</b>
<i>Nikolaos Karalis, Georgios Mandilaras, and Manolis Koubarakis</i>	
<b>The SEPSES Knowledge Graph: An Integrated Resource for Cybersecurity . . . . .</b>	<b>198</b>
<i>Elmar Kiesling, Andreas Ekelhart, Kabul Kurniawan, and Fajar Ekaputra</i>	
<b>SemanGit: A Linked Dataset from <code>git</code> . . . . .</b>	<b>215</b>
<i>Dennis Oliver Kubitz, Matthias Böckmann, and Damien Graux</i>	
<b>Squerall: Virtual Ontology-Based Access to Heterogeneous and Large Data Sources . . . . .</b>	<b>229</b>
<i>Mohamed Nadjib Mami, Damien Graux, Simon Scerri, Hajira Jabeen, Sören Auer, and Jens Lehmann</i>	
<b>List.MID: A MIDI-Based Benchmark for Evaluating RDF Lists . . . . .</b>	<b>246</b>
<i>Albert Meroño-Peñuela and Enrico Daga</i>	
<b>A Scalable Framework for Quality Assessment of RDF Datasets. . . . .</b>	<b>261</b>
<i>Gezim Sejdiu, Anisa Rula, Jens Lehmann, and Hajira Jabeen</i>	
<b>QaldGen: Towards Microbenchmarking of Question Answering Systems over Knowledge Graphs. . . . .</b>	<b>277</b>
<i>Kuldeep Singh, Muhammad Saleem, Abhishek Nadgeri, Felix Conrads, Jeff Z. Pan, Axel-Cyrille Ngonga Ngomo, and Jens Lehmann</i>	
<b>Sparklify: A Scalable Software Component for Efficient Evaluation of SPARQL Queries over Distributed RDF Datasets . . . . .</b>	<b>293</b>
<i>Claus Stadler, Gezim Sejdiu, Damien Graux, and Jens Lehmann</i>	
<b>ClaimsKG: A Knowledge Graph of Fact-Checked Claims . . . . .</b>	<b>309</b>
<i>Andon Tchechmedjiev, Pavlos Fafalios, Katarina Boland, Malo Gasquet, Matthäus Zloch, Benjamin Zapolko, Stefan Dietze, and Konstantin Todorov</i>	

CoCoOn: Cloud Computing Ontology for IaaS Price and Performance Comparison . . . . .	325
<i>Qian Zhang, Armin Haller, and Qing Wang</i>	

## In-Use Track

Semantically-Enabled Optimization of Digital Marketing Campaigns . . . . .	345
<i>Vincenzo Cutrona, Flavio De Paoli, Aljaž Košmerlj, Nikolay Nikolov, Matteo Palmonari, Fernando Perales, and Dumitru Roman</i>	
An End-to-End Semantic Platform for Nutritional Diseases Management . . . .	363
<i>Ivan Donadello and Mauro Dragoni</i>	
VLX-Stories: Building an Online Event Knowledge Base with Emerging Entity Detection . . . . .	382
<i>Dèlia Fernández-Cañellas, Joan Espadaler, David Rodriguez, Blai Garolera, Gemma Canet, Aleix Colom, Joan Marco Rimmek, Xavier Giro-i-Nieto, Elisenda Bou, and Juan Carlos Riveiro</i>	
Personalized Knowledge Graphs for the Pharmaceutical Domain . . . . .	400
<i>Anna Lisa Gentile, Daniel Gruhl, Petar Ristoski, and Steve Welch</i>	
Use of OWL and Semantic Web Technologies at Pinterest . . . . .	418
<i>Rafael S. Gonçalves, Matthew Horridge, Rui Li, Yu Liu, Mark A. Musen, Csongor I. Nyulas, Evelyn Obamos, Dhananjay Shrouty, and David Temple</i>	
An Assessment of Adoption and Quality of Linked Data in European Open Government Data . . . . .	436
<i>Luis-Daniel Ibáñez, Ian Millard, Hugh Glaser, and Elena Simperl</i>	
Easy Web API Development with SPARQL Transformer . . . . .	454
<i>Pasquale Lisena, Albert Meroño-Peñuela, Tobias Kuhn, and Raphaël Troncy</i>	
Benefit Graph Extraction from Healthcare Policies . . . . .	471
<i>Vanessa Lopez, Valentina Rho, Theodora S. Brisimi, Fabrizio Cucci, Morten Kristiansen, John Segrave-Daly, Jillian Scalvini, John Davis, and Grace Ferguson</i>	
Knowledge Graph Embedding for Ecotoxicological Effect Prediction . . . . .	490
<i>Erik B. Myklebust, Ernesto Jimenez-Ruiz, Jiaoyan Chen, Raoul Wolf, and Knut Erik Tollefsen</i>	
Improving Editorial Workflow and Metadata Quality at Springer Nature . . . .	507
<i>Angelo A. Salatino, Francesco Osborne, Aliaksandr Birukou, and Enrico Motta</i>	

A Pay-as-you-go Methodology to Design and Build Enterprise Knowledge  
Graphs from Relational Databases . . . . . 526  
*Juan F. Sequeda, Willard J. Briggs, Daniel P. Miranker,  
and Wayne P. Heideman*

**Author Index** . . . . . 547



# Contents – Part I

## Research Track

Decentralized Indexing over a Network of RDF Peers . . . . .	3
<i>Christian Aebeloe, Gabriela Montoya, and Katja Hose</i>	
Datalog Materialisation in Distributed RDF Stores with Dynamic Data Exchange . . . . .	21
<i>Temitope Ajileye, Boris Motik, and Ian Horrocks</i>	
How to Make Latent Factors Interpretable by Feeding Factorization Machines with Knowledge Graphs . . . . .	38
<i>Vito Walter Anelli, Tommaso Di Noia, Eugenio Di Sciascio, Azzurra Ragone, and Joseph Trotta</i>	
Observing LOD Using Equivalent Set Graphs: It Is Mostly Flat and Sparsely Linked . . . . .	57
<i>Luigi Asprino, Wouter Beek, Paolo Ciancarini, Frank van Harmelen, and Valentina Presutti</i>	
Optimizing Horn- <i>SHIQ</i> Reasoning for OBDA. . . . .	75
<i>Labinot Bajraktari, Magdalena Ortiz, and Guohui Xiao</i>	
Using a KG-Copy Network for Non-goal Oriented Dialogues. . . . .	93
<i>Debanjan Chaudhuri, Md. Rashad Al Hasan Rony, Simon Jordan, and Jens Lehmann</i>	
Canonicalizing Knowledge Base Literals . . . . .	110
<i>Jiaoyan Chen, Ernesto Jiménez-Ruiz, and Ian Horrocks</i>	
Bag Semantics of DL-Lite with Functionality Axioms . . . . .	128
<i>Gianluca Cima, Charalampos Nikolaou, Egor V. Kostylev, Mark Kaminski, Bernardo Cuenca Grau, and Ian Horrocks</i>	
Validating SHACL Constraints over a SPARQL Endpoint . . . . .	145
<i>Julien Corman, Fernando Florenzano, Juan L. Reutter, and Ognjen Savković</i>	
Mapping Factoid Adjective Constraints to Existential Restrictions over Knowledge Bases. . . . .	164
<i>Jiwei Ding, Wei Hu, Qixin Xu, and Yuzhong Qu</i>	
Mining Significant Maximum Cardinalities in Knowledge Bases. . . . .	182
<i>Arnaud Giacometti, Béatrice Markhoff, and Arnaud Soulet</i>	

HapPenIng: Happen, Predict, Infer—Event Series Completion in a Knowledge Graph. . . . .	200
<i>Simon Gottschalk and Elena Demidova</i>	
Uncovering the Semantics of Wikipedia Categories. . . . .	219
<i>Nicolas Heist and Heiko Paulheim</i>	
Qsearch: Answering Quantity Queries from Text. . . . .	237
<i>Vinh Thinh Ho, Yusra Ibrahim, Koninika Pal, Klaus Berberich, and Gerhard Weikum</i>	
A Worst-Case Optimal Join Algorithm for SPARQL. . . . .	258
<i>Aidan Hogan, Cristian Riveros, Carlos Rojas, and Adrián Soto</i>	
Knowledge Graph Consolidation by Unifying Synonymous Relationships . . .	276
<i>Jan-Christoph Kalo, Philipp Ehler, and Wolf-Tilo Balke</i>	
Skyline Queries over Knowledge Graphs . . . . .	293
<i>Ilkcan Keles and Katja Hose</i>	
Detecting Influences of Ontology Design Patterns in Biomedical Ontologies. . .	311
<i>Christian Kindermann, Bijan Parsia, and Uli Sattler</i>	
Popularity-Driven Ontology Ranking Using Qualitative Features. . . . .	329
<i>Niklas Kolbe, Sylvain Kubler, and Yves Le Traon</i>	
Incorporating Literals into Knowledge Graph Embeddings . . . . .	347
<i>Agustinus Kristiadi, Mohammad Asif Khan, Denis Lukovnikov, Jens Lehmann, and Asja Fischer</i>	
Extracting Novel Facts from Tables for Knowledge Graph Completion . . . . .	364
<i>Benno Kruit, Peter Boncz, and Jacopo Urbani</i>	
Difficulty-Controllable Multi-hop Question Generation from Knowledge Graphs . . . . .	382
<i>Vishwajeet Kumar, Yuncheng Hua, Ganesh Ramakrishnan, Guilin Qi, Lianli Gao, and Yuan-Fang Li</i>	
Type Checking Program Code Using SHACL . . . . .	399
<i>Martin Leinberger, Philipp Seifer, Claudia Schon, Ralf Lämmel, and Steffen Staab</i>	
Decentralized Reasoning on a Network of Aligned Ontologies with Link Keys. . . . .	418
<i>Jérémy Lhez, Chan Le Duc, Thinh Dong, and Myriam Lamolle</i>	
Ontology Completion Using Graph Convolutional Networks . . . . .	435
<i>Na Li, Zied Bouraoui, and Steven Schockaert</i>	

Non-parametric Class Completeness Estimators for Collaborative Knowledge Graphs—The Case of Wikidata . . . . .	453
<i>Michael Luggen, Djellel Difallah, Cristina Sarasua, Gianluca Demartini, and Philippe Cudré-Mauroux</i>	
Pretrained Transformers for Simple Question Answering over Knowledge Graphs. . . . .	470
<i>Denis Lukovnikov, Asja Fischer, and Jens Lehmann</i>	
Learning to Rank Query Graphs for Complex Question Answering over Knowledge Graphs. . . . .	487
<i>Gaurav Maheshwari, Priyansh Trivedi, Denis Lukovnikov, Nilesh Chakraborty, Asja Fischer, and Jens Lehmann</i>	
THOTH: Neural Translation and Enrichment of Knowledge Graphs . . . . .	505
<i>Diego Moussallem, Tommaso Soru, and Axel-Cyrille Ngonga Ngomo</i>	
Entity Enabled Relation Linking . . . . .	523
<i>Jeff Z. Pan, Mei Zhang, Kuldeep Singh, Frank van Harmelen, Jinguang Gu, and Zhi Zhang</i>	
SHACL Constraints with Inference Rules. . . . .	539
<i>Paolo Pareti, George Konstantinidis, Timothy J. Norman, and Murat Şensoy</i>	
Query-Based Entity Comparison in Knowledge Graphs Revisited . . . . .	558
<i>Alina Petrova, Egor V. Kostylev, Bernardo Cuenca Grau, and Ian Horrocks</i>	
Anytime Large-Scale Analytics of Linked Open Data . . . . .	576
<i>Arnaud Soulet and Fabian M. Suchanek</i>	
Absorption-Based Query Answering for Expressive Description Logics . . . . .	593
<i>Andreas Steigmiller and Birte Glimm</i>	
TransEdge: Translating Relation-Contextualized Embeddings for Knowledge Graphs. . . . .	612
<i>Zequn Sun, Jiacheng Huang, Wei Hu, Muhao Chen, Lingbing Guo, and Yuzhong Qu</i>	
Unsupervised Discovery of Corroborative Paths for Fact Validation . . . . .	630
<i>Zafar Habeeb Syed, Michael Röder, and Axel-Cyrille Ngonga Ngomo</i>	
RDF Explorer: A Visual SPARQL Query Builder . . . . .	647
<i>Hernán Vargas, Carlos Buil-Aranda, Aidan Hogan, and Claudia López</i>	

Capturing Semantic and Syntactic Information for Link Prediction  
in Knowledge Graphs . . . . . 664  
*Changjian Wang, Minghui Yan, Chuanrun Yi, and Ying Sha*

A Framework for Evaluating Snippet Generation for Dataset Search . . . . . 680  
*Xiaxia Wang, Jinchi Chen, Shuxin Li, Gong Cheng, Jeff Z. Pan,  
Evgeny Kharlamov, and Yuzhong Qu*

Summarizing News Articles Using Question-and-Answer Pairs  
via Learning . . . . . 698  
*Xuezhi Wang and Cong Yu*

Product Classification Using Microdata Annotations . . . . . 716  
*Ziqi Zhang and Monica Paramita*

Truthful Mechanisms for Multi Agent Self-interested  
Correspondence Selection. . . . . 733  
*Nan Zhi, Terry R. Payne, Piotr Krysta, and Minming Li*

**Author Index . . . . . 751**