

Annual Research Report 2021

Department of Computer Science, University of Pisa

September 2022

Preface

This report summarizes the main research activities and achievements at the Computer Science Department of the University of Pisa in 2021. Specifically, after a short introduction to the Department, we list: *(i)* the funded projects active in 2021 that were managed by the Department; *(ii)* the editorships of journals or special issues pursued by members of the Department; *(iii)* the scientific events involving members of the Department in 2021; *(iv)* the new research positions that have been opened in 2021 with their specific themes; *(v)* the description of the three PhD schools managed by the Department in 2021; *(vi)* the visiting fellows that were welcome in 2021; and finally *(vii)* the complete list of publications having members of the Department as co-authors in the same year.

All of this testifies the relevant activity and the extensive scientific results that were achieved by the community of researchers of the Computer Science Department in 2021. As shown in this report, such a community has been enhanced in the considered year via the opening of several young researcher and PhD student positions, as well as of new faculty positions. Together with the exchange opportunities of the visiting fellows, which have shown an increase in 2021 with respect to 2020, where they were limited due to the Covid-19 pandemic disease, this emphasizes the great attention of the Department towards research activities and their enhancements, as well as its wide network of scientific collaborations.

1 The Department

During the academic year 1969/1970, the University of Pisa activated a graduation program in Computer Science, i.e., the *Corso di Laurea in Scienze dell'Informazione*, the first one in Italy and one of the very first ones in Europe. Simultaneously, the Computer Science Institute ISI (*Istituto di Scienze dell'Informazione* in Italian) of the University of Pisa was founded, collecting the designers of the Calcolatrice Elettronica Pisana (CEP) together with several researchers coming from other universities, mostly with engineering and mathematics background, all characterized by a great interest and passion towards the Computer Science themes and challenges. This Institute is the ancestor of the current Computer Science Department.

Starting from the scientific results achieved in those pioneering years, the research activities of the Computer Science Department have been continuously enhanced and evolved, spanning now across all the sectors of the Computer Science discipline (INF/01) as well as to areas of applied mathematics. Specifically, since 2012 all faculties of the University of Pisa in the area of Operations Research (MAT/09) are now with the Computer Science Department, as well as about a half of the researchers in Numerical Analysis (MAT/08).

Within the above mentioned scientific sectors, at the beginning of 2021 the composition of the Department was as follows:

- 19 Full Professors (15 INF/01, 1 MAT/08 and 3 MAT/09)
- 23 Associate Professors (18 INF/01, 2 MAT/08 and 3 MAT/09)
- 4 Assistant Professors (RTI)(4 INF/01)
- 11 Temporary Assistant Professors (RTD) (11 INF/01 and 1 MAT/09):

- 5 RTD-A (5 INF/01)
- 6 RTD-B (6 INF/01 and 1 MAT/09)

On the other hand, at the end of 2021 the Department was composed of:

- 21 Full Professors (17 INF/01, 1 MAT/08 and 3 MAT/09)
- 27 Associate Professors (21 INF/01, 2 MAT/08 and 4 MAT/09)
- 3 Assistant Professors (RTI)(3 INF/01)
- 11 Temporary Assistant Professors (RTD) (11 INF/01):
 - 6 RTD-A (6 INF/01)
 - 5 RTD-B (5 INF/01)

In particular, one INF/01 Full Professor retired in January 2021, while one INF/01 Associate Professor retired in November 2021. Moreover:

- one INF/01 Full Professor was recruited via an exchange with a professor of the Department of Mathematics of the University of Pisa;
- one INF/01 Associate Professor was recruited from abroad;
- one INF/01 Full Professor joined the Department coming from another department of the University of Pisa;
- one INF/01 RTI upgraded to Associate Professor;
- two INF/01 RTD-B and one MAT/09 RTD-B upgraded to Associate Professors;
- there were three new entries as RTD-A;
- there were two new entries as RTD-B.

Finally, at the end of 2021 four RTD-A position competitions (3 INF/01 and 1 MAT/09), partially funded by PON 2014/2020, were concluded, but the starting date of such position was on February 2022.

2 Research projects in 2021

The researchers of the Department have been involved in several projects, both at international, national and regional level. We report here the list of the projects funded after an open competitive call, with funds that have been managed by the Department, and that were active in 2021. We classify them according to their typology of funding.

We also list projects funded by private companies, hence without an open call, but rather a direct contract with a Principal Investigator (PI) affiliated with the Department. Data of this section are taken from the research office of the Department, integrated with information from PIs when needed.

In all of the tables below, the BUDGET column indicates the fraction of the total budget of the project (that is, for the whole duration, not just during year 2021) that has been assigned to our Department.

2.1 International projects

NAME	PI UNIPI	PROGRAMME	ROLE UNIPI	DURATION	BUDGET
SMS++4MHD2EP	Frangioni	PGMO	coordinator	11/18 - 3/23	€ 70.000,00
HELIOS	Ricci	UE - H2020	partner	01/19 - 02/22	€ 411.903,75
XAI	Pedreschi	UE - ERC	partner	10/19 - 09/25	€ 1.022.000,00
HumMingBird	Sirbu	UE - H2020	partner	12/19 - 05/24	€ 159.312,50
TEACHING	Bacciu	UE - H2020	coordinator	01/20 - 12/22	€ 635.960,00
NoBIAS	Ruggieri - Turini	UE - H2020	partner	01/20 - 12/23	€ 522.999,36
SoBigData++	Pedreschi	UE - H2020	partner	01/20 - 12/24	€ 580.735,00
Humane AI-NET	Pedreschi	UE - H2020	partner	09/20 - 08/23	€ 140.000,00
TAILOR	Attardi-Bacciu	UE - H2020	partner	09/20 - 08/23	€ 103.437,50
SMS++4OuU	Frangioni	PGMO	coordinator	10/20 - 10/22	€ 50.000,00
LISCIO	Brogi	UE - H2020	invoiced entity	11/20 - 03/21	€ 54.947,92
PLANET4	Mazzei	UE - EPLUS	coordinator	11/20 - 10/23	€ 199.594,00
ME-MIND	Ferrari	UE - CREA2020	partner	01/21 - 10/22	€ 62.505,12
ALPACA	Pisanti	UE - H2020	partner	01/21 - 12/24	€ 261.499,68
SAI	Pedreschi	UE - CHISTERA	partner	02/21 - 07/24	€ 45.937,50
ADMIRE	Torquati	UE - H2020	third part of CINI	04/21 - 03/24	€ 98.750,00
TEXTAROSSA	Danelutto	UE - H2020	third part of CINI	04/21 - 03/24	€ 28.560,00
SMS++M2EO	Frangioni	PGMO	coordinator	09/21 - 08/23	€ 25.000,00

2.2 National projects

CALL	PI UNIPI	DURATION	BUDGET
PRIN	Bonchi	08/19 - 02/23	€ 159.600,00
PRIN	Ferragina	08/19 - 02/23	€ 93.127,00
PRIN	Gadducci	08/19 - 02/23	€ 128.000,00
PRIN	Grossi	08/19 - 02/23	€ 76.385,00
PRIN	Venturini	08/19 - 02/23	€ 136.305,00

2.3 Regional projects

NAME	PI UNIPI	CALL	DURATION	BUDGET
BRAID	Micheli	RICERCA-SALUTE 2018	09/20 - 09/23	€ 158.566,31
I-POTERI	Prencipe	POR	01/21 - 01/23	€ 105.285,38
MYBREATHINGHEART	Gervasi	Regionale covid	02/21 - 02/23	€ 72.000,00
OPTIMISED	Bacciu	Regionale Covid	02/21 - 02/23	€ 26.673,69

2.4 University projects

COORDINATOR	CALL	DURATION	BUDGET
Pisanti	PRA 2020	up to 08/22	€ 59.855,61
Poloni	PRA 2020	up to 08/22	€ 56.925,00
Bacciu	BIHO 2019	up to 08/22	€ 75.000,00
Brogi	BIHO 2020	up to 12/21	€ 50.000,00
Monreale	BIHO 2020	up to 12/21	€ 50.000,00
Venturini	BIHO 2021	up to 12/22	€ 30.000

2.5 Industrial projects

PI UNIFI	INDUSTRY PARTNER	DURATION	BUDGET
Bacciu	Biobeats Group Ltd	11/2018 - 06/2021	€ 50.000,00
Frangioni	MAIOR	12/2018 - 12/2021	€ 60.000,00
Cisternino	Stellamaris	07/2019 - 07/2021	€ 61.000,00
Ferragina	European Broadcasting Union	02/2020 - 07/2023	€ 180.000,00
Cisternino	Consorzio 1 Toscana Nord	04/2020 - 04/2021	€ 3.333,33
Cisternino	Consorzio 4 Basso Valdarno	04/2020 - 04/2021	€ 3.333,33
Cisternino	Consorzio di bonifica N. 5 Toscana costa	04/2020 - 04/2021	€ 3.333,33
Priami	GSK Vaccines S.r.l.	09/2020 - 12/2023	€ 176.226,00
Frangioni	MAIOR	09/2020 - 08/2021	€ 7.020,00
Ferragina	Sadas srl	04/2021 - 04/2022	€ 47.520,00
Ruggieri	Sadas srl	04/2021 - 02/2022	€ 24.000,00
Priami	Chiesi	05/2021 - 10/2023	€ 105.000,00
Lomonaco	Seavision	10/2021 - 12/2022	€ 30.000,00
Micheli	Fosber	12/2021 - 12/2022	€ 30.000,00

3 Editorships of journals

We list here the editorial boards and the special issues of journals that involved members of the Department in 2021. This section is edited with data collected via a direct communication with the researchers.

3.1 Editorial Boards

In 2021, the members of the Department joined the editorial board, or were an area editor, an associate editor or an academic editor, of the following journals.

Bacciu Associate Editor of *IEEE Transactions on Neural Networks and Learning Systems* by IEEE (since 2018)

Electronic ISSN: 2162-2388, Print ISSN: 2162-237X,

<https://cis.ieee.org/publications/t-neural-networks-and-learning-systems>

Bacciu Academic Editor of *PLOS ONE* by Plos (since 2019)

ISSN 1932-6203,

<https://journals.plos.org/plosone/>

Bigi Associate Editor of *INFORMS Journal of Computing* by INFORMS (since 2021)

ISSN: 1091-9856,

<https://pubsonline.informs.org/journal/ijoc>

Bonuccelli Area Editor of *Mobile Networks and Applications* by Springer (since 1996)

Electronic ISSN 1572-8153,

<https://www.springer.com/journal/11036>

Brogi Associate Editor of *IEEE Transactions on Cloud Computing* by IEEE (since 2019)

Electronic ISSN: 2168-7161,

<https://www.computer.org/csdl/journal/cc>

Brogi Editorial Board Member of *Journal of Computer Languages* by Elsevier (since 2019)

ISSN: 2590-1184,

<https://www.journals.elsevier.com/journal-of-computer-languages>

Brogi Editorial Board Member of *Electronics* by MDPI (since 2020)

ISSN: 2079-9292,

<https://www.mdpi.com/journal/electronics>

Chessa Associate Editor of *Journal of Ambient Intelligence and Smart Environments* by IOS Press (since 2014)

ISSN: 1876-1364,

<https://www.iospress.com/catalog/journals/journal-of-ambient-intelligence-and-smart-environments>

Ferragina Editorial Board Member of *Journal of Graph Algorithms and Applications* by Brown University (since 2011)

ISSN: 1526-1719,

<https://jgaa.info/>

Ferragina Editorial Board Member of *Encyclopedia of Algorithms* by Springer (since 2008)

ISSN: 978-0-387-36061-4,

<https://link.springer.com/referencework/10.1007/978-0-387-30162-4>

- Ferragina** Editorial Board Member of *Encyclopedia of Big Data Technologies* by Springer (since 2019)
 ISSN: 978-3-319-77525-8,
<https://link.springer.com/referencework/10.1007/978-3-319-77525-8>
- Frangioni** Area "Design and Analysis of Algorithms - Continuous" Editor of *Journal on Computing* by INFORMS (since 2019)
 ISSN: 1091-9856,
<https://pubsonline.informs.org/journal/ijoc>
- Frangioni** Associate Editor of *4OR - A Quarterly Journal of Operations Research* by Springer (since 2015)
 ISSN: 1619-4500,
<http://www.4or.be>
- Frangioni** Associate Editor of *Open Journal of Mathematical Optimization* by Centre Mersenne (since 2019)
 ISSN: 2777-5860
<https://ojmo.centre-mersenne.org>
- Frangioni** Associate Editor of *INFOR: Information Systems and Operational Research* by Taylor & Francis (since 2008)
 ISSN: 0315-5986, e-ISSN: 1916-0615
<https://www.tandfonline.com/journals/tinf20>
- Gallicchio** Editorial Board Member of *PLOS ONE* by (since)
 ISSN: 1932-6203,
<https://journals.plos.org/plosone/static/editorial-board>
- Gallicchio** Associate Editor of *Intelligenza Artificiale* by IOSPress (since)
 ISSN: 1724-8035,
<https://www.iospress.com/catalog/journals/intelligenza-artificiale>
- Gallicchio** Associate Editor of *Transactions on Neural Networks and Learning Systems* by IEEE (since)
 ISSN: 2162-237X,
<https://cis.ieee.org/publications/t-neural-networks-and-learning-systems>
- Gemignani** Editorial Board Member of *Mathematics* by MDPI (since 2020)
 ISSN: 2227-7390,
<https://www.mdpi.com/journal/mathematics>
- Gervasi** Editorial Board Member of *Expert Systems* by Wiley (since before 2005)
 ISSN: 1468-0394,
<https://onlinelibrary.wiley.com/journal/14680394>
- Guidi** Academic Editor of *PLOS ONE* by Plos (since 2020)
 ISSN:1932-6203,
<https://journals.plos.org/plosone/>
- Guidi** Associate Editor of *Communications* by SciencePG (since 2020)
 ISSN:2328-5923,
<http://www.sciencepublishinggroup.com/journal/index?journalid=139>

- Guidi** Associate Editor of *IET Networks* by the Institution of Engineering and Technology (since 2021)
Online ISSN: 2047-4962, Print ISSN: 2047-4954
<https://digital-library.theiet.org/content/journals/iet-net>
- Guidi** Academic Editor of *Wireless Communications and Mobile Computing* by Hindawi (since 2021)
ISSN: 1530-8669 (Print), ISSN: 1530-8677 (Online)
<https://www.hindawi.com/journals/wcmc/>
- Malizia** Associate editor of *ACM Ubiquity* by ACM (since 2017)
ISSN: 1530-2180,
<https://ubiquity.acm.org/>
- Malizia** Editorial Board Member of *Interacting with Computers* by Oxford Academic (since 2021)
ISSN: 0953-5438,
<https://academic.oup.com/iwc>
- Mencagli** Editorial Board Member of *Future Generation Computer Systems* by Elsevier (since 2019)
ISSN: 0167-739X,
<https://www.sciencedirect.com/journal/future-generation-computer-systems>
- Mencagli** Editorial Board Member of *Cluster Computing* by Springer (since 2019)
ISSN: 1386-7857,
<https://www.springer.com/journal/10586>
- Micheli** Associate editor of *Transactions on Neural Networks and Learning Systems* by IEEE (since 2019)
ISSN: 2162-237X,
<https://cis.ieee.org/publications/t-neural-networks-and-learning-systems>
- Micheli** Academic Editor of *PLOS ONE* by Plos (from 2018 until September 2020)
ISSN: 1932-6203,
<https://journals.plos.org/plosone/>
- Micheli** Editorial Board Member of *Intelligenza Artificiale* by IOS Press (since 2015)
ISSN: 1724-8035
ISSN: print 1724-8035,
<http://www.iospress.nl/journal/intelligenza-artificiale/>
- Monreale** Editorial Board Member of *Transactions on Data Privacy* by University of Skovde (since 2013)
ISSN: 1888-5063
ISSN electronic: 2013-1631,
<http://www.tdp.cat>
- Monreale** Editorial Board Member of *Intelligent Information Systems: Integrating Artificial Intelligence and Database Technologies* by Springer (since 2019)
ISSN electronic: 1573-7675
ISSN print: 0925-9902,
<https://www.springer.com/journal/10844>

- Paganelli** Associate Editor of *IEEE Transactions on Network and Service Management* by IEEE (since 2019)
ISSN: 1932-4537,
<https://www.comsoc.org/publications/journals/ieee-tnsm>
- Paganelli** Associate Editor of *Future Internet* by MDPI (since 2016)
ISSN: 1999-5903,
<https://www.mdpi.com/journal/futureinternet>
- Paganelli** Associate Editor of *Telecom* by MDPI (since 2020)
ISSN: 2673-4001,
<https://www.mdpi.com/journal/telecom>
- Pappalardo** Editorial Board Member of *Minimax theory and its applications* by Heldermann (since 2016)
ISSN: 2199-1413 (printed edition), 2199-1421 (electronic edition)
<https://www.heldermann.de/MTA/mtacover.htm>
- Passacantando** Editorial Board Member of *Mathematics* by MDPI (since 2021)
ISSN: 2227-7390
<https://www.mdpi.com/journal/mathematics>
- Pisanti** Editorial Board Member of *International Journal of Computer Science and Application* by Science and Engineering Publishing Company USA (since 2012)
ISSN: 2324-7134,
<https://www.destechpub.com/product/ijcsa/>
- Pisanti** Associate Editor of *Network Modeling Analysis in Health Informatics and Bioinformatics* by Springer (since 2017)
ISSN: 21926662, Online: 21926670,
<https://www.springer.com/journal/13721>
- Poloni** Editorial Board Member of *Linear and Multilinear Algebra* by Taylor & Francis (since 2020)
Print ISSN: 0308-1087 Online ISSN: 1563-5139,
<https://www.tandfonline.com/action/journalInformation?journalCode=glma20>
- Poloni** Editorial Board Member of *Stochastic Models* by Taylor & Francis (since 2020)
Print ISSN: 1532-6349 Online ISSN: 1532-4214,
<https://www.tandfonline.com/action/journalInformation?show=editorialBoard&journalCode=lstm20>
- Prencipe** Editorial Board Member of *Electronics* by MDPI, Section Board for Computer Science & Engineering (since 2019)
ISSN: 2079-9292,
https://www.mdpi.com/journal/electronics/sectioneditors/computer_science_engineering
- Ricci** Associate Editor of *Distributed Ledger Technologies* by ACM (since 2021)
ISSN 2096-7209,
<https://dl.acm.org/journal/dlt>
- Ricci** Associate Editor of *Blockchain: Research and Applications* by Elsevier (since 2020)
ISSN 2098-7300,
<https://www.journals.elsevier.com/blockchain-research-and-applications>

Ricci Section Editor of *Innovation in Blockchain and Distributed Ledgers*, SN in Computer Science by Springer (since 2020)

<https://www.springer.com/journal/42979/updates/17470758>

ISSN 0967-0912

Scutellà Associate Editor of *Networks* by Wiley (since 2013)

Online ISSN:1097-0037,

<https://onlinelibrary.wiley.com/journal/10970037>

Scutellà Editorial Advisory Board Member of *Computers & Operations Research* by Elsevier (since 2004)

ISSN: 0305-0548,

<http://www.journals.elsevier.com/computers-and-operations-research/>

Soldani Associate Editor of *ACM SIGSOFT Software Engineering Notes* by ACM (since 2019)

ISSN: 0163-5948,

<https://www.sigsoft.org/SEN/>

Soldani Academic Editor of *PLOS ONE* by Plos (since 2019)

ISSN: 1932-6203,

<https://journals.plos.org/plosone/>

Soldani Editorial Board Member of *Mathematics and Computer Science* by SciencePG (since 2020)

ISSN: 2575-6028,

<http://www.sciencepublishinggroup.com/j/mcs>

Soldani Editorial Board Member of *Journal of Systems and Software* by Elsevier (since 2021)

ISSN: 0164-1212,

<https://www.journals.elsevier.com/journal-of-systems-and-software>

3.2 Guest editorship of special issues

The members of the Department managed as guest editors the following special issues, whose call had a deadline in 2021 or in the very first months of 2022, and/or were published in 2021.

This section is edited with data collected via a direct communication with the researchers.

Bigi Special Issue of *Optimization*, Taylor & Francis, “EUROPT 2019”, opened in 2019 and published online in 2021.

Print ISSN: 0233-1934,

Online ISSN: 1029-4945,

<https://www.tandfonline.com/toc/gopt20/71/8>

Di Francesco Maesa Special Issue of *Blockchain: Research and Applications*, Elsevier, “Blockchain: protocols, applications, and Transaction analysis”, opened in 2021 and published in 2022.

ISSN: 2096-7209,

<https://www.sciencedirect.com/journal/blockchain-research-and-applications/special-issue/10L8LLK3VVH>

Gadducci Special issue of *Theoretical Computer Science*, Elsevier, “Theoretical Topics in Graph Transformation”, opened in 2020 and closed in 2021.

ISSN:0304-3975,

<https://www.sciencedirect.com/journal/theoretical-computer-science/special-issue/10N3TH4CHW7>

- Gadducci** Special issue of *Science of Computer Programming*, Elsevier, “Application-oriented aspects of Graph Transformation”, opened in 2020 and closed in 2021.
ISSN:0167-6423,
<https://www.sciencedirect.com/journal/science-of-computer-programming/special-issue/10LWN9PLMWJ>
- Gadducci** Special issue of *Journal of Logical & Algebraic Methods in Programming*, Elsevier, “Specification and Modelling of Computing Systems through Graphs and Graph Transformation”, opened in 2021 and closed in 2022.
ISSN:0743-1066 (print) 1873-5789 (online),
- Gadducci** Special issue of *Logical Methods in Computer Science*, Episcience, “Selected Papers of the 9th Conference on Algebra and Coalgebra in Computer Science (CALCO 2021)”, opened in 2021 and closed in 2022.
ISSN:1860-5974,
- Galicchio** Special issue of *Transactions on Neural Networks and Learning Systems*, IEEE, “New Frontiers in Extremely Efficient Reservoir Computing”, opened in 2020 and closing in 2022.
ISSN:2162-237X,
<https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385>
- Guidi** Special issue of *Sustainability*, MDPI, “Mobile Networks and Sustainable Applications”, opened in 2020 and closing in 2021.
ISSN:2071-1050,
https://www.mdpi.com/journal/sustainability/special_issues/Mobile_Networks_Sustainable_Applications
- Guidi** Special issue of *IET Networks*, Wiley, “Blockchain and Decentralized Solutions for Social Good”, opened in 2021.
ISSN: 2047-4962
https://ietresearch.onlinelibrary.wiley.com/pb-assets/assets/20474962/Special%20Issues/IET_NET_CFP_BDSSG-1658243941623.pdf
- Guidi** Special issue of *Applied Sciences*, MDPI, “Advanced Analysis Technologies for Social Media”, opened in 2021.
ISSN:2076-3417
https://www.mdpi.com/journal/applsci/special_issues/analysis_social_media
- Guidi** Special issue of *Multimedia Tools and Applications*, Springer, “Information Technology for Social Good - Selected papers of GoodIT 2021”, opened in 2021.
Electronic ISSN: 1573-7721
<http://www.grc.upv.es/goodit2021/figs/MTAPSpecialIssueGoodIT.PDF>
- Guidi** Special issue of *Information*, MDPI, “Decentralization and New Technologies for Social Media”, opened in 2021.
Electronic ISSN: 2078-2489
https://www.mdpi.com/journal/information/special_issues/Decentralization_Social_Media
- Micheli** Special issue of *Transactions on Neural Networks and Learning Systems*, IEEE, “New Frontiers in Extremely Efficient Reservoir Computing”, opened in 2020 and closed in 2022.
ISSN:2162-237X
<https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385>

- Micheli** Special issue of *Transactions on Neural Networks and Learning Systems*, IEEE, “Deep Neural Networks for Graphs: Theory, Models, Algorithms and Applications”, opened in 2021.
ISSN:2162-237X
<https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385>
- Michienzi** Special issue of *IET Networks*, Wiley, “Blockchain and Decentralized Solutions for Social Good”, opened in 2021.
Online ISSN:2047-4962
<https://ietresearch.onlinelibrary.wiley.com/journal/20474962>
- Pisanti** Special Issue of *BMC Algorithms for Bioinformatics*, dedicated to “Selected papers of WABI 2020”, opened in 2020 and published in 2021.
ISSN: 1748-7188,
<https://almob.biomedcentral.com/>
- Ricci** Special Issue of *Blockchain: Research and Applications*, Elsevier, “Blockchain: protocols, applications, and Transaction analysis”, opened in 2021 and published in 2022.
ISSN: 2096-7209,
<https://www.sciencedirect.com/journal/blockchain-research-and-applications/special-issue/10L8LLK3VVH>
- Ruggieri** Special Issue of *ACM SIGKDD Explorations*, ACM, “Special Section on Bias and Fairness in AI”, opened in 2021.
ISSN: 1931- 0145,
<https://dl.acm.org/doi/10.1145/3468507.3468509>
- Soldani** Special issue of *Information*, MDPI, “Microservices and Cloud-Native Solutions: From Design to Operation”, opened in 2021.
ISSN:2078-2489
<https://www.mdpi.com/journal/information>
- Soldani** Special issue of *Future Internet*, MDPI, “Service-Oriented Systems and Applications”, opened in 2021.
ISSN:1999-5903
<https://www.mdpi.com/journal/futureinternet>
- Torquati** Special Issue of *IEEE Transactions on Emerging Topics in Computing* on “New Trends in Parallel and Distributed Computing for Human Sensible Applications”, published in 2021
ISSN: 2168-6750,
https://www.scopus.com/record/display.uri?eid=2-s2.0-85121669260&origin=resultslist&sort=plf-f&featureToggles=FEATURE_NEW_DOC_DETAILS_EXPORT:1

4 Managing Boards of Scientific Associations and Societies

We list here the scientific associations and societies that involved members of the Department, in their managing boards, in 2021. This section is edited with data collected via a direct communication with the researchers.

Bacciu Associazione Italiana per l'Intelligenza Artificiale (Vice-president, since 2015)

<https://aixia.it/organizzazione/>

Bacciu IEEE Technical Committee on Neural Networks (Vice-chair, since 2021)

<https://cis.ieee.org/activities/technical-activities/neural-networks-technical-committee/30-technical-committees/132-neural-networks-members>

Bacciu IEEE Task Force on Learning for Structured Data (Chair, since 2020)

www.learning4graphs.org

Bigi EUROPT (Chair, since 2018)

<https://www.euro-online.org/websites/continuous-optimization/>

Gadducci AICA Associazione Italiana per l'Informatica e il Calcolo Automatico (Comitato Direttivo, since 2021)

<https://www.aicanet.it/>

Gadducci GRIN Gruppo di Informatica (Chair, since 2020)

<http://www.grin-informatica.it/opencms/opencms/grin>

Micheli European Neural Network Society (Executive committee, since 2020)

<https://e-nns.org/current-enms-executive-committee/>

Micheli IEEE Task Force on Reservoir Computing (TFRC) (Co-chair and co-founder, since 2018)

<https://sites.google.com/view/reservoir-computing-tf>

Micheli AIxIA MLDM (Machine Learning and Data Mining) group (National coordinator, since 2014)

<https://aixia.it/en/gruppi/mldm/>

Micheli AIIS - CINI National Lab (Artificial Intelligence and Intelligent Systems) (Director of Pisa group, since 2021)

<https://www.consortio-cini.it/index.php/it/artificial-intelligence-and-intelligent-systems>

Priami Fondazione The Microsoft Research - University of Trento Centre of Computational and Systems Biology (Advisory board, since 2020)

<https://www.cosbi.eu>

Priami Digital Health - CINI National Lab (Advisory board, since 2021)

<https://www.consortio-cini.it/index.php/it/laboratori-nazionali/digital-health>

5 Scientific events

Here we report the list of the scientific events, such as conferences and workshops, that took place in 2021 and involved members of the Department in their scientific and/or technical organization. The events are classified according to the role of the involved researchers. This section is based on data taken from the url:

<https://ricerca.di.unipi.it/workshops-and-conferences/>

combined with data obtained via personal communications with the researchers.

5.1 Chairing of conferences

Chairing or co-chairing of international conferences in Computer Science settings:

Bonchi: MFCS 2021

Chessa: SAGE 2021

Gadducci: CALCO 2021, ICGT 2021

Guidi, Michienzi: OASIS21

Guidi-Ricci: BANDIT 2021, LSDVE21

Guidotti: XKDD 2021

Micheli: MLDM

Monreale: XAI.it 2021, XKDD2021

Ricci: LSDVE 2021, OASIS 2021

Semini: FormaliSE 2021

Sirbu: HMBEthics&Privacy2021

Di Francesco Maesa, Ricci: BRAIN 2021

5.2 Program Committee membership of conferences

Program Committee (PC) membership of the following international conferences in Computer Science and Operations Research settings:

Bigi: EUROPT 2021, ICORES 2021

Bodei: ICISSP 2021

Bonchi: LICS 2021

Broggi: ADAPTIVE 2021, AICCSA 2021, ASYDE, CloudAM 2021, CLOUD COMPUTING 2021, CIBSE 2021, CSIT 2021, ICFEC 2021, ICSEA 2021, ICSOC 2021, JCC 2021, MODELSWARD 2021, ScalCom 2021, SERVICE COMPUTATION 2021, SummerSoc 2021, UCC 2021

Bruni: ICTAC 2021

Chessa: IE, IEEE PIMRC, IPIN, ISCC

Conte: COMPLEX NETWORKS 2021, ECIR 2021, IWOCA 2021, SAC 2021

Di Francesco Maesa: IEEE ICBC, IEEE ICBTA, DAIS 2021

Frangioni: LION15, Odysseus 2021 (held in 2022)

Gadducci: MFPS XXXVII

Galicchio: AAAI 2021, ECML-PKDD 2021, ESANN 2021, ICLR 2021, IJCNN 2021, NeurIPS 2021

Gervasi: ABZ 2021, AIRE'21, NLP4RE2021, RE'21, REFSQ 2021

Gori: FormaliSE 2021, ICTCS 2021

Guidi: AMBIENT21, BANDIT21, BRAIN21, CloudCom21, eKNOW21, GoodIT21, LSDVE21, OASIS21, SMS21

Mencagli: APDCM, CCGrid, DEBS, D-MMEP, FRAME, ICDM, ISPASS, PDP, PPOPP

Micheli: AAAI 2021, AIXIA 2021, ECML/PKDD 2021, ESANN 2021, ICANN 2021

Michienzi: OASIS21

Paganelli: CNSM 2021, IEEE NetSoft 2021

Passacantando: ICORES 2021

Pisanti: ALENEX 2021, ICCS 2021, ISBRA 2021, MFCS 2021, SOFSEM 2021, SPIRE 2021, WABI 2021

Prencipe: SSS 2021

Ricci: Complex Networks 2021, IEEE COINS 2021, ACM GoodIT 2021, HiBB 2021, ACM ICBTA 2021, IEEE ICUMT 2021, IEEE Blockchain 2021, IEEE Blockchain and Cryptocurrencies, ICBC 2021, IWBOSE 2021, BIBM 2021

Ruggieri: AI*IA 2021, AISTATS 2021, ECML/PKDD 2021, IJCAI 2021, UAI 2021

Scutellà: ODS 2021

Sirbu: HMBEthics&Privacy2021

Soldani: AMP 2021, BDIOT 2021, CCIOT 2021, CLOSER 2021, DASA 2021, DistInSys 2021, eLmL 2021, FACS 2021, SERVICE COMPUTATION 2021, SIoTEC

5.3 Steering Committee membership of conferences

Bonchi: CALCO 2021

Danelutto: EuroMICRO PDP 2021

Micheli: ICANN 2021

Priami: CMSB 2021

Ricci: DAIS 2021

Ruggieri: FAccT 2021, FORC 2021

Torquati: Euro-Par 2021

5.4 Invited and keynote speakers at conferences

Chessa: Keynote speaker at WORIE

Di Francesco Maesa, Ricci: Invited speaker at Blockchain Days, Ecole Superieure de genie informatique

Mencagli: Invited speaker at WCloud-HPC 2021

Pisanti: Invited speaker at CPM 2021, IC-TCS 2021, RECOMB-SEQ 2021

5.5 Tutorial speakers at conferences

Gallicchio: AAAI 2021, IJCNN 2021

Guidi: WebSci'21

5.6 Conference organization

Local organization of the following international conferences in Computer Science settings:

Conte: GraphMastersOpen 2021 (in IWOCA 2021)

Guidi: GoodIT 2021

Mencagli, Torquati: AutoDaSP

Michienzi: OASIS21

Paganelli: NoF2021

Poloni: METT IX

Sirbu: HMBEthics&Privacy2021

Soldani: Publicity chair at ICSCA 2021

6 Research positions

In order to enhance the research activity of the Department, several research fellow positions have been assigned in 2021 so as to favour the participation of researchers at the very beginning of their scientific career, as well as to foster international collaborations. Specifically (data source: administrative secretariat of the Department):

1. 13 Junior Research grant positions (*Borse di studio e approfondimento* in Italian) have been opened on the following topics:
 - (a) *Design and development of a framework for Industry 4.0 needs and technologies identification and matching*
 - (b) *Machine learning on the edge for WIFI signal analysis*
 - (c) *Studying interpretable models derived by merging of tree-based classifiers*
 - (d) *Implementazione di Tecniche Zero Knowledge su Blockchain Ethereum*
 - (e) *Tensor decompositions in learning for structured data*
 - (f) *Causal discovery for explainable artificial intelligence*
 - (g) *Study and application of NLP techniques to XAI methods for healthcare*
 - (h) *Configurazione automatica di algoritmi di decomposizione*
 - (i) *Explainability and Interpretability for Few Shot Learning Models*
 - (j) *Didattica del Deep Learning*
 - (k) *Sviluppo di una metodologia semi-automatica per l'identificazione di errori e/o incoerenze di annotazione all'interno di porzioni rappresentative di specifiche varietà d'uso della lingua (es. dibattiti parlamentari, varietà storiche di italiano) della Italian Universal Dependency Treebank e relativa correzione*
 - (l) *Explanation Methods for Time Series Classification*
 - (m) *Modifica della versione distribuita di FastFlow per il supporto all'esecuzione su cluster MP*
2. 8 Senior Research grant positions (*Borse di ricerca* in Italian) have been opened on the following topics:
 - (a) *Progettazione e Sviluppo di interfacce grafiche per motori di ricerca dedicati all'identificazione dei bisogni e delle tecnologie abilitanti in contesti industria 4.0*
 - (b) *Machine learning e data science per studiare e predire la migrazione umana integrando dati provenienti da reti sociali e da fonti tradizionali*
 - (c) *Machine Learning su dati e pathway genetici per la prognosi in ambito oncologico*
 - (d) *Arricchire modelli di machine learning non interpretabili con spiegazioni usando metodologie di tipo local to global*
 - (e) *Predicting and explaining collective well-being from big data sources*
 - (f) *Incremental type systems for secure compilation*
 - (g) *Data driven analysis of the "Machine Learning and AI on the edge for 4.0 applications" topic by means of Natural language processing techniques*
 - (h) *Incremental type systems for secure compilation*
3. 22 Research fellow positions (*Assegni di ricerca* in Italian) have been opened:
 - (a) 3-year positions:
 - i. *Algorithms for PAngenome Computational Analysis*
 - (b) 2-year positions:
 - i. *Deep Learning and autoencoders applied to vaccine candidate identification*
 - (c) 1-year positions:

- i. *Toward the identification of relevant generic features for 4CMenB*
- ii. *Formal Methods and Techniques for Secure Compilation*
- iii. *Continual learning for recurrent neural models*
- iv. *Design and implementation of machine-learning for the analysis of multivariate time series on sensor data for cardio-respiratory patterns*
- v. *Distributed ledger: security and privacy*
- vi. *Development of Machine Learning models for automated ECG analysis*
- vii. *Secure Compilation*
- viii. *Combinatorial algorithms for the enumeration and analysis of sequential/structural patterns for large collection of biological data*
- ix. *Development of a C++ Structured Modelling System for Large-scale Optimization*
- x. *Scalable Processing and Explainable Mining of Big Mobility Data and applications to Sustainable Mobility*
- xi. *Internet of Things and artificial intelligence methodologies for the development of systems and models for precision agriculture*
- xii. *Complex network analysis: from theory to applications*
- xiii. *Continuous Automatic Learning for Predictive Maintenance*
- xiv. *Design and development of XAI methods for healthcare*
- xv. *Study methods for assessing, predicting and explaining individual privacy risks in human mobility*
- xvi. *Integrating Domain Knowledge in the explainable AI process*
- xvii. *Study and design of learning experiences for the enhancement of virtual and blended mobility; didactic and promotional videos of local cultures in a common European framework; open and multilingual educational content*
- xviii. *Set-up and analysis with Artificial Intelligence tools of a dataset relative to post-surgery cardiological rehabilitation*
- xix. *Categorical graph-based specification and verification of temporal properties*
- xx. *Design of data structures and algorithms which combine data compression and machine learning, with applications to big data indexing*

7 PhD Schools

We report here some basic information on the three PhD Schools managed by the Department. For additional information we refer to the respective web sites:

- PhD School in Computer Science: <https://dottorato.di.unipi.it/>
- PhD School in Data Science: <https://datasciencephd.eu/>
- National PhD in Artificial Intelligence for Society: <https://phd-ai-society.di.unipi.it/>

In 2021, indeed, thus considering cycle XXXVII, the PhD School in Data Science has become part of the National PhD in Artificial Intelligence for Society. In turn, the National PhD in Artificial Intelligence for Society is part of the National PhD in Artificial Intelligence, see <https://www.phd-ai.it/> for details.

7.1 PhD School in Computer Science

In 2021, the board of the PhD School in Computer Science included the following members:

- **Antonio Brogi, Coordinator**, Davide Bacciu (since March 2021), Stefano Chessa, Marco Danelutto, Paolo Ferragina, Gian-Luigi Ferrari, Antonio Frangioni, Roberto Grossi, Andrea Lisi (student, till October 2021), Corrado Priami, Laura Emilia Maria Ricci (since March 2021), Maria Grazia Scutellà, Andrea Valenti (student, till October 2021) from the Department of Computer Science of the University of Pisa.
- Michele Boreale, Elisa Pergola (till March 2021), Rosario Pugliese from the University of Florence.
- Sara Brunetti, Simone Rinaldi from the University of Siena.
- Fabio Martinelli (CNR-IIT, Institute of Informatics and Telematics), Chiara Renso (CNR-ISTI, Information Science and Technology Institute), Paolo Santi (CNR-IIT), Roberto Scopigno (CNR-ISTI) from National Research Council of Italy (*Consiglio Nazionale delle Ricerche* in Italian).
- Ricardo Baeza-Yates (Northeast University), Sajal Das (Missouri University of Science and Technology), Joshua Guttman (Worcester Polytechnic Institute and MITRE Corporation), Daria Mochly-Rosen (Stanford University) from USA.
- Leo Liberti, Catuscia Palamidessi from Ecole Polytechnique and CNRS, France.
- Frank Leymann from the University of Stuttgart, Germany.

In 2021, 18 new PhD student positions were opened (Cycle XXXVII), and across that year the PhD students enrolled in the Computer Science PhD were the following ones (arranged per cycle):

- Cycle XXXIII: Busi Matteo, Carta Antonio, Castellana Daniele, Crecchi Francesco, Daoudagh Said, De Mattei Lorenzo, Iommazzo Gabriele, Metilli Daniele, Michienzi Andrea, Oslia Oleksii, Podda Marco, Puccetti Roberto, Rahman Mohsin Ur, Rinaldi Luca, Spataru Adrian Florin, Versari Luca.
- Cycle XXXIV: Alderighi Thomas, Bienh Uls Benedikt, Ceragioli Lorenzo, Errica Federico, Mischi Alessio, Setzu Mattia, Sucameli Irene, Vinciguerra Giorgio.
- Cycle XXXV: Baccini Federica, Bocci Alessandro, Citraro Salvatore, Di Sarli Daniele, Iadarola Giacomo, Lagani Gabriele, Landolfi Francesco, Lisi Andrea, Machado Bruno, Manolas Iason, Molinari Alessio, Oliveira Fernanda, Palma Giulia, Punzi Giulia, Rotelli Daniela, Rulli Cosimo, Sansone Francesco, Sattar Asma, Tortelli Tarlis, Valenti Andrea, Vogel Adriano Jose, Zedda Eleonora.
- Cycle XXXVI: Berti Alessandro, Boffa Antonio, Bussi Laura, Cornacchia Giuliano, De Caro Valerio, Di Giorgio Alessandro, Fuchs Andrew, Gravina Alessio, Loporchio Matteo, Numeroso Danilo, Pedrotti Andrea, Resta Michele, Rucci Davide, Tortorella Domenico, Tosoni Francesco.

- Cycle XXVII: Alabasi Wesam Nitham, Ascari Flavio, Cardia Marco, Cinquini Martina, Corbucci Luca, Di Pasquale Federica, Gaglianese Marco, Guerra Andrea, Kapitako Jeconia, Lomurno Giuseppe, Massa Jacopo, Massidda Riccardo, Mwaniki Moses Njagi, Ottimo Alberto, Pugliese Chiara, Ramjattan Reshawn, Semola Rudy, Tonci Nicolo', Tortola Domenico.

7.2 PhD School in Data Science

In 2021, the board of the PhD School in Data Science included the following members:

- **Dino Pedreschi, Coordinator** (Department of Computer Science), Roberta Bracciale (Department of Political Science), Fabio Gadducci (Department of Computer Science), Pier Luigi Lopalco (Department of Translational Research on New Technologies in Medicine and Surgery), Francesco Marcelloni (Department of Information Engineering), Anna Monreale (Department of Computer Science), Nadia Pisanti (Department of Computer Science), Monica Pratesi (Department of Economics & Management), Chiara Maria Angela Roda (Department of Physics), Salvatore Ruggieri (Department of Computer Science) from the University of Pisa.
- Giuseppe Brancato, Alessandro Cellerino, Henrik Koch, Elena Pavan, Sergio Rampino from Scuola Normale Superiore.
- Francesca Chiaromonte, Giovanni Comandé, Tommaso Cucinotta, Andrea Mario Cuore Piccaluga from Sant'Anna School of Advanced Studies.
- Giulio Cimini, Diego Garlaschelli, Tiziano Squartini from IMT School for Advanced Studies, Lucca.
- Marco Conti (CNR-IIT - Institute of Informatics and Telematics), Fosca Giannotti (CNR-ISTI - Information Science and Technology Institute), Mirco Nanni (CNR-ISTI), Raffaele Perego (CNR-ISTI), from National Research Council of Italy (*Consiglio Nazionale delle Ricerche* in Italian).
- Janos Kertész from Budapest University of Technology and Economics, Hungary.
- Stan Matwin from Dalhousie University, Canada.
- Albert-László Barabási (Northeastern University), Alex 'Sandy' Pentland from Massachusetts Institute of Technology), from USA.

Across 2021, the PhD students enrolled in the Data Science PhD were the following ones (arranged per cycle):

- Cycle XXXIII: Elisa Ferrari, Luca Insolia, Jisu Kim, Cecilia Panigutti, Tommaso Radicioni, Giorgio Tripodi, Vasiliki Voukelatou, Gevorg Yeghikyan.
- Cycle XXXIV: Agnese Bonavita, Leonardo Niccolò Ialongo, Benedetta Iavarone, Francesca Lizzi, Kilian Ollivier, Ivan Ortiz Rodriguez, German Rodikov, Andrea Somazzi, Giovanni Tonutti.
- Cycle XXXV: Dario Balboni, Francesco Bodria, Silvia Corbara, Andrea Cossu, Andrea Gini, Giacomo Lanciano, Valentina Macchiati, Sara Mazzilli, Francesca Naretto, Anthony Onoja, Giovanni Puccetti.
- Cycle XXXVI: Jose Manuel Alvarez, Mila Andreani, Lorenzo Bellomo, Filippo Galli, Mirko Nardi, Valentina Pansanella, Andrea Pugnana, Francesco Spinnato, Laura State, Jack Tacchi.

7.3 National PhD in Artificial Intelligence for Society

In 2021, the board of the PhD in Artificial Intelligence for Society included the following members, plus two elected representatives of the PhD students:

- **Dino Pedreschi, Coordinator**, Anna Monreale, Vice-coordinator, Fabio Gadducci, Alessio Malizia, Nadia Pisanti, Salvatore Ruggieri from the Department of Computer Science of the University of Pisa.

- Roberta Bracciale, Marco Cococcioni, Francesco Marcelloni, Monica Pratesi, Chiara Maria Angela Roda from the University of Pisa.
- Giacomo De Palma, Fosca Giannotti from Scuola Normale Superiore, Pisa.
- Francesca Chiaromonte, Giovanni Comandè, Tommaso Cucinotta, Andrea Piccaluga, Andrea Vandin from Scuola Sant'Anna, Pisa.
- Chiara Boldrini, Marco Conti, Maurizio Tesconi from CNR-IIT.
- Mirco Nanni, Marco Conti, Raffaele Perego from CNR-ISTI.
- Rosa Lanzilotti, Nicole Novielli from the University of Bari.
- Emanuele Mingione from the University of Bologna.
- Giuseppe Riva from Università Cattolica del Sacro Cuore.
- Michela Baccini, Paolo Nesi from the University of Florence.
- Stefania Costantini from University of L'Aquila.
- Diego Garlaschelli, Tiziano Squartini, Yesim Tonga Uriarte from Scuola IMT Lucca.
- Rita Cucchiara, Costantino Grana, Marco Lippi from University of Modena e Reggio Emilia.
- Maria Pia Di Buono from Università degli Studi di Napoli L'Orientale.
- Valentina Poggioni from the University of Perugia.
- Adriano Barra from the University of Salento.
- Massimo Tistarelli from Università degli Studi di Sassari.
- Stefano Melacci from the University of Siena.
- Andrea Passerini, Elena Pavan from the University di Trento

In 2021, 50 PhD student positions were opened for Cycle XXXVII:

- Cycle XXVII: Costanza Alfieri, Maddalena Amendola, Giada Anastasi, Alberto Baldrati, Simone Barandoni, Isacco Beretta, Valerio Bonsignori, Gianpaolo Bontempo, Giovanni Camarda, Eleonora Cappuccio, Francesco Carli, Irina Carnat, Roberto Casaluca, Enrico Collini, Tommaso Crepax, Nicola Dall'Asen, Daniele D'Armineto, Michele Fontana, Simone Gallo, Mitisha Gaur, Gianluca Guidi, Muhammad Imran, Daniele Lotito, Lorenzo Mannocci, Marta Marchiori Manerba, Emanuele Marconato, Giovanni Mauro, Marco Minici, Davide Morelli, Virginia Morini, Cosimo Palma, Emanuele Parisini, Vittorio Pippi, Robert Lee Poe, Samuele Poppi, Nischay Purnkear, Andrea Rafanelli, Bin Ren, Guido Rocchietti, Muhammad Waheed Sabir, Elena Sajno, Quirino Saraceni, Gaia Saveri, Giuseppe Saviano, Gianluca Sperduti, Edoardo Urettini, Serena Versino, Qifan Yang, Filippo Zimmaro, Maciej Krzysztof Zuziak.

8 Visiting Fellows

Thanks to its scientific prestige and highly international profile, the Department of Computer Science often hosts scientific events and seminars that external researchers attend, and research staff of the Department often receives visits of colleagues from other Italian institutions and from abroad. We report here on the unique researcher who visited the Department in 2021 (source: direct communication with the CAI of the Department Prof. Andrea Corradini, i.e., the delegate of the Department for the international relationships).

Prof. Letizia Jaccheri, Norwegian University of Science and Technology (Trondheim, Norvegia), visited the Computer Science Department under the invitation of Prof. Susanna Pelagatti from December 6, 2021 to January 10, 2022. Together with Prof. Pelagatti and other colleagues, Prof. Jaccheri worked to a paper entitled "Guidelines for research and design of software for children with ASD in e-health", which was submitted for publication.

Unfortunately, the other four visits planned in 2021 were cancelled, mainly due to the pandemic Covid-19 health situation.

9 Peer-reviewed publications

In this section we report the complete list of the research products published in 2021 and having members of the Department among the authors. This section has been populated with data taken from the official file sent to the *Area 01 Committee* by the Research Office of the University in June 2022, limited to entries published in 2021, and then integrated with information from the researchers.

9.1 Journal papers

The following papers have been published in peer reviewed international journals in 2021 by the members of the Department:

- [1] Gabriell Araujo, Dalvan Griebler, Dinei Rockenbach, Marco Danelutto, and Luiz G. Fernandes. NAS parallel benchmarks with CUDA and beyond. *Software: Practice and Experience*, 2021.
- [2] Davide Bacciu, Alessio Conte, Roberto Grossi, Francesco Landolfi, and Andrea Marino. K-plex cover pooling for graph neural networks. *Data Min. Knowl. Discov.*, 35(5):2200–2220, 2021.
- [3] Paolo Baldan, Andrea Corradini, and Fabio Gadducci. Concurrent semantics for fusions: Weak prime domains and connected event structures. *Inf. Comput.*, 281:104770, 2021.
- [4] Roberto Barbuti, Anna Bernasconi, Roberta Gori, and Paolo Milazzo. Characterization and computation of ancestors in reaction systems. *Soft Comput.*, 25(3):1683–1698, 2021.
- [5] Roberto Barbuti, Pasquale Bove, Roberta Gori, Damas P. Gruska, Francesca Levi, and Paolo Milazzo. Encoding threshold boolean networks into reaction systems for the analysis of gene regulatory networks. *Fundam. Informaticae*, 179(2):205–225, 2021.
- [6] Roberto Barbuti, Roberta Gori, and Paolo Milazzo. Encoding boolean networks into reaction systems for investigating causal dependencies in gene regulation. *Theor. Comput. Sci.*, 881:3–24, 2021.
- [7] Giulia Bernardini, Huiping Chen, Alessio Conte, Roberto Grossi, Grigorios Loukides, Nadia Pisanti, Solon P. Pissis, Giovanna Rosone, and Michelle Sweering. Combinatorial algorithms for string sanitization. *ACM Trans. Knowl. Discov. Data*, 15(1):8:1–8:34, 2021.
- [8] Alessandro Bocci, Stefano Forti, Gian Luigi Ferrari, and Antonio Brogi. Secure faas orchestration in the fog: how far are we? *Computing*, 103(5):1025–1056, 2021.
- [9] Chiara Bodei, Lorenzo Ceragioli, Pierpaolo Degano, Riccardo Focardi, Letterio Galletta, Flaminia L. Luccio, Mauro Tempesta, and Lorenzo Veronese. FWS: analyzing, maintaining and transcompiling firewalls. *J. Comput. Secur.*, 29(1):77–134, 2021.
- [10] Chiara Bodei, Pierpaolo Degano, Gian Luigi Ferrari, and Letterio Galletta. Modelling and analysing IoT systems. *J. Parallel Distributed Comput.*, 157:233–242, 2021.
- [11] Filippo Bonchi, Robin Piedeleu, Pawel Sobocinski, and Fabio Zanasi. Bialgebraic foundations for the operational semantics of string diagrams. *Inf. Comput.*, 281:104767, 2021.
- [12] Filippo Bonchi, Alexandra Silva, and Ana Sokolova. Distribution bisimilarity via the power of convex algebras. *Log. Methods Comput. Sci.*, 17(3), 2021.
- [13] Mariasole Bondioli, Stefano Chessa, Antonio Narzisi, Susanna Pelagatti, and Michele Zoncheddu. Towards motor-based early detection of autism red flags: Enabling technology and exploratory study protocol. *Sensors*, 21(6):1971, 2021.
- [14] Linda Brodo, Roberto Bruni, and Moreno Falaschi. A logical and graphical framework for reaction systems. *Theor. Comput. Sci.*, 875:1–27, 2021.
- [15] Linda Brodo, Roberto Bruni, and Moreno Falaschi. A process algebraic approach to reaction systems. *Theor. Comput. Sci.*, 881:62–82, 2021.

- [16] Toon Calders, Eirini Ntoutsi, Mykola Pechenizkiy, Bodo Rosenhahn, and Salvatore Ruggieri. Introduction to the special section on bias and fairness in AI. *SIGKDD Explor.*, 23(1):1–3, 2021.
- [17] Antonio Carta, Alessandro Sperduti, and Davide Bacciu. Encoding-based memory for recurrent neural networks. *Neurocomputing*, 456:407–420, 2021.
- [18] Antonio Caruso, Stefano Chessa, Soledad Escolar, Jesús Barba, and Juan Carlos López. Collection of data with drones in precision agriculture: Analytical model and lora case study. *IEEE Internet Things J.*, 8(22):16692–16704, 2021.
- [19] Alessio Conte, Donatella Firmani, Maurizio Patrignani, and Riccardo Torlone. A meta-algorithm for finding large k-plexes. *Knowl. Inf. Syst.*, 63(7):1745–1769, 2021.
- [20] Andrea Cossu, Antonio Carta, Vincenzo Lomonaco, and Davide Bacciu. Continual learning for recurrent neural networks: An empirical evaluation. *Neural Networks*, 143:607–627, 2021.
- [21] Marco Danelutto, Gabriele Mencagli, Massimo Torquati, Horacio González-Vélez, and Peter Kilpatrick. Algorithmic skeletons and parallel design patterns in mainstream parallel programming. *Int. J. Parallel Program.*, 49(2):177–198, 2021.
- [22] Shantanu Das, Giuseppe Antonio Di Luna, Daniele Mazzei, and Giuseppe Prencipe. Compacting oblivious agents on dynamic rings. *PeerJ Comput. Sci.*, 7:e466, 2021.
- [23] Kasper Dokter, Fabio Gadducci, Benjamin Lion, and Francesco Santini. Soft constraint automata with memory. *J. Log. Algebraic Methods Program.*, 118:100615, 2021.
- [24] Federico Errica, Marco Giulini, Davide Bacciu, Alessio Micheli Roberto Menichetti, and Raffaello Potestio. A deep graph network-enhanced sampling approach to efficiently explore the space of reduced representations of proteins. *Frontiers in Molecular Biosciences*, 8, 2021.
- [25] Paolo Ferragina, Fabrizio Lillo, and Giorgio Vinciguerra. On the performance of learned data structures. *Theor. Comput. Sci.*, 871:107–120, 2021.
- [26] Gabriele Fici, Nicola Prezza, and Rossano Venturini. Adaptive learning of compressible strings. *Theor. Comput. Sci.*, 896:46–52, 2021.
- [27] Davide Fioriti, Antonio Frangioni, and Davide Poli. Optimal sizing of energy communities with fair revenue sharing and exit clauses: Value, role and business model of aggregators and users. *Applied Energy*, 299:117328, 2021.
- [28] Stefano Forti, Marco Gaglianese, and Antonio Brogi. Lightweight self-organising distributed monitoring of fog infrastructures. *Future Gener. Comput. Syst.*, 114:605–618, 2021.
- [29] Stefano Forti, Isaac Lera, Carlos Guerrero, and Antonio Brogi. Declarative application management in the fog: A bacteria-inspired decentralised approach. *Journal of Grid Computing*, 19, 2021.
- [30] Stefano Forti, Isaac Lera, Carlos Guerrero, and Antonio Brogi. Osmotic management of distributed complex systems: a declarative decentralised approach. *Journal of Software: Evolution and Process*, page e2405, 2021.
- [31] Antonio Frangioni, Stefania Pan, Emiliano Traversi, and Roberto Wolfler Calvo. A constraints-aware reweighted feasibility pump approach. *Oper. Res. Lett.*, 49(5):671–675, 2021.
- [32] Laura Galli and Adam N. Letchford. A separation algorithm for the simple plant location problem. *Oper. Res. Lett.*, 49(4):610–615, 2021.
- [33] Laura Galli and Adam N. Letchford. Valid inequalities for quadratic optimisation with domain constraints. *Discret. Optim.*, 41:100661, 2021.
- [34] Laura Galli, Silvano Martello, Carlos Rey, and Paolo Toth. Polynomial-size formulations and relaxations for the quadratic multiple knapsack problem. *Eur. J. Oper. Res.*, 291(3):871–882, 2021.

- [35] Rosario Giuseppe Garroppo, Gianfranco Nencioni, Luca Tavanti, Bernard Gendron, and Maria Grazia Scutellà. Optimal access point power management for green IEEE 802.11 networks. *Sensors*, 21(6):2076, 2021.
- [36] Filippo Geraci and Giovanni Manzini. *EZcount*: An all-in-one software for microrna expression quantification from NGS sequencing data. *Comput. Biol. Medicine*, 133:104352, 2021.
- [37] Ali Ghezelsoufi, Massimo Di Francesco, Antonio Frangioni, and Paola Zuddas. A multiperiod drayage problem with customer-dependent service periods. *Comput. Oper. Res.*, 129:105189, 2021.
- [38] Michele Girolami, Dimitri Belli, Stefano Chessa, and Luca Foschini. How mobility and sociality reshape the context: A decade of experience in mobile crowdsensing. *Sensors*, 21(19):6397, 2021.
- [39] Barbara Guidi. An overview of blockchain online social media from the technical point of view. *Applied Sciences*, 11(21):9880, 2021.
- [40] Barbara Guidi and Andrea Michienzi. Dynamic community structure in online social groups. *Inf.*, 12(3):113, 2021.
- [41] Barbara Guidi, Andrea Michienzi, and Laura Ricci. Analysis of witnesses in the Steem blockchain. *Mob. Networks Appl.*, 26(5):2099–2110, 2021.
- [42] Riccardo Guidotti. Evaluating local explanation methods on ground truth. *Artif. Intell.*, 291:103428, 2021.
- [43] Riccardo Guidotti and Matteo D’Onofrio. Matrix profile-based interpretable time series classifier. *Frontiers Artif. Intell.*, 4:699448, 2021.
- [44] Dirk Helbing, Farzam Fanitabasi, Fosca Giannotti, Regula Hänggli, Carina Hausladen, Jeroen a van den Hoven, Sachit Mahajan, Dino Pedreschi, and Evangelos Pournaras. Ethics of smart cities: Towards value-sensitive design and co-evolving city life. *Sustainability*, 13(20):11162, 2021.
- [45] Lorena Leonardelli, Giuseppe Lofano, Gianluca Selvaggio, Silvia Parolo, Stefano Giampiccolo, Danilo Tomasoni, Enrico Domenici, Corrado Priami, Haifeng Song, Duccio Medini, et al. Literature mining and mechanistic graphical modelling to improve mrna vaccine platforms. *Frontiers in Immunology*, 12, 2021.
- [46] Fabrizio Lillo and Salvatore Ruggieri. Estimating the total volume of queries to a search engine. *IEEE Transactions on Knowledge and Data Engineering*, 2021.
- [47] Andrea Lisi, Andrea De Salve, Paolo Mori, Laura Ricci, and Samuel Fabrizi. Rewarding reviews with tokens: An ethereum-based approach. *Future Gener. Comput. Syst.*, 120:36–54, 2021.
- [48] Júnior Löff, Dalvan Griebler, Gabriele Mencagli, Gabriell Alves de Araujo, Massimo Torquati, Marco Danelutto, and Luiz Gustavo Fernandes. The NAS parallel benchmarks for evaluating C++ parallel programming frameworks on shared-memory architectures. *Future Gener. Comput. Syst.*, 125:743–757, 2021.
- [49] Matteo Loporchio, Anna Bernasconi, Damiano Di Francesco Maesa, and Laura Ricci. Authenticating spatial queries on blockchain systems. *IEEE Access*, 9:163363–163378, 2021.
- [50] Sabrina Mantaci, Antonio Restivo, Giuseppe Romana, Giovanna Rosone, and Marinella Sciortino. A combinatorial view on string attractors. *Theor. Comput. Sci.*, 850:236–248, 2021.
- [51] Giandomenico Mastroeni and Massimo Pappalardo. Optimality conditions for vector variational inequalities via image space analysis. *Journal of nonlinear and variational analysis*, 5, 2021.
- [52] Daniele Mazzei, Filippo Chiarello, and Gualtiero Fantoni. Analyzing social robotics research with natural language processing techniques. *Cogn. Comput.*, 13(2):308–321, 2021.
- [53] Gabriele Mencagli, Massimo Torquati, Andrea Cardaci, Alessandra Fais, Luca Rinaldi, and Marco Danelutto. Windflow: High-speed continuous stream processing with parallel building blocks. *IEEE Trans. Parallel Distributed Syst.*, 32(11):2748–2763, 2021.

- [54] Andrea Michienzi, Barbara Guidi, Laura Ricci, and Andrea De Salve. Incremental communication patterns in online social groups. *Knowl. Inf. Syst.*, 63(6):1339–1364, 2021.
- [55] Paolo Milazzo, Roberta Gori, Alessio Micheli, Lucia Nasti, and Marco Podda. In silico modelling of biochemical pathways. *Biomedical Science and Engineering*, 4(s1), 2021.
- [56] Ioanna Miliou, Xinyue Xiong, Salvatore Rinzivillo, Qian Zhang, Giulio Rossetti, Fosca Giannotti, Dino Pedreschi, and Alessandro Vespignani. Predicting seasonal influenza using supermarket retail records. *PLoS Comput. Biol.*, 17(7), 2021.
- [57] Georgios Mylonas, Federica Paganelli, Giovanni Cuffaro, Ilaria Nesi, and Dionysis Karantzis. Using gamification and IoT-based educational tools towards energy savings-some experiences from two schools in italy and greece. *Journal of Ambient Intelligence and Humanized Computing*, pages 1–20, 2021.
- [58] Mirco Nanni, Gennady Andrienko, Albert-Laszlo Barabasi, Chiara Boldrini, Francesco Bonchi, Ciro Cattuto, Francesca Chiaromonte, Giovanni Comandè, Marco Conti, Mark Cote, Paolo Feragina, et al. Give more data, awareness and control to individual citizens, and they will help COVID-19 containment. *Ethics and Information Technology*, 2021.
- [59] Vanni Noferini and Federico Poloni. Nearest Ω -stable matrix via Riemannian optimization. *Numerische Mathematik*, 148(4):817–851, 2021.
- [60] Federica Paganelli, Paola Cappanera, and Giovanni Cuffaro. Tenant-defined service function chaining in a multi-site network slice. *Future Gener. Comput. Syst.*, 121:1–18, 2021.
- [61] Cecilia Panigutti, Alan Perotti, André Panisson, Paolo Bajardi, and Dino Pedreschi. Fairlens: Auditing black-box clinical decision support systems. *Information Processing & Management*, 58(5):102657, 2021.
- [62] Mauro Passacantando, Giorgio Gnecco, Yuval Hadas, and Marcello Sanguineti. Braess’ paradox: A cooperative game-theoretic point of view. *Networks*, 78(3):264–283, 2021.
- [63] Mauro Passacantando and Fabio Raciti. Optimal road maintenance investment in traffic networks with random demands. *Optim. Lett.*, 15(5):1799–1819, 2021.
- [64] Mauro Passacantando and Fabio Raciti. A performance measure analysis for traffic networks with random data and general monotone cost functions. *Optimization*, pages 1–27, 2021.
- [65] Raffaele Perego, Giulio Ermanno Pibiri, and Rossano Venturini. Compressed indexes for fast search of semantic data. *IEEE Trans. Knowl. Data Eng.*, 33(9):3187–3198, 2021.
- [66] Giulio Ermanno Pibiri and Rossano Venturini. Practical trade-offs for the prefix-sum problem. *Softw. Pract. Exp.*, 51(5):921–949, 2021.
- [67] Giulio Ermanno Pibiri and Rossano Venturini. Techniques for inverted index compression. *ACM Comput. Surv.*, 53(6):125:1–125:36, 2021.
- [68] Ernesto Pimentel and Jacopo Soldani. Preface to the special issue on coordination and self-adaptiveness of software applications. *Sci. Comput. Program.*, 204:102594, 2021.
- [69] Nicola Prezza and Giovanna Rosone. Space-efficient construction of compressed suffix trees. *Theor. Comput. Sci.*, 852:138–156, 2021.
- [70] Corrado Priami. Computational approaches to understanding nutrient metabolism and metabolic disorders. *Current Opinion in Biotechnology*, 70:7–14, 2021.
- [71] Luigi Di Puglia Pugliese, Francesca Guerriero, and Maria Grazia Scutellà. The last-mile delivery process with trucks and drones under uncertain energy consumption. *J. Optim. Theory Appl.*, 191(1):31–67, 2021.
- [72] Michele Resta, Anna Monreale, and Davide Bacciu. Occlusion-based explanations in deep recurrent models for biomedical signals. *Entropy*, 23(8):1064, 2021.

- [73] Laura Ricci, Damiano Di Francesco Maesa, Alfredo Favenza, and Enrico Ferro. Blockchains for COVID-19 contact tracing and vaccine support: A systematic review. *IEEE Access*, 9:37936–37950, 2021.
- [74] Andrea De Salve, Paolo Mori, Barbara Guidi, Laura Ricci, and Roberto Di Pietro. Predicting influential users in online social network groups. *ACM Trans. Knowl. Discov. Data*, 15(3):35:1–35:50, 2021.
- [75] Simone Scardapane, Claudio Gallicchio, Alessio Micheli, and Miguel C Soriano. Guest editorial: Trends in reservoir computing. *Cognitive Computation*, pages 1–2, 2021.
- [76] Murilo Reolon Scuzziato, Erlon Cristian Finardi, and Antonio Frangioni. Solving stochastic hydrothermal unit commitment with a new primal recovery technique based on lagrangian solutions. *International Journal of Electrical Power & Energy Systems*, 127:106661, 2021.
- [77] Hamta Sedghani, Danilo Ardagna, Mauro Passacantando, Mina Zolfy Lighvan, and Hadi S. Aghdasi. An incentive mechanism based on a stackelberg game for mobile crowdsensing systems with budget constraint. *Ad Hoc Networks*, 123:102626, 2021.
- [78] Mattia Setzu, Riccardo Guidotti, Anna Monreale, Franco Turini, Dino Pedreschi, and Fosca Giannotti. Glocalx - from local to global explanations of black box AI models. *Artif. Intell.*, 294:103457, 2021.
- [79] Alina Sirbu, Greta Barbieri, Francesco Faita, Paolo Ferragina, Luna Gargani, Lorenzo Ghiadoni, and Corrado Priami. Early outcome detection for COVID-19 patients. *Scientific reports*, 11(1):1–14, 2021.
- [80] Jacopo Soldani. Pains and gains of peer-reviewing in software engineering (4). *ACM SIGSOFT Softw. Eng. Notes*, 46(1):8, 2021.
- [81] Jacopo Soldani. Pains and gains of peer-reviewing in software engineering (5). *ACM SIGSOFT Softw. Eng. Notes*, 46(3):14, 2021.
- [82] Jacopo Soldani, Giuseppe Muntoni, Davide Neri, and Antonio Brogi. The μ tosca toolchain: Mining, analyzing, and refactoring microservice-based architectures. *Softw. Pract. Exp.*, 51(7):1591–1621, 2021.
- [83] Charles Michael Stein, Dinei A. Rockenbach, Dalvan Griebler, Massimo Torquati, Gabriele Mencagli, Marco Danelutto, and Luiz Gustavo Fernandes. Latency-aware adaptive micro-batching techniques for streamed data compression on graphics processing units. *Concurr. Comput. Pract. Exp.*, 33(11), 2021.
- [84] Danilo Tomasoni, Alessio Paris, Stefano Giampiccolo, Federico Reali, Giulia Simoni, Luca Marchetti, Chanchala Kaddi, Susana Neves-Zaph, Corrado Priami, Karim Azer, et al. QSPcc reduces bottlenecks in computational model simulations. *Communications biology*, 4(1):1–10, 2021.
- [85] Jeroen van de Hoven, Giovanni Comandé, Salvatore Ruggieri, Josep Domingo-Ferrer, Francesca Musiani, Fosca Giannotti, Francesca Pratesi, and Marc Stauch. Towards a digital ecosystem of trust: Ethical, legal and societal implications. *Opinio Juris In Comparatione*, 1-2021:131–156, 2021.
- [86] Adriano Vogel, Gabriele Mencagli, Dalvan Griebler, Marco Danelutto, and Luiz Gustavo Fernandes. Online and transparent self-adaptation of stream parallel patterns. *Computing*, pages 1–19, 2021.
- [87] Q. Yao, P. Ferragina, Y. Reshef, G. Lettre, DE Bauer, and L. Pinello. Motif-raptor: A cell type-specific and transcription factor centric approach for post-gwas prioritization of causal regulators. *Bioinformatics (Oxford, England)*, 2021.
- [88] Vladimir Yussupov, Jacopo Soldani, Uwe Breitenbücher, Antonio Brogi, and Frank Leymann. Faasten your decisions: A classification framework and technology review of function-as-a-service platforms. *J. Syst. Softw.*, 175:110906, 2021.

9.2 Conference papers

The following papers have been published in proceedings of national and international conferences in 2021 by the members of the Department:

- [1] Giovanni Agosta, Daniele Cattaneo, William Fornaciari, Andrea Galimberti, Giuseppe Masari, Federico Reghenzani, Federico Terraneo, Davide Zoni, Carlo Brandolese, Massimo Celino, Francesco Iannone, Paolo Palazzari, Giuseppe Zummo, Massimo Bernaschi, Pasqua D’Ambra, Sergio Saponara, Marco Danelutto, Massimo Torquati, Marco Aldinucci, Yasir Arfat, Barbara Cantalupo, Iacopo Colonnelli, Roberto Esposito, Alberto Riccardo Martinelli, Gianluca Mittone, Olivier Beaumont, Bérenger Bramas, Lionel Eyraud-Dubois, Brice Goglin, Abdou Guermouche, Raymond Namyst, Samuel Thibault, Antonio Filgueras, Miquel Vidal, Carlos Álvarez, Xavier Martorell, Ariel Oleksiak, Michal Kulczewski, Alessandro Lonardo, Piero Vicini, Francesca Lo Cicero, Francesco Simula, Andrea Biagioni, Paolo Cretaro, Ottorino Frezza, Pier Stanislao Paolucci, Matteo Turisini, Francesco Giacomini, Tommaso Boccali, Simone Montangelo, and Roberto Ammendola. TEXTAROSSA: towards extreme scale technologies and accelerators for eurohpc hw/sw supercomputing applications for exascale. In Francesco Loporati, Salvatore Vitabile, and Amund Skavhaug, editors, *24th Euromicro Conference on Digital System Design, DSD 2021, Palermo, Spain, September 1-3, 2021*, pages 286–294. IEEE, 2021.
- [2] Michele Albano, Stefano Chessa, and Kim Guldstrand Larsen. A model-checking static analysis of task-based energy neutrality for energy harvesting iot. In *IEEE Symposium on Computers and Communications, ISCC 2021, Athens, Greece, September 5-8, 2021*, pages 1–7. IEEE, 2021.
- [3] Marco Aldinucci, Giovanni Agosta, Antonio Andreini, Claudio Agostino Ardagna, Andrea Bartolini, Alessandro Cilardo, Biagio Cosenza, Marco Danelutto, Roberto Esposito, William Fornaciari, Roberto Giorgi, Davide Lengani, Raffaele Montella, Mauro Olivieri, Sergio Saponara, Daniele Simoni, and Massimo Torquati. The italian research on HPC key technologies across eurohpc. In Maurizio Palesi, Antonino Tumeo, Georgios I. Goumas, and Carmen G. Almudéver, editors, *CF ’21: Computing Frontiers Conference, Virtual Event, Italy, May 11-13, 2021*, pages 178–184. ACM, 2021.
- [4] Gabriella Andrade, Dalvan Griebler, Rodrigo Pereira dos Santos, Marco Danelutto, and Luiz Gustavo Fernandes. Assessing coding metrics for parallel programming of stream processing programs on multi-cores. In Maria Teresa Baldassarre, Giuseppe Scanniello, and Amund Skavhaug, editors, *47th Euromicro Conference on Software Engineering and Advanced Applications, SEAA 2021, Palermo, Italy, September 1-3, 2021*, pages 291–295. IEEE, 2021.
- [5] Giuseppe Attardi, Daniele Sartiano, and Maria Simi. Biaffine dependency and semantic graph parsing for enhanced universal dependencies. In *Proceedings of the 17th International Conference on Parsing Technologies and the IWPT 2021 Shared Task on Parsing into Enhanced Universal Dependencies (IWPT 2021)*, pages 184–200, 2021.
- [6] Lyes Attouche, Mohamed Amine Baazizi, Dario Colazzo, Yunchen Ding, Michael Fruth, Giorgio Ghelli, Carlo Sartiani, and Stefanie Scherzinger. A test suite for JSON schema containment. In Roman Lukyanenko, Binny M. Samuel, and Arnon Sturm, editors, *Proceedings of the ER Demos and Posters 2021 co-located with 40th International Conference on Conceptual Modeling (ER 2021), St. John’s, NL, Canada, October 18-21, 2021*, volume 2958 of *CEUR Workshop Proceedings*, pages 19–24. CEUR-WS.org, 2021.
- [7] Lyes Attouche, Mohamed Amine Baazizi, Dario Colazzo, Francesco Falleni, Giorgio Ghelli, Cristiano Landi, Carlo Sartiani, and Stefanie Scherzinger. A tool for JSON schema witness generation. In Yannis Velegarakis, Demetris Zeinalipour-Yazti, Panos K. Chrysanthis, and Francesco Guerra, editors, *Proceedings of the 24th International Conference on Extending Database Technology, EDBT 2021, Nicosia, Cyprus, March 23 - 26, 2021*, pages 694–697. OpenProceedings.org, 2021.
- [8] Daniele Atzeni, Davide Bacciu, Federico Errica, and Alessio Micheli. Modeling edge features with deep bayesian graph networks. In *International Joint Conference on Neural Networks, IJCNN 2021, Shenzhen, China, July 18-22, 2021*, pages 1–8. IEEE, 2021.

- [9] Mohamed Amine Baazizi, Dario Colazzo, Giorgio Ghelli, Carlo Sartiani, and Stefanie Scherzinger. An empirical study on the "usage of not" in real-world JSON schema documents. In Aditya K. Ghose, Jennifer Horkoff, Vitor E. Silva Souza, Jeffrey Parsons, and Joerg Evermann, editors, *Conceptual Modeling - 40th International Conference, ER 2021, Virtual Event, October 18-21, 2021, Proceedings*, volume 13011 of *Lecture Notes in Computer Science*, pages 102–112. Springer, 2021.
- [10] Davide Bacciu, Siranush Akarmazyan, Eric Armengaud, Manlio Bacco, George Bravos, Calogero Calandra, Emanuele Carlini, Antonio Carta, Pietro Cassarà, Massimo Coppola, Charalampos Davalas, Patrizio Dazzi, Maria Carmela De Gennaro, Daniele Di Sarli, Jürgen Dobaj, Claudio Gallicchio, Sylvain Girbal, Alberto Gotta, Riccardo Groppo, Vincenzo Lomonaco, Georg Macher, Daniele Mazzei, Gabriele Mencagli, Dimitrios Michail, Alessio Micheli, Roberta Peroglio, Salvatore Petroni, Rosaria Potenza, Farank Pourdanesh, Christos Sardianos, Konstantinos Tserpes, Fulvio Tagliabo, Jakob Valtl, Iraklis Varlamis, and Omar Veledar. TEACHING - trustworthy autonomous cyber-physical applications through human-centred intelligence. In *2021 IEEE International Conference on Omni-Layer Intelligent Systems, COINS 2021, Barcelona, Spain, August 23-25, 2021*, pages 1–6. IEEE, 2021.
- [11] Davide Bacciu, Filippo Maria Bianchi, Benjamin Paassen, and Cesare Alippi. Deep learning for graphs. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [12] Davide Bacciu, Antonio Carta, Daniele Di Sarli, Claudio Gallicchio, Vincenzo Lomonaco, and Salvatore Petroni. Towards functional safety compliance of recurrent neural networks. In *CAIP 2021: Proceedings of the 1st International Conference on AI for People: Towards Sustainable AI, CAIP 2021, 20-24 November 2021, Bologna, Italy*, page 86. European Alliance for Innovation, 2021.
- [13] Davide Bacciu and Marco Podda. Graphgen-redux: a fast and lightweight recurrent model for labeled graph generation. In *International Joint Conference on Neural Networks, IJCNN 2021, Shenzhen, China, July 18-22, 2021*, pages 1–8. IEEE, 2021.
- [14] Davide Bacciu, Daniele Di Sarli, Pouria Faraji, Claudio Gallicchio, and Alessio Micheli. Federated reservoir computing neural networks. In *International Joint Conference on Neural Networks, IJCNN 2021, Shenzhen, China, July 18-22, 2021*, pages 1–7. IEEE, 2021.
- [15] Davide Bacciu, Daniele Di Sarli, Claudio Gallicchio, Alessio Micheli, and Niccolò Puccinelli. Benchmarking reservoir and recurrent neural networks for human state and activity recognition. In Ignacio Rojas, Gonzalo Joya, and Andreu Català, editors, *Advances in Computational Intelligence - 16th International Work-Conference on Artificial Neural Networks, IWANN 2021, Virtual Event, June 16-18, 2021, Proceedings, Part II*, volume 12862 of *Lecture Notes in Computer Science*, pages 168–179. Springer, 2021.
- [16] Padmanabhan Balasubramanian, Anna Bernasconi, Valentina Ciriani, and Tiziano Villa. A boolean heuristic for disjoint SOP synthesis. In Francesco Loporati, Salvatore Vitabile, and Amund Skavhaug, editors, *24th Euromicro Conference on Digital System Design, DSD 2021, Palermo, Spain, September 1-3, 2021*, pages 62–68. IEEE, 2021.
- [17] Davide Basile, Maurice H. ter Beek, Pierpaolo Degano, Axel Legay, Gian Luigi Ferrari, Stefania Gnesi, and Felicita Di Giandomenico. Supervisory synthesis of configurable behavioural contracts with modalities. In Kirstin Peters and Tim A. C. Willemse, editors, *Formal Techniques for Distributed Objects, Components, and Systems - 41st IFIP WG 6.1 International Conference, FORTE 2021, Held as Part of the 16th International Federated Conference on Distributed Computing Techniques, DisCoTec 2021, Valletta, Malta, June 14-18, 2021, Proceedings*, volume 12719 of *Lecture Notes in Computer Science*, pages 177–181. Springer, 2021.
- [18] Anna Bernasconi and Valentina Ciriani. Autosymmetry of incompletely specified functions. In *Design, Automation & Test in Europe Conference & Exhibition, DATE 2021, Grenoble, France, February 1-5, 2021*, pages 360–365. IEEE, 2021.

- [19] Giuseppe Bisicchia, Stefano Forti, and Antonio Brogi. Declarative goal mediation in smart environments. In *IEEE International Conference on Smart Computing, SMARTCOMP 2021, Irvine, CA, USA, August 23-27, 2021*, pages 389–391. IEEE, 2021.
- [20] Giuseppe Bisicchia, Stefano Forti, and Antonio Brogi. A declarative goal-oriented framework for smart environments with lpaas. In Stefania Monica and Federico Bergenti, editors, *Proceedings of the 36th Italian Conference on Computational Logic, Parma, Italy, September 7-9, 2021*, volume 3002 of *CEUR Workshop Proceedings*, pages 143–157. CEUR-WS.org, 2021.
- [21] Alessandro Bocci, Stefano Forti, Gian Luigi Ferrari, and Antonio Brogi. Placing faas in the fog, securely. In Alessandro Armando and Michele Colajanni, editors, *Proceedings of the Italian Conference on Cybersecurity, ITASEC 2021, All Digital Event, April 7-9, 2021*, volume 2940 of *CEUR Workshop Proceedings*, pages 166–179. CEUR-WS.org, 2021.
- [22] Antonio Boffa, Paolo Ferragina, and Giorgio Vinciguerra. A “learned” approach to quicken and compress rank/select dictionaries. In *2021 Proceedings of the Workshop on Algorithm Engineering and Experiments (ALENEX)*, pages 46–59. SIAM, 2021.
- [23] Filippo Bonchi, Alessandro Di Giorgio, and Pawel Sobocinski. Diagrammatic polyhedral algebra. In Mikolaj Bojanczyk and Chandra Chekuri, editors, *41st IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS 2021, December 15-17, 2021, Virtual Conference*, volume 213 of *LIPICs*, pages 40:1–40:18. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [24] Filippo Bonchi, Alessandro Di Giorgio, and Fabio Zanasi. From Farkas’ lemma to linear programming: an exercise in diagrammatic algebra ((co)algebraic pearls). In Fabio Gadducci and Alexandra Silva, editors, *9th Conference on Algebra and Coalgebra in Computer Science, CALCO 2021, August 31 to September 3, 2021, Salzburg, Austria*, volume 211 of *LIPICs*, pages 9:1–9:19. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [25] Filippo Bonchi and Simon J. Puglisi, editors. *46th International Symposium on Mathematical Foundations of Computer Science, MFCS 2021, August 23-27, 2021, Tallinn, Estonia*, volume 202 of *LIPICs*. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [26] Filippo Bonchi and Alessio Santamaria. Combining semilattices and semimodules. In Stefan Kiefer and Christine Tasson, editors, *Foundations of Software Science and Computation Structures - 24th International Conference, FOSSACS 2021, Held as Part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2021, Luxembourg City, Luxembourg, March 27 - April 1, 2021, Proceedings*, volume 12650 of *Lecture Notes in Computer Science*, pages 102–123. Springer, 2021.
- [27] Filippo Bonchi, Alessio Santamaria, Jens Seeber, and Pawel Sobocinski. On doctrines and cartesian bicategories. In Fabio Gadducci and Alexandra Silva, editors, *9th Conference on Algebra and Coalgebra in Computer Science, CALCO 2021, August 31 to September 3, 2021, Salzburg, Austria*, volume 211 of *LIPICs*, pages 10:1–10:17. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [28] Filippo Bonchi, Ana Sokolova, and Valeria Vignudelli. Presenting convex sets of probability distributions by convex semilattices and unique bases ((co)algebraic pearls). In Fabio Gadducci and Alexandra Silva, editors, *9th Conference on Algebra and Coalgebra in Computer Science, CALCO 2021, August 31 to September 3, 2021, Salzburg, Austria*, volume 211 of *LIPICs*, pages 11:1–11:18. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [29] Alessandro Bondielli and Lucia C. Passaro. Leveraging CLIP for image emotion recognition. In Elena Cabrio, Danilo Croce, Lucia C. Passaro, and Rachele Sprugnoli, editors, *Proceedings of the Fifth Workshop on Natural Language for Artificial Intelligence (NL4AI 2021) co-located with 20th International Conference of the Italian Association for Artificial Intelligence (AI*IA 2021), Online event, November 29, 2021*, volume 3015 of *CEUR Workshop Proceedings*. CEUR-WS.org, 2021.

- [30] Valerio Bonsignori, Riccardo Guidotti, and Anna Monreale. Deriving a single interpretable model by merging tree-based classifiers. In Carlos Soares and Luís Torgo, editors, *Discovery Science - 24th International Conference, DS 2021, Halifax, NS, Canada, October 11-13, 2021, Proceedings*, volume 12986 of *Lecture Notes in Computer Science*, pages 347–357. Springer, 2021.
- [31] Christina Boucher, Ondrej Cvacho, Travis Gagie, Jan Holub, Giovanni Manzini, Gonzalo Navarro, and Massimiliano Rossi. PFP compressed suffix trees. In Martin Farach-Colton and Sabine Storandt, editors, *Proceedings of the Symposium on Algorithm Engineering and Experiments, ALENEX 2021, Virtual Conference, January 10-11, 2021*, pages 60–72. SIAM, 2021.
- [32] Christina Boucher, Travis Gagie, Tomohiro I, Dominik Köppl, Ben Langmead, Giovanni Manzini, Gonzalo Navarro, Alejandro Pacheco, and Massimiliano Rossi. PHONI: streamed matching statistics with multi-genome references. In Ali Bilgin, Michael W. Marcellin, Joan Serra-Sagristà, and James A. Storer, editors, *31st Data Compression Conference, DCC 2021, Snowbird, UT, USA, March 23-26, 2021*, pages 193–202. IEEE, 2021.
- [33] Linda Brodo, Roberto Bruni, Moreno Falaschi, Roberta Gori, Francesca Levi, and Paolo Milazzo. Exploiting modularity of SOS semantics to define quantitative extensions of reaction systems. In Claus Aranha, Carlos Martín-Vide, and Miguel A. Vega-Rodríguez, editors, *Theory and Practice of Natural Computing - 10th International Conference, TPNC 2021, Tsukuba, Japan, December 7-10, 2021, Proceedings*, volume 13082 of *Lecture Notes in Computer Science*, pages 15–32. Springer, 2021.
- [34] Roberto Bruni, Roberto Giacobazzi, Roberta Gori, and Francesco Ranzato. A logic for locally complete abstract interpretations. In *36th Annual ACM/IEEE Symposium on Logic in Computer Science, LICS 2021, Rome, Italy, June 29 - July 2, 2021*, pages 1–13. IEEE, 2021.
- [35] Andrea Bruno, Franco Maria Nardini, Giulio Ermanno Pibiri, Roberto Trani, and Rossano Venturini. TSXOR: A simple time series compression algorithm. In Thierry Lecoq and Hélène Touzet, editors, *String Processing and Information Retrieval - 28th International Symposium, SPIRE 2021, Lille, France, October 4-6, 2021, Proceedings*, volume 12944 of *Lecture Notes in Computer Science*, pages 217–223. Springer, 2021.
- [36] Laura Bussi, Vincenzo Ciancia, and Fabio Gadducci. Towards a spatial model checker on GPU. In Kirstin Peters and Tim A. C. Willemse, editors, *Formal Techniques for Distributed Objects, Components, and Systems - 41st IFIP WG 6.1 International Conference, FORTE 2021, Held as Part of the 16th International Federated Conference on Distributed Computing Techniques, DisCoTec 2021, Valletta, Malta, June 14-18, 2021, Proceedings*, volume 12719 of *Lecture Notes in Computer Science*, pages 188–196. Springer, 2021.
- [37] Valeria Cardellini, Gabriele Mencagli, and Massimo Torquati. The 4th international workshop on autonomic solutions for parallel and distributed data stream processing (Auto-DaSP 2021), preface. In *Proceedings of the ACM/SPEC International Conference on Performance Engineering*, pages 285–286, 2021.
- [38] Sankardeep Chakraborty, Roberto Grossi, Kunihiko Sadakane, and Srinivasa Rao Satti. Succinct representations for (non)deterministic finite automata. In Alberto Leporati, Carlos Martín-Vide, Dana Shapira, and Claudio Zandron, editors, *Language and Automata Theory and Applications - 15th International Conference, LATA 2021, Milan, Italy, March 1-5, 2021, Proceedings*, volume 12638 of *Lecture Notes in Computer Science*, pages 55–67. Springer, 2021.
- [39] Panagiotis Charalampopoulos, Huiping Chen, Peter Christen, Grigorios Loukides, Nadia Pisanti, Solon P. Pissis, and Jakub Radoszewski. Pattern masking for dictionary matching. In Hee-Kap Ahn and Kunihiko Sadakane, editors, *32nd International Symposium on Algorithms and Computation, ISAAC 2021, December 6-8, 2021, Fukuoka, Japan*, volume 212 of *LIPICs*, pages 65:1–65:19. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [40] Huiping Chen, Alessio Conte, Roberto Grossi, Grigorios Loukides, Solon P. Pissis, and Michelle Sweering. On breaking truss-based communities. In Feida Zhu, Beng Chin Ooi, and Chunyan Miao, editors, *KDD '21: The 27th ACM SIGKDD Conference on Knowledge Discovery and Data Mining, Virtual Event, Singapore, August 14-18, 2021*, pages 117–126. ACM, 2021.

- [41] Martina Cinquini, Fosca Giannotti, and Riccardo Guidotti. Boosting synthetic data generation with effective nonlinear causal discovery. In *Third IEEE International Conference on Cognitive Machine Intelligence, CogMI 2021, Atlanta, GA, USA, December 13-15, 2021*, pages 54–63. IEEE, 2021.
- [42] Antonio Cisternino, Pietro Ducange, Nicola Tonellotto, and Carlo Vallati. Leveraging cloud infrastructures for teaching advanced computer engineering classes. In *Bridges and Mediation in Higher Distance Education*, pages 256–270, Cham, 2021. Springer International Publishing.
- [43] Alessio Conte, Roberto Grossi, Grigorios Loukides, Nadia Pisanti, Solon P. Pissis, and Giulia Punzi. Beyond the BEST theorem: Fast assessment of eulerian trails. In Evripidis Bampis and Aris Pagourtzis, editors, *Fundamentals of Computation Theory - 23rd International Symposium, FCT 2021, Athens, Greece, September 12-15, 2021, Proceedings*, volume 12867 of *Lecture Notes in Computer Science*, pages 162–175. Springer, 2021.
- [44] Alessio Conte and Etsuji Tomita. Overall and delay complexity of the CLIQUES and bronkerbosch algorithms. In Ryuhei Uehara, Seok-Hee Hong, and Subhas C. Nandy, editors, *WALCOM: Algorithms and Computation - 15th International Conference and Workshops, WALCOM 2021, Yangon, Myanmar, February 28 - March 2, 2021, Proceedings*, volume 12635 of *Lecture Notes in Computer Science*, pages 195–207. Springer, 2021.
- [45] Andrea Cossu, Davide Bacciu, Antonio Carta, Claudio Gallicchio, and Vincenzo Lomonaco. Continual learning with echo state networks. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [46] Andrea Cossu, Marta Ziosi, and Vincenzo Lomonaco. Sustainable artificial intelligence through continual learning. In *CAIP 2021: Proceedings of the 1st International Conference on AI for People: Towards Sustainable AI, CAIP 2021, 20-24 November 2021, Bologna, Italy*, page 103. European Alliance for Innovation, 2021.
- [47] Giovanna Maria Dimitri, Claudio Gallicchio, Alessio Micheli, Maria-Aurora Morales, Emanuele Ungaro, and Federico Vozzi. A preliminary evaluation of echo state networks for brugada syndrome classification. In *IEEE Symposium Series on Computational Intelligence, SSCI 2021, Orlando, FL, USA, December 5-7, 2021*, pages 1–8. IEEE, 2021.
- [48] Federico Errica, Davide Bacciu, and Alessio Micheli. Graph mixture density networks. In Marina Meila and Tong Zhang, editors, *Proceedings of the 38th International Conference on Machine Learning, ICML 2021, 18-24 July 2021, Virtual Event*, volume 139 of *Proceedings of Machine Learning Research*, pages 3025–3035. PMLR, 2021.
- [49] Federico Errica, Giacomo Iadarola, Fabio Martinelli, Francesco Mercaldo, and Alessio Micheli. Robust malware classification via deep graph networks on call graph topologies. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [50] Tooba Faisal, Damiano Di Francesco Maesa, Nishanth Sastry, and Simone Mangiante. Automated quality of service monitoring for 5G and beyond using distributed ledgers. In *29th IEEE/ACM International Symposium on Quality of Service, IWQOS 2021, Tokyo, Japan, June 25-28, 2021*, pages 1–6. IEEE, 2021.
- [51] Tooba Faisal, Damiano Di Francesco Maesa, Nishanth Sastry, and Simone Mangiante. How to request network resources just-in-time using smart contracts. In *IEEE International Conference on Blockchain and Cryptocurrency, ICBC 2021, Sydney, Australia, May 3-6, 2021*, pages 1–5. IEEE, 2021.
- [52] Alessandro Fantechi, Stefania Gnesi, Samuele Livi, and Laura Semini. A spacy-based tool for extracting variability from NL requirements. In Mohammad Reza Mousavi and Pierre-Yves Schobbens, editors, *SPLC '21: 25th ACM International Systems and Software Product Line Conference, Leicester, United Kingdom, September 6-11, 2021, Volume B*, pages 32–35. ACM, 2021.

- [53] Alessandro Fantechi, Stefania Gnesi, and Laura Semini. Language and communication problems in formalization: A natural language approach. In Alexander Raschke, Elvinia Riccobene, and Klaus-Dieter Schewe, editors, *Logic, Computation and Rigorous Methods - Essays Dedicated to Egon Börger on the Occasion of His 75th Birthday*, volume 12750 of *Lecture Notes in Computer Science*, pages 121–134. Springer, 2021.
- [54] Paolo Ferragina, Giovanni Manzini, and Giorgio Vinciguerra. Repetition- and linearity-aware rank/select dictionaries. In Hee-Kap Ahn and Kunihiko Sadakane, editors, *32nd International Symposium on Algorithms and Computation, ISAAC 2021, December 6-8, 2021, Fukuoka, Japan*, volume 212 of *LIPICs*, pages 64:1–64:16. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [55] Davide Fioriti, Davide Poli, and Antonio Frangioni. A bi-level formulation to help aggregators size energy communities: a proposal for virtual and physical closed distribution systems. In *2021 IEEE International Conference on Environment and Electrical Engineering and 2021 IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe)*, pages 1–6. IEEE, 2021.
- [56] Michele Fontana, Francesca Naretto, and Anna Monreale. A new approach for cross-silo federated learning and its privacy risks. In *18th International Conference on Privacy, Security and Trust, PST 2021, Auckland, New Zealand, December 13-15, 2021*, pages 1–10. IEEE, 2021.
- [57] Stefano Forti and Antonio Brogi. Declarative osmotic application placement. In Artem Polyvyanyy and Stefanie Rinderle-Ma, editors, *Advanced Information Systems Engineering Workshops - CAiSE 2021 International Workshops, Melbourne, VIC, Australia, June 28 - July 2, 2021, Proceedings*, volume 423 of *Lecture Notes in Business Information Processing*, pages 177–190. Springer, 2021.
- [58] Fabio Gadducci and Francesco Santini. Residuation for soft constraints: Lexicographic orders and approximation techniques. In Wolfgang Faber, Gerhard Friedrich, Martin Gebser, and Michael Morak, editors, *Logics in Artificial Intelligence - 17th European Conference, JELIA 2021, Virtual Event, May 17-20, 2021, Proceedings*, volume 12678 of *Lecture Notes in Computer Science*, pages 162–176. Springer, 2021.
- [59] Travis Gagie, Garance Gourdel, and Giovanni Manzini. Compressing and indexing aligned read-sets. In Alessandra Carbone and Mohammed El-Kebir, editors, *21st International Workshop on Algorithms in Bioinformatics, WABI 2021, August 2-4, 2021, Virtual Conference*, volume 201 of *LIPICs*, pages 13:1–13:21. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [60] Claudio Gallicchio, Alessio Micheli, and Luca Silvestri. Phase transition adaptation. In *International Joint Conference on Neural Networks, IJCNN 2021, Shenzhen, China, July 18-22, 2021*, pages 1–8. IEEE, 2021.
- [61] Barbara Guidi and Andrea Michienzi. The decentralization of social media through the blockchain technology. In Oshani Seneviratne, Vivek Singh, Ana Freire, and Jar-der Luo, editors, *WebSci '21: 13th ACM Web Science Conference 2021, Virtual Event, United Kingdom, 21-25 June, 2021, Companion Publication*, pages 138–139. ACM, 2021.
- [62] Barbara Guidi and Andrea Michienzi. Interaction communities in blockchain online social media. In *Third International Conference on Blockchain Computing and Applications, BCCA 2021, Tartu, Estonia, November 15-17, 2021*, pages 89–96. IEEE, 2021.
- [63] Barbara Guidi, Andrea Michienzi, and Laura Ricci. Data persistence in decentralized social applications: The IPFS approach. In *18th IEEE Annual Consumer Communications & Networking Conference, CCNC 2021, Las Vegas, NV, USA, January 9-12, 2021*, pages 1–4. IEEE, 2021.
- [64] Barbara Guidi, Andrea Michienzi, and Laura Ricci. A libp2p implementation of the Bitcoin block exchange protocol. In *DICG@Middleware 2021: Proceedings of the 2nd International Workshop on Distributed Infrastructure for Common Good, Virtual Event, Canada, December 6-10, 2021*, pages 1–4. ACM, 2021.

- [65] Barbara Guidi, Andrea Michienzi, Laura Ricci, and Vincenzo Ambriola. Analysing dunbar circles in facebook groups. In *18th IEEE Annual Consumer Communications & Networking Conference, CCNC 2021, Las Vegas, NV, USA, January 9-12, 2021*, pages 1–6. IEEE, 2021.
- [66] Riccardo Guidotti and Anna Monreale. Designing shapelets for interpretable data-agnostic classification. In Marion Fourcade, Benjamin Kuipers, Seth Lazar, and Deirdre K. Mulligan, editors, *AIES '21: AAAI/ACM Conference on AI, Ethics, and Society, Virtual Event, USA, May 19-21, 2021*, pages 532–542. ACM, 2021.
- [67] Riccardo Guidotti and Anna Monreale. Xai.it 2021 - preface to the second italian workshop on explainable artificial intelligence. In *Second Italian Workshop on Explainable Artificial Intelligence*. CEUR, 2021.
- [68] Riccardo Guidotti and Salvatore Ruggieri. Ensemble of counterfactual explainers. In Carlos Soares and Luís Torgo, editors, *Discovery Science - 24th International Conference, DS 2021, Halifax, NS, Canada, October 11-13, 2021, Proceedings*, volume 12986 of *Lecture Notes in Computer Science*, pages 358–368. Springer, 2021.
- [69] Giuseppe F. Italiano, Nicola Prezza, Blerina Sinimeri, and Rossano Venturini. Compressed weighted de Bruijn Graphs. In Pawel Gawrychowski and Tatiana Starikovskaya, editors, *32nd Annual Symposium on Combinatorial Pattern Matching, CPM 2021, July 5-7, 2021, Wrocław, Poland*, volume 191 of *LIPICs*, pages 16:1–16:16. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [70] David G. Kirkpatrick, Irina Kostitsyna, Alfredo Navarra, Giuseppe Prencipe, and Nicola Santoro. Separating bounded and unbounded asynchrony for autonomous robots: Point convergence with limited visibility. In Avery Miller, Keren Censor-Hillel, and Janne H. Korhonen, editors, *PODC '21: ACM Symposium on Principles of Distributed Computing, Virtual Event, Italy, July 26-30, 2021*, pages 9–19. ACM, 2021.
- [71] Giacomo Lanciano, Filippo Galli, Tommaso Cucinotta, Davide Bacciu, and Andrea Passarella. Predictive auto-scaling with openstack monasca. In Ivona Brandic, Rizos Sakellariou, and Josef Spillner, editors, *UCC '21: 2021 IEEE/ACM 14th International Conference on Utility and Cloud Computing, Leicester, United Kingdom, December 6 - 9, 2021*, pages 20:1–20:10. ACM, 2021.
- [72] Andrea Lisi, Damiano Di Francesco Maesa, Paolo Mori, and Laura Ricci. Lightnings over rose bouquets: an analysis of the topology of the bitcoin lightning network. In *IEEE 45th Annual Computers, Software, and Applications Conference, COMPSAC 2021, Madrid, Spain, July 12-16, 2021*, pages 324–331. IEEE, 2021.
- [73] Vincenzo Lomonaco, Lorenzo Pellegrini, Andrea Cossu, Antonio Carta, Gabriele Graffieti, Tyler L. Hayes, Matthias De Lange, Marc Masana, Jary Pomponi, Gido M. van de Ven, Martin Mundt, Qi She, Keiland Cooper, Jeremy Forest, Eden Belouadah, Simone Calderara, German Ignacio Parisi, Fabio Cuzzolin, Andreas S. Tolia, Simone Scardapane, Luca Antiga, Subutai Ahmad, Adrian Popescu, Christopher Kanan, Joost van de Weijer, Tinne Tuytelaars, Davide Bacciu, and Davide Maltoni. Avalanche: An end-to-end library for continual learning. In *IEEE Conference on Computer Vision and Pattern Recognition Workshops, CVPR Workshops 2021, virtual, June 19-25, 2021*, pages 3600–3610. Computer Vision Foundation / IEEE, 2021.
- [74] Vincenzo Lomonaco, Lorenzo Pellegrini, Andrea Cossu, Antonio Carta, Gabriele Graffieti, Tyler L. Hayes, Matthias De Lange, Marc Masana, Jary Pomponi, Gido M. van de Ven, Martin Mundt, Qi She, Keiland Cooper, Jeremy Forest, Eden Belouadah, Simone Calderara, German Ignacio Parisi, Fabio Cuzzolin, Andreas S. Tolia, Simone Scardapane, Luca Antiga, Subutai Amhad, Adrian Popescu, Christopher Kanan, Joost van de Weijer, Tinne Tuytelaars, Davide Bacciu, and Davide Maltoni. Avalanche: an end-to-end library for continual learning. *CoRR*, abs/2104.00405, 2021.
- [75] Giuseppe Antonio Di Luna, Paola Flocchini, Giuseppe Prencipe, and Nicola Santoro. Black hole search in dynamic rings. In *41st IEEE International Conference on Distributed Computing Systems, ICDCS 2021, Washington DC, USA, July 7-10, 2021*, pages 987–997. IEEE, 2021.

- [76] Georg Macher, Siranush Akarmazyan, Eric Armengaud, Davide Bacciu, Calogero Calandra, Herbert Danzinger, Patrizio Dazzi, Charalampos Davalas, Maria Carmela De Gennaro, Angela Dimitriou, Jürgen Dobaj, Maid Dzambic, Lorenzo Giraudi, Sylvain Girbal, Dimitrios Michail, Roberta Peroglio, Rosaria Potenza, Farank Pourdanesh, Matthias Seidl, Christos Sardanios, Konstantinos Tserpes, Jakob Valtl, Iraklis Varlamis, and Omar Veledar. Dependable integration concepts for human-centric ai-based systems. In Ibrahim Habli, Mark Sujun, Simos Gerasimou, Erwin Schoitsch, and Friedemann Bitsch, editors, *Computer Safety, Reliability, and Security. SAFECOMP 2021 Workshops - DECSoS, MAPSOD, DepDevOps, USDAI, and WAISE, York, UK, September 7, 2021, Proceedings*, volume 12853 of *Lecture Notes in Computer Science*, pages 11–23. Springer, 2021.
- [77] Damiano Di Francesco Maesa, Frank Tietze, and Julius Theye. Putting trust back in IP licensing: DLT smart licenses for the internet of things. In *IEEE International Conference on Blockchain and Cryptocurrency, ICBC 2021, Sydney, Australia, May 3-6, 2021*, pages 1–3. IEEE, 2021.
- [78] Paolo Mancarella. Introduzione. In *Università di Pisa, Obiettivo 5*. Pisa University Press, 2021.
- [79] Paolo Mancarella. Prefazione. In *In Supreme dignitatis - Per la Storia dell’Università e dell’Ospedale di Pisa*. Pisa University Press, 2021.
- [80] Paolo Mancarella. Saluti introduttivi. In *Malattia psichiatrica e pericolosità sociale. Tra sistema penale e servizi sanitari*. Giappichelli, 2021.
- [81] Marta Marchiori Manerba and Riccardo Guidotti. Fairshades: Fairness auditing via explainability in abusive language detection systems. In *Third IEEE International Conference on Cognitive Machine Intelligence, CogMI 2021, Atlanta, GA, USA, December 13-15, 2021*, pages 34–43. IEEE, 2021.
- [82] Giacomo Mariani, Anna Monreale, and Francesca Naretto. Privacy risk assessment of individual psychometric profiles. In Carlos Soares and Luís Torgo, editors, *Discovery Science - 24th International Conference, DS 2021, Halifax, NS, Canada, October 11-13, 2021, Proceedings*, volume 12986 of *Lecture Notes in Computer Science*, pages 411–421. Springer, 2021.
- [83] Carlo Metta, Riccardo Guidotti, Yuan Yin, Patrick Gallinari, and Salvatore Rinzivillo. Exemplars and counterexemplars explanations for image classifiers, targeting skin lesion labeling. In *IEEE Symposium on Computers and Communications, ISCC 2021, Athens, Greece, September 5-8, 2021*, pages 1–7. IEEE, 2021.
- [84] Mirco Nanni, Agnese Bonavita, and Riccardo Guidotti. City indicators for mobility data mining. In Constantinos Costa and Evaggelia Pitoura, editors, *Proceedings of the Workshops of the EDBT/ICDT 2021 Joint Conference, Nicosia, Cyprus, March 23, 2021*, volume 2841 of *CEUR Workshop Proceedings*. CEUR-WS.org, 2021.
- [85] Lucia Nasti, Roberta Gori, and Paolo Milazzo. Formal characterization and efficient verification of a biological robustness property. In Simon Bliudze, Stefania Gnesi, Nico Plat, and Laura Semini, editors, *9th IEEE/ACM International Conference on Formal Methods in Software Engineering, FormaliSE@ICSE 2021, Madrid, Spain, May 17-21, 2021*, pages 13–18. IEEE, 2021.
- [86] Danilo Numeroso and Davide Bacciu. Meg: Generating molecular counterfactual explanations for deep graph networks. In *2021 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE, 2021.
- [87] Marco Oliva, Massimiliano Rossi, Jouni Sirén, Giovanni Manzini, Tamer Kahveci, Travis Gagie, and Christina Boucher. Efficiently merging r-indexes. In Ali Bilgin, Michael W. Marcellin, Joan Serra-Sagristà, and James A. Storer, editors, *31st Data Compression Conference, DCC 2021, Snowbird, UT, USA, March 23-26, 2021*, pages 203–212. IEEE, 2021.
- [88] Luca Oneto, Nicolò Navarin, Battista Biggio, Federico Errica, Alessio Micheli, Franco Scarselli, Monica Bianchini, and Alessandro Sperduti. Complex data: Learning trustworthily, automatically, and with guarantees. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.

- [89] Federica Paganelli, Paola Cappanera, Antonio Brogi, and Riccardo Falco. Profit-aware placement of multi-flavoured VNF chains. In *10th IEEE International Conference on Cloud Networking, CloudNet 2021, Cookeville, TN, USA, November 8-10, 2021*, pages 48–55. IEEE, 2021.
- [90] Dimitris Palyvos-Giannas, Gabriele Mencagli, Marina Papatriantafilou, and Vincenzo Gulisano. Lachesis: a middleware for customizing os scheduling of stream processing queries. In *Proceedings of the 22nd International Middleware Conference*, pages 365–378, 2021.
- [91] Lorenzo Pellegrini, Vincenzo Lomonaco, Gabriele Graffieti, and Davide Maltoni. Continual learning at the edge: Real-time training on smartphone devices. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [92] Raffaele Perego, Giulio Ermanno Pibiri, and Rossano Venturini. Compressed indexes for fast search of semantic data (extended abstract). In *37th IEEE International Conference on Data Engineering, ICDE 2021, Chania, Greece, April 19-22, 2021*, pages 2325–2326. IEEE, 2021.
- [93] Nadia Pisanti. On-line pattern matching on d-texts (invited talk). In Pawel Gawrychowski and Tatiana Starikovskaya, editors, *32nd Annual Symposium on Combinatorial Pattern Matching, CPM 2021, July 5-7, 2021, Wroclaw, Poland*, volume 191 of *LIPICs*, pages 3:1–3:2. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021.
- [94] Marco Podda, Pasquale Bove, Alessio Micheli, and Paolo Milazzo. Classification of biochemical pathway robustness with neural networks for graphs. In *CAIP 2021: Proceedings of the International Joint Conference on Biomedical Engineering Systems and Technologies, BIOSTEC 2020*, pages 215–239. Springer, 2021.
- [95] Marco Ponza, Diego Ceccarelli, Paolo Ferragina, Edgar Meij, and Sambhav Kothari. Contextualizing trending entities in news stories. In Liane Lewin-Eytan, David Carmel, Elad Yom-Tov, Eugene Agichtein, and Evgeniy Gabrilovich, editors, *WSDM '21, The Fourteenth ACM International Conference on Web Search and Data Mining, Virtual Event, Israel, March 8-12, 2021*, pages 346–354. ACM, 2021.
- [96] Mohsin Ur Rahman, Fabrizio Baiardi, and Laura Ricci. Tacl: Trust-based and scalable access control for iot using blockchain. In *FTC 2021: Proceedings of the Future Technologies Conference (FTC) 2021*. Lecture Notes in Networks and Systems book series (LNNS, volume 358), 2021.
- [97] Sridhar K. N. Rao, Federica Paganelli, and Al Morton. Benchmarking Kubernetes container-networking for telco usecases. In *IEEE Global Communications Conference, GLOBECOM 2021, Madrid, Spain, December 7-11, 2021*, pages 1–7. IEEE, 2021.
- [98] Asma Sattar and Davide Bacciu. Context-aware graph convolutional autoencoder. In Ignacio Rojas, Gonzalo Joya, and Andreu Català, editors, *Advances in Computational Intelligence - 16th International Work-Conference on Artificial Neural Networks, IWANN 2021, Virtual Event, June 16-18, 2021, Proceedings, Part I*, volume 12861 of *Lecture Notes in Computer Science*, pages 279–290. Springer, 2021.
- [99] Jacopo Soldani and Antonio Brogi. Automated generation of configurable cloud-native chaos testbeds. In Rasmus Adler, Amel Bennaceur, Simon Burton, Amleto Di Salle, Nicola Nostro, Rasmus Løvenstein Olsen, Selma Saidi, Philipp Schleiss, Daniel Schneider, and Hans-Peter Schwefel, editors, *Dependable Computing - EDCC 2021 Workshops - DREAMS, DSOGRI, SERENE 2021, Munich, Germany, September 13, 2021, Proceedings*, volume 1462 of *Communications in Computer and Information Science*, pages 101–108. Springer, 2021.
- [100] Jacopo Soldani, Giuseppe Montesano, and Antonio Brogi. What went wrong? explaining cascading failures in microservice-based applications. In Johanna Barzen, editor, *Service-Oriented Computing - 15th Symposium and Summer School, SummerSOC 2021, Virtual Event, September 13-17, 2021, Proceedings*, volume 1429 of *Communications in Computer and Information Science*, pages 133–153. Springer, 2021.

- [101] Domenico Tortorella and Alessio Micheli. Dynamic graph echo state networks. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [102] David John Tree and Alessio Malizia. A multi-planar approach to encoding story worlds for dynamic narrative generation. In Carmelo Ardito, Rosa Lanzilotti, Alessio Malizia, Helen Petrie, Antonio Piccinno, Giuseppe Desolda, and Kori Inkpen, editors, *Human-Computer Interaction - INTERACT 2021 - 18th IFIP TC 13 International Conference, Bari, Italy, August 30 - September 3, 2021, Proceedings, Part V*, volume 12936 of *Lecture Notes in Computer Science*, pages 355–358. Springer, 2021.
- [103] Marco Trincavelli, Haris Dukic, Georgios Deligiorgis, Pierpaolo Sepe, and Davide Bacciu. Inductive learning for product assortment graph completion. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [104] Andrea Valenti, Stefano Berti, and Davide Bacciu. Calliope - A polyphonic music transformer. In *29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning, ESANN 2021, Online event (Bruges, Belgium), October 6-8, 2021*, 2021.
- [105] Adriano Vogel, Gabriele Mencagli, Dalvan Griebler, Marco Danelutto, and Luiz Gustavo Fernandes. Towards on-the-fly self-adaptation of stream parallel patterns. In *29th Euromicro International Conference on Parallel, Distributed and Network-Based Processing, PDP 2021, Valladolid, Spain, March 10-12, 2021*, pages 89–93. IEEE, 2021.
- [106] Marko Vukovic, Daniele Mazzei, Stefano Chessa, and Gualtiero Fantoni. Digital twins in industrial IoT: a survey of the state of the art and of relevant standards. In *IEEE International Conference on Communications Workshops, ICC Workshops 2021, Montreal, QC, Canada, June 14-23, 2021*, pages 1–6. IEEE, 2021.
- [107] Michael Wurster, Uwe Breitenbücher, Antonio Brogi, Felix Diez, Frank Leymann, Jacopo Soldani, and Karoline Wild. Automating the deployment of distributed applications by combining multiple deployment technologies. In Markus Helfert, Donald Ferguson, and Claus Pahl, editors, *Proceedings of the 11th International Conference on Cloud Computing and Services Science, CLOSER 2021, Online Streaming, April 28-30, 2021*, pages 178–189. SCITEPRESS, 2021.
- [108] Vladimir Yussupov, Jacopo Soldani, Uwe Breitenbücher, Antonio Brogi, and Frank Leymann. From serverful to serverless: A spectrum of patterns for hosting application components. In Markus Helfert, Donald Ferguson, and Claus Pahl, editors, *Proceedings of the 11th International Conference on Cloud Computing and Services Science, CLOSER 2021, Online Streaming, April 28-30, 2021*, pages 268–279. SCITEPRESS, 2021.

9.3 Book chapters

The following book chapters have been published in 2021 by the members of the Department:

- [1] Tiziano Bacci, Antonio Frangioni, and Claudio Gentile. Start-up/shut-down MINLP formulations for the unit commitment with ramp constraints. In *Graphs and Combinatorial Optimization: from Theory to Applications*, pages 335–347. Springer, 2021.
- [2] Filippo Bonchi, Paweł Sobociński, and Fabio Zanasi. A survey of compositional signal flow theory. In *Advancing Research in Information and Communication Technology: IFIP's Exciting First 60+ Years, Views from the Technical Committees and Working Groups*, pages 29–56. Springer International Publishing, Cham, 2021.
- [3] Matteo Cacciola, Antonio Frangioni, Laura Galli, and Giovanni Stea. A lagrangian approach to chance constrained routing with local broadcast. In *Graphs and Combinatorial Optimization: from Theory to Applications*, pages 277–291. Springer, 2021.
- [4] Antonio Frangioni and Bernard Gendron. Piecewise linear cost network design. In *Network Design with Applications to Transportation and Logistics*, pages 167–185. Springer, 2021.

- [5] Claudio Gallicchio and Alessio Micheli. Deep reservoir computing. In *Reservoir Computing*, pages 77–95. Springer, 2021.
- [6] Emanuela Navarretta, Laura Ricci, and Antonio Vallini. La tecnologia delle blockchain: concetti di base. In *Il potere della tecnica e la funzione del diritto: un’analisi interdisciplinare di blockchain*, pages 39–49. Giappichelli Editore, 2021.
- [7] Mauro Passacantando, Giorgio Gnecco, Yuval Hadal, and Marcello Sanguineti. On Braess’ paradox and average quality of service in transportation network cooperative games. In *Optimization and Decision Science*, pages 27–37. Springer, 2021.
- [8] Mauro Passacantando and Fabio Raciti. A note on generalized Nash games played on networks. In *Nonlinear Analysis, Differential Equations, and Applications*, pages 365–380. Springer, 2021.
- [9] Mauro Passacantando and Fabio Raciti. A note on network games with strategic complements and the Katz-Bonacich centrality measure. In *Optimization and Decision Science*, pages 51–61. Springer, 2021.
- [10] Mauro Passacantando and Fabio Raciti. On the approximation of monotone variational inequalities in L^p spaces with probability measure. In *Nonlinear Analysis and Global Optimization*, pages 403–425. Springer, 2021.
- [11] Mauro Passacantando and Fabio Raciti. Optimal improvement of communication network congestion via nonlinear programming with generalized Nash equilibrium constraints. In *Optimization and Decision Science*, pages 39–49. Springer, 2021.

9.4 Editorships

9.4.1 Conferences Proceedings

The following conferences proceedings have been edited in 2021 by the members of the Department:

- [1] Simon Bliudze and Laura Semini, editors. *2021 IEEE/ACM 9th International Conference on Formal Methods in Software Engineering (FormaliSE)*. IEEE, 2021.
- [2] Elena Cabrio, Danilo Croce, Lucia C. Passaro, and Rachele Sprugnoli, editors. *Proceedings of the Fifth Workshop on Natural Language for Artificial Intelligence (NL4AI 2021) co-located with 20th International Conference of the Italian Association for Artificial Intelligence (AI*IA 2021), Online event, November 29, 2021*, volume 3015 of *CEUR Workshop Proceedings*. CEUR-WS.org, 2021.
- [3] Fabio Gadducci and Silva Alexandra, editors. *Algebra and Coalgebra in Computer Science, 9th Conference (CALCO 2021)*. Schloss Dagstuhl, Leibniz-Zentrum für Informatik, 2021.
- [4] Fabio Gadducci and Timo Kehrer, editors. *Graph Transformation: 14th International Conference, ICGT 2021, Held as Part of STAF 2021, Virtual Event, June 24–25, 2021, Proceedings*. Springer International Publishing, 2021.
- [5] Barbara Guidi, Andrea Michienzi, and Laura Ricci, editors. *OASIS@HT 2021: Proceedings of the 2021 Workshop on Open Challenges in Online Social Networks, Virtual Event, Ireland, 30 August 2021*. ACM, 2021.

9.4.2 Books

The following books have been edited in 2021 by the members of the Department:

- [1] Natalia Selini Hadjidimitriou, Antonio Frangioni, Thorsten Koch, and Andrea Lodi. *Mathematical Optimization for Efficient and Robust Energy Networks*. Springer, 2021.
- [2] Emanuela Navarretta, Laura Ricci, and Antonio Vallini. *La tecnologia delle blockchain: concetti di base*. Giappichelli Editore, 2021.

9.4.3 Journals

The following journals have been edited in 2021 by the members of the Department:

- [1] Daniele DAgostino, Francesco Leporati, Massimo Torquati, and Jingling Xue, editors. *Guest Editorial: Special Section on New Trends in Parallel and Distributed Computing for Human Sensible Applications*, volume 9-04. IEEE Computer Society, 2021.