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) (10 INF/01 and 1 MAT/09):

- 5 RTD-A (5 INF/01)
- 6 RTD-B (5 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 positions 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 UNIPI	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 Marsenne (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: 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,

Gallicchio 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-enns-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.consorzio-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.consorzio-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

Brogi: 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

Gallicchio: 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, OA-SIS21, 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 ICSA 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 (Worchester 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, Osliak 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, Miaschi 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 Casaluce, 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 (Tronheim, Norvegia), visited the Computer Science Department under the invitation of Prof. Susanna Pelagatti from Decembre 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-healt", 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 Ghezelsoflu, 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.

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9.2 Conference papers

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[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 ˆ 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.