

## Antonio Cruciani

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Aalto University

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<https://antonio-cruciani.github.io/>

## Current Position

**Postdoctoral Researcher**, in Computer Science at Aalto University. Working with [Jukka Suomela](#).

*Espoo, FI*  
*Mar. 2025 – Now*

## Education

**Ph.D. Student**, in Computer Science at Gran Sasso Science Institute.  
Thesis: *Models and Algorithms for Temporal Betweenness Centrality and Dynamic Distributed Data Structures*.

*L'Aquila, IT*  
*Nov. 2020 – Mar. 2025*

<https://iris.gssi.it/handle/20.500.12571/34764>

Grade: Excellent.

Supervisor: [Francesco Pasquale](#) (University of Rome “Tor Vergata”)

co-Supervisor: [Pierluigi Crescenzi](#) (Gran Sasso Science Institute)

Reviewers: Christian Scheideler, Fabio Vandin.

**M.S.**, in Computer Science, University of Rome “Tor Vergata”, *summa cum laude*.  
Thesis: *Dynamic Random Graphs and unstructured P2P networks, analysis of two models inspired by the Bitcoin network*.

*Rome, IT*  
*2017 – 2020*

Supervisor: [Francesco Pasquale](#) (University of Rome “Tor Vergata”)

**B.S.**, in Computer Science, University of Rome “Tor Vergata”.

Thesis: *Efficient learning methods for playlist prediction*.

*Rome, IT*  
*2011 – 2017*

Supervisor: [Giorgio Gambosi](#) (University of Rome “Tor Vergata”)

## Academic Appointments

**Visiting Researcher Fellow**, KTH.

Host: [Aristides Gionis](#)

*Stockholm, SE*  
*June 2025*

**Visiting Researcher Fellow**, Department of Computer Science University of Hamburg.

Host: [Thorsten Götte](#)

*Hamburg, GE*  
*January 2025*

**Visiting Researcher Fellow**, Department of Computer Science and Engineering, IIT Madras.

Supervisor: [John Augustine](#)

*Chennai, IN*  
*1st-Aug. – 31st-Oct. 2024*

**Visiting Researcher Fellow**, Department of Computer Science and Engineering, University of Padua.

Host: [Leonardo Pellegrina](#)

*Padova, IT*  
*July 2024*

**Visiting Researcher Fellow**, Department of Computer Science and Engineering, IIT Madras.

Supervisor: [John Augustine](#)

*Chennai, IN*  
*1st-Aug. 2023 – 27th-Feb. 2024*

**Visiting Researcher Fellow**, Big Data Analytics Lab, Fondazione Ugo Bordoni

Supervisor: [Giambattista Amati](#)

*Rome, IT*  
*Feb. – Nov. 2020*

## Teaching Activities

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**Invited Teacher**, CS-E4565 - Combinatorics of Computation D. (MSc), Aalto University. Covered the opening module on introductory probability, the probabilistic method, and derandomization across four sessions (Lessons 1–4), including lecture delivery and guided problem solving.

*Finland, FI  
April - May. 2025*

**Teaching Assistant**, Computability and Computational Complexity Theory (BSc), University of Rome “Tor Vergata”, (In Italian). Delivered a 2-hour weekly session throughout the semester focused on problem solving: proposing exercises, guiding students through solution strategies, and presenting complete solutions and proof techniques.

*Rome, IT  
Oct. 2018 – Jun. 2019*

**Teaching Assistant**, Computer Programming in C (BSc), University of Rome “Tor Vergata” (In Italian). Led exercise sessions focused on problem solving and programming practice, supported students during in-class exercises, and graded weekly homework assignments.

*Rome, IT  
Oct. 2017 – Jun. 2018*

## Work

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**Software Developer**, WeDot Rome.

*Rome, IT  
Oct. 2015 – Jun. 2016*

**Software Developer**, New System.

*Falerone, IT  
Jun. – Sep. 2010*

## Languages

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◦ Italian **Mother tongue**

◦ English **Fluent**

## Programming Skills

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- Basic: OWL, SPARQL, FORTRAN, COBOL, LISP
- Intermediate: GO, MATLAB, JAVASCRIPT, R, ASP.NET, PHP
- Advanced: PYTHON, JULIA, JAVA, C, C++, C#, SQL
- Frameworks: Apache Spark

## Research Interests

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- Graph Mining
- Distributed Computing
- Temporal Graphs
- Randomized Algorithms
- Random Graphs
- Approximation Algorithms
- Statistical Learning
- Evolving Graphs

## Publications

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In case of theoretical computer science conferences, authors are sorted alphabetically, otherwise by contribution.

## PhD Thesis

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- [1] A. Cruciani. *Highly Dynamic and Fully Distributed Data Structures*. 2025. URL: <https://iris.gssi.it/handle/20.500.12571/34764>.

- [2] A. Cruciani. “Maintaining a Bounded Degree Expander in Dynamic Peer-to-Peer Networks”. In: *Structural Information and Communication Complexity - 33th International Colloquium, SIROCCO 2026, Durham, United Kingdom (TO APPEAR)*. Lecture Notes in Computer Science. 2026.
- [3] A. Cruciani and L. Pellegrina. “Fast Percolation Centrality Approximation with Importance Sampling”. In: *2025 IEEE International Conference on Data Mining (ICDM)*. 2025.
- [4] J. Augustine, A. Cruciani, and I. A. Gillani. “Brief Announcement: Highly Dynamic and Fully Distributed Data Structures”. In: *39th International Symposium on Distributed Computing (DISC 2025)*. Ed. by D. R. Kowalski. Vol. 356. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 47:1–47:7. ISBN: 978-3-95977-402-4. DOI: [10.4230/LIPIcs.DISC.2025.47](https://doi.org/10.4230/LIPIcs.DISC.2025.47). URL: <https://drops.dagstuhl.de/entities/document/10.4230/LIPIcs.DISC.2025.47>.
- [5] A. Balliu, C. Coupette, A. Cruciani, F. d’Amore, M. Equi, H. Lievonon, A. Modanese, D. Olivetti, and J. Suomela. “New Limits on Distributed Quantum Advantage: Dequantizing Linear Programs”. In: *39th International Symposium on Distributed Computing (DISC 2025)*. Ed. by D. R. Kowalski. Vol. 356. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 11:1–11:22. ISBN: 978-3-95977-402-4. DOI: [10.4230/LIPIcs.DISC.2025.11](https://doi.org/10.4230/LIPIcs.DISC.2025.11). URL: <https://drops.dagstuhl.de/entities/document/10.4230/LIPIcs.DISC.2025.11>.
- [6] A. Cruciani. “Brief Announcement: Maintaining a Bounded Degree Expander in Dynamic Peer-To-Peer Networks”. In: *39th International Symposium on Distributed Computing (DISC 2025)*. Ed. by D. R. Kowalski. Vol. 356. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 53:1–53:7. ISBN: 978-3-95977-402-4. DOI: [10.4230/LIPIcs.DISC.2025.53](https://doi.org/10.4230/LIPIcs.DISC.2025.53). URL: <https://drops.dagstuhl.de/entities/document/10.4230/LIPIcs.DISC.2025.53>.
- [7] A. Cruciani. “MANTRA: Temporal Betweenness Centrality Approximation Through Sampling”. In: *Machine Learning and Knowledge Discovery in Databases. Research Track - European Conference, ECML PKDD 2024, Vilnius, Lithuania, September 9-13, 2024, Proceedings, Part I*. Ed. by A. Bifet, J. Davis, T. Krilavicius, M. Kull, E. Ntoutsi, and I. Zliobaite. Vol. 14941. Lecture Notes in Computer Science. Springer, 2024, pp. 125–143. DOI: [10.1007/978-3-031-70341-6\\_8](https://doi.org/10.1007/978-3-031-70341-6_8). URL: [https://doi.org/10.1007/978-3-031-70341-6\\_8](https://doi.org/10.1007/978-3-031-70341-6_8).
- [8] G. Amati, A. Cruciani, D. Pasquini, P. Vocca, and S. Angelini. “propagate: A Seed Propagation Framework to Compute Distance-Based Metrics on Very Large Graphs”. In: *Machine Learning and Knowledge Discovery in Databases: Research Track - European Conference, ECML PKDD 2023, Turin, Italy, September 18-22, 2023, Proceedings, Part III*. Ed. by D. Koutra, C. Plant, M. G. Rodriguez, E. Baralis, and F. Bonchi. Vol. 14171. Lecture Notes in Computer Science. Springer, 2023, pp. 671–688. DOI: [10.1007/978-3-031-43418-1\\_40](https://doi.org/10.1007/978-3-031-43418-1_40). URL: [https://doi.org/10.1007/978-3-031-43418-1\\_40](https://doi.org/10.1007/978-3-031-43418-1_40).
- [9] R. Becker, P. Crescenzi, A. Cruciani, and B. Kodric. “Proxying Betweenness Centrality Rankings in Temporal Networks”. In: *21st International Symposium on Experimental Algorithms, SEA 2023, July 24-26, 2023, Barcelona, Spain*. Ed. by L. Georgiadis. Vol. 265. LIPIcs. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2023, 6:1–6:22. DOI: [10.4230/LIPIcs.SEA.2023.6](https://doi.org/10.4230/LIPIcs.SEA.2023.6). URL: <https://doi.org/10.4230/LIPIcs.SEA.2023.6>.
- [10] A. Cruciani and F. Pasquale. “Dynamic graph models inspired by the Bitcoin network-formation process”. In: *24th International Conference on Distributed Computing and Networking, ICDCN 2023, Kharagpur, India, January 4-7, 2023*. ACM, 2023, pp. 125–134. DOI: [10.1145/3571306.3571398](https://doi.org/10.1145/3571306.3571398). URL: <https://doi.org/10.1145/3571306.3571398>.
- [11] A. Cruciani and F. Pasquale. “Brief Announcement: Dynamic Graph Models for the Bitcoin P2P Network: Simulation Analysis for Expansion and Flooding Time”. In: *Stabilization, Safety, and Security of Distributed Systems - 24th International Symposium, SSS 2022, Clermont-Ferrand, France, November 15-17, 2022, Proceedings*. Ed. by S. Devismes, F. Petit, K. Altisen, G. A. D. Luna, and A. F. Anta. Vol. 13751. Lecture Notes in Computer Science. Springer, 2022, pp. 335–340. DOI: [10.1007/978-3-031-21017-4\\_23](https://doi.org/10.1007/978-3-031-21017-4_23). URL: [https://doi.org/10.1007/978-3-031-21017-4\\_23](https://doi.org/10.1007/978-3-031-21017-4_23).
- [12] G. Amati, S. Angelini, A. Cruciani, G. Fusco, G. Gaudino, D. Pasquini, and P. Vocca. “Topic Modeling by Community Detection Algorithms”. In: *OASIS@HT 2021: Proceedings of the 2021 Workshop on Open Challenges in Online Social Networks, Virtual Event, Ireland, 30 August 2021*. Ed. by B. Guidi, A. Michienzi, and L. Ricci. ACM, 2021, pp. 15–20. DOI: [10.1145/3472720.3483622](https://doi.org/10.1145/3472720.3483622). URL: <https://doi.org/10.1145/3472720.3483622>.

- [13] A. Cruciani, D. Pasquini, G. Amati, and P. Vocca. “About Graph Index Compression Techniques”. In: *Proceedings of the 10th Italian Information Retrieval Workshop, Padova, Italy, September 16-18, 2019*. Ed. by M. Agosti, E. D. Buccio, M. Melucci, S. Mizzaro, G. Pasi, and F. Silvestri. Vol. 2441. CEUR Workshop Proceedings. CEUR-WS.org, 2019, pp. 21–24. URL: <https://ceur-ws.org/Vol-2441/paper23.pdf>.

## Preprints

- [14] A. Cruciani and L. Pellegrina. *Fast Percolation Centrality Approximation with Importance Sampling*. 2025. arXiv: [2509.11454](https://arxiv.org/abs/2509.11454) [cs.SI]. URL: <https://arxiv.org/abs/2509.11454>.
- [15] J. Augustine, A. Cruciani, and I. A. Gillani. *Highly Dynamic and Fully Distributed Data Structures*. 2025. arXiv: [2409.10235](https://arxiv.org/abs/2409.10235) [cs.DC]. URL: <https://arxiv.org/abs/2409.10235>.
- [16] A. Cruciani, A. Das, A. Raevskaya, and J. Suomela. *It does not matter how you define locally checkable labelings*. 2026. arXiv: [2602.18188](https://arxiv.org/abs/2602.18188) [cs.DC]. URL: <https://arxiv.org/abs/2602.18188>.
- [17] A. Cruciani, A. Das, M. Equi, H. Lievonon, D. Luong-Le, A. Modanese, and J. Suomela. *Is a LOCAL algorithm computable?* 2026. arXiv: [2602.21022](https://arxiv.org/abs/2602.21022) [cs.DC]. URL: <https://arxiv.org/abs/2602.21022>.

## Talks

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|--|---------------------------------|
| Fast Percolation Centrality Approximation with Importance Sampling. (ICDM)   | Washington DC, USA<br>Nov. 2025 |
| Maintaining a Bounded Degree Expander in Dynamic Peer-To-Peer Networks. (DISC)   | Berlin, DE<br>Oct. 2025         |
| Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. (DISC)   | Berlin, DE<br>Oct. 2025         |
| Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. Joint Estonian-Latvian Theory Days.  | Riga, LV<br>Aug. 2025           |
| Fast Percolation Centrality Approximation with Importance Sampling. Helsinki Algorithms & Theory Days  | Helsinki, FI<br>Aug. 2025       |
| Approximating Distance-based metrics through sampling. IIT Madras.   | Chennai, IN<br>Oct. 2024        |
| Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. Aalto University.  | Online<br>Oct. 2024             |
| Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. IIT Madras   | Chennai, IN<br>Oct. 2024        |
| On the Temporal Betweenness Centrality. IIT Madras.  | Chennai, IN<br>Oct. 2024        |
| MANTRA: Temporal Betweenness Centrality Approximation through Sampling. European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD).                         | Vilnius, LT<br>Sep. 2024        |
| Computing Distance-based metrics on Very Large Graphs. University of Padua   | Padua, IT<br>Jul. 2024          |
| PROPAGATE: A Seed Propagation Framework to Compute Distance-Based Metrics on Very Large Graphs. European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD). | Turin, IT<br>Sep. 2023          |
| Proxying Betweenness Centrality Rankings in Temporal Networks. 21st International Symposium on Experimental Algorithms (SEA),  | Barcelona, ES<br>Jul. 2023      |
| Dynamic graph models inspired by the Bitcoin network-formation process. 24th   | Kharagpur, IN                   |

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| international Conference on Distributed Computing and Networking (ICDCN).  | <i>Jan. 2023</i>                          |
| Dynamic graph models for the Bitcoin P2P network: simulation analysis for expansion and flooding time. 24th International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS). | <i>Clermont-Ferrand, FR<br/>Nov. 2022</i> |
| About Graph Index Compression Techniques. Proceedings of the 10th Italian Information Retrieval Workshop (IIR-2019)  | <i>Padua, IT<br/>Sep. 2019</i>            |
| Iterative Compression technique for NP-Hard problems on Graphs. University of Rome Tor Vergata.  | <i>Rome, IT<br/>Jun. 2019</i>             |

## Schools

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| Bertinoro International Spring School   | <i>Bertinoro, IT<br/>Mar. 2022</i>          |
| European Summer School on Learning in Games, Markets, and Online Decision Making  | <i>Rome, IT<br/>Sep. 2021</i>               |
| Max Planck Advanced Course on the Foundations of Computer Science (Convex Optimization) (online)  | <i>Saarbrücken, GE<br/>Jul. - Aug. 2021</i> |
| Algorithmic Tools for Massive Network Analytics (online)  | <i>Pisa, IT<br/>May - Jun. 2021</i>         |
| Max Planck Advanced Course on the Foundations of Computer Science (Market Design and Computational Fair Division) (online)                  | <i>Saarbrücken, GE<br/>August 2020</i>      |
| Algorithms and computational models for large-scale data analysis. University of Rome: “La Sapienza”. By Silvio Lattanzi (Google Research). | <i>Rome, IT<br/>August 2019</i>             |

## Academic Service

### Conferences

Reviewer ICANN 2025  
 Sub-reviewer STACS-PODC-WSDM-SDM-SEA-ISAAC-FSTTCS 2025  
 Sub-reviewer FUN 2020-2024  
 Sub-reviewer AAMAS 2023

### Journals

Reviewer: The Review of Socionetwork Strategies

## Supervision

**Bachelor Students.** Giacomo Rivetti (2025, co-supervised with Francesco Pasquale)

## Software Packages

- PROPAGATE, an efficient algorithm for approximating various distance-based metrics (i.e., average distance, effective diameter, diameter and connectivity rate).  
<https://github.com/BigDataLaboratory/MHSE>
- DREG, a dynamic expander graph generator.  
<https://github.com/Antonio-Cruciani/DREG-DynamicRandomExpanderGenerator>
- TSBPROXY, a suite of efficient proxies for the temporal betweenness centrality rankings.  
<https://github.com/Antonio-Cruciani/TSBProxy>
- MANTRA, an efficient framework for approximating the temporal betweenness centrality using sampling.  
<https://github.com/Antonio-Cruciani/MANTRA>

- FEPIC, an efficient approximation algorithm for the (doubly normalized) percolation centrality.  
[https://github.com/Antonio-Cruciani/percolation\\_centrality](https://github.com/Antonio-Cruciani/percolation_centrality)
- PERCIS, a fast approximation algorithm for the percolation centrality that uses importance sampling.  
<https://github.com/Antonio-Cruciani/PERCIS>