Antonio Cruciani

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Aalto University

Tietotekniikantalo, Konemiehentie 2, 02150 Espoo, Finland

antonio.cruciani@aalto.fi

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. — *L'Aquila, IT* — *Nov. 2020 – Mar. 2025*
Thesis: *Models and Algorithms for Temporal Betweenness Centrality and Dynamic Distributed Data Structures.*
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.* — *Rome, IT* — *2017 – 2020*
Thesis: *Dynamic Random Graphs and unstructured P2P networks, analysis of two models inspired by the Bitcoin network.*
Supervisor: Francesco Pasquale (University of Rome "Tor Vergata")

B.S., in Computer Science, University of Rome "Tor Vergata". — *Rome, IT* — *2011 – 2017*
Thesis: *Efficient learning methods for playlist prediction.*
Supervisor: Giorgio Gambosi (University of Rome "Tor Vergata")

Academic Appointments

Visiting Researcher Fellow, KTH. — *Stockholm, SE* — *June 2025*
Host: Aristides Gionis

Visiting Researcher Fellow, Department of Computer Science University of Hamburg. — *Hamburg, GE* — *January 2025*
Host: Thorsten Götte

Visiting Researcher Fellow, Department of Computer Science and Engineering, IIT Madras. — *Chennai, IN* — *1st-Aug. – 31st-Oct. 2024*
Supervisor: John Augustine

Visiting Researcher Fellow, Department of Computer Science and Engineering, University of Padua. — *Padova, IT* — *July 2024*
Host: Leonardo Pellegrina

Visiting Researcher Fellow, Department of Computer Science and Engineering, IIT Madras. — *Chennai, IN* — *1st-Aug. 2023 – 27th-Feb. 2024*
Supervisor: John Augustine

Visiting Researcher Fellow, Big Data Analytics Lab, Fondazione Ugo Bordoni — *Rome, IT* — *Feb. – Nov. 2020*
Supervisor: Giambattista Amati

Teaching Activities

Teaching Assistant, Computability and Computational Complexity Theory, University of Rome "Tor Vergata". *Rome, IT* *Oct. 2018 – Jun. 2019*

Teaching Assistant, Computer Programming, University of Rome "Tor Vergata". *Rome, IT* *Oct. 2015 – Jun. 2019*

Work

Software Developer, WeDot Rome. *Rome, IT* *Oct. 2015 – Jun. 2016*

Software Developer, New System. *Falerone, IT* *Jun. – Sep. 2010*

Languages

- Italian **Mother toungue**
- English **Fluent** (C2 CEFR)

Programming Skills

- 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

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

Publications

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

Conference Proceedings

[1] 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.

[2] 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. URL: https://doi.org/10.1145/3472720.3483622.

[3] 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. URL: https://doi.org/10.1007/978-3-031-21017-4%5C_23.

[4] 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. URL: https://doi.org/10.4230/LIPIcs.SEA.2023.6.

[5] 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. URL: https://doi.org/10.1007/978-3-031-43418-1%5C_40.

[6] 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. URL: https://doi.org/10.1145/3571306.3571398.

[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. URL: https://doi.org/10.1007/978-3-031-70341-6%5C_8.

Preprints

[8] A. Cruciani. *Fast Estimation of Percolation Centrality*. 2024. arXiv: 2408.02389 [cs.SI]. URL: https://arxiv.org/abs/2408.02389.

[9] J. Augustine, A. Cruciani, and I. A. Gillani. *Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks*. 2024. arXiv: 2409.10235 [cs.DC]. URL: https://arxiv.org/abs/2409.10235.

[10] A. Balliu, C. Coupette, A. Cruciani, F. d'Amore, M. Equi, H. Lievonen, A. Modanese, D. Olivetti, and J. Suomela. *New Limits on Distributed Quantum Advantage: Dequantizing Linear Programs*. 2025. arXiv: 2506.07574 [cs.DC]. URL: https://arxiv.org/abs/2506.07574.

[11] A. Cruciani. *Maintaining a Bounded Degree Expander in Dynamic Peer-to-Peer Networks*. 2025. arXiv: 2506.17757 [cs.DC]. URL: https://arxiv.org/abs/2506.17757.

Talks

Approximating Distance-based metrics through sampling. IIT Madras.	*Chennai, IN* *Oct. 2024*
Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. Aalto University.	*Online* *Oct. 2024*
Maintaining Distributed Data Structures in Dynamic Peer-to-Peer Networks. IIT Madras	*Chennai, IN* *Oct. 2024*
On the Temporal Betweenness Centrality. IIT Madras.	*Chennai, IN* *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* *Sep. 2024*
Computing Distance-based metrics on Very Large Graphs. University of Padua	*Padua, IT* *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* *Sep. 2023*

Proxying Betweenness Centrality Rankings in Temporal Networks. 21st International Symposium on Experimental Algorithms (SEA), — *Barcelona, ES* *Jul. 2023*

Dynamic graph models inspired by the Bitcoin network-formation process. 24th international Conference on Distributed Computing and Networking (ICDCN). — *Kharagpur, IN* *Jan. 2023*

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). — *Clermont-Ferrand, FR* *Nov. 2022*

About Graph Index Compression Techniques. Proceedings of the 10th Italian Information Retrieval Workshop (IIR-2019) — *Padua, IT* *Sep. 2019*

Iterative Compression technique for NP-Hard problems on Graphs. University of Rome Tor Vergata. — *Rome, IT* *Jun. 2019*

Schools

Bertinoro International Spring School — *Bertinoro, IT* *Mar. 2022*

European Summer School on Learning in Games, Markets, and Online Decision Making — *Rome, IT* *Sep. 2021*

Max Planck Advanced Course on the Foundations of Computer Science (Convex Optimization) (online) — *Saarbrucken, GE* *Jul. - Aug. 2021*

Algorithmic Tools for Massive Network Analytics (online) — *Pisa, IT* *May - Jun. 2021*

Max Planck Advanced Course on the Foundations of Computer Science (Market Design and Computational Fair Division) (online) — *Saarbrucken, GE* *August 2020*

Algorithms and computational models for large-scale data analysis. University of Rome: "La Sapienza". By Silvio Lattanzi (Google Research). — *Rome, IT* *August 2019*

Academic Service

Conferences

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

Journals

Reviewer: The Review of Socionetwork Strategies

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 percolation centrality.
  https://github.com/Antonio-Cruciani/percolation_centrality