

LORENZO ORECCHIA

- CONTACT INFORMATION** Department of Computer Science *Phone: (773) 702-2356*
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Chicago, IL 60637 USA *Web: http://orecchia.net*
- RESEARCH INTERESTS** Convex Optimization, Spectral Methods, Graph Algorithms, Machine Learning
- ACADEMIC POSITIONS** **The University of Chicago**, Chicago, IL
Assistant Professor, Department of Computer Science 7/2019 – Present
- Boston University**, Boston, MA
Assistant Professor, Department of Computer Science 1/2015 – 6/2019
- POSTDOCTORAL POSITIONS** **Massachusetts Institute of Technology**, Cambridge, MA
Applied Mathematics Instructor, Department of Mathematics 9/2011 – 12/2014
Mentor: Jonathan Kelner
- EDUCATION** **University of California**, Berkeley CA
Ph.D., Computer Science, 5/2011
Advisor: Satish Rao
Dissertation: Fast Approximation Algorithms for Graph Partitioning Using Spectral and Semidefinite-Programming Techniques
- Princeton University**, Princeton, NJ
A.B. summa cum laude, Computer Science, 5/2005
- HONORS AND AFFILIATIONS** NSF CAREER Award 2020
Co-winner of Best Paper Award at SODA 2014
- GRANTS** PI for NSF CAREER Award *Next-Generation Design of First-Order Optimization Algorithms by the Calculus of Variations of Self-Dual Functionals* (CCF 1943510), 2020-2024
PI for NSF AF Grant *Continuous Perspectives on Accelerated Methods for Combinatorial Optimization* (CCF 1718342), 2017-2020
PI for NSF AF Grant *New Perspectives on Spectral Methods for Graph Algorithms* (CCF 1319460), 2013-2017
co-PI for DHS ALERT Subaward *Anomaly Detection in Advanced Imaging Technology Systems based on Graph Theory* (DHS 505035-78050) 2017-2018
- PUBLICATIONS**
- L.Orecchia, J.Hu, X.He, W.Mark, X.Yang, M.Wu, X.Geng. *Training Binary Neural Networks via Gaussian Variational Inference and Low-Rank Semidefinite Programming*. **NeurIPS'24**: Proc. Neural Inf. Proc. Systems, 2024.
 - Y.Yang, A.Chen, L.Orecchia, C.Ma. *Top-K ranking with a monotone adversary*. **COLT'24**: Proc. Conf. Learning Theory, pp. 5123-5162. 2024.
 - K.Ameranis, A.Chen, A.DePavia, L.Orecchia and E.Tani. *Fast Algorithms for Hypergraph PageRank with Applications to Semi-Supervised Learning*. **ICML'24**: Proc. Intl. Conf. Machine Learning. 2024.

- K.Ameranis, L.Orecchia, C.Tsourakakis and K.Talwar. *Practical Almost-Linear-Time Approximation Algorithms for Hybrid and Overlapping Graph Clustering*. **ICML'22**: Proc. Intl. Conf. Machine Learning, pp. 17071-17093, 2022.
- J.Diakonikolas, M.Fazel and L.Orecchia. *Fair Packing and Covering on a Relative Scale*. **SIAM Journal on Optimization**, vol. 30:4, pp.3284–3314, 2020.
- J.Diakonikolas and L.Orecchia. *The Approximate Duality Gap Technique: A Unified Theory of First-Order Methods*. **SIAM Journal on Optimization**, vol. 29:1, pp. 660–689, 2019.
- J.Diakonikolas and L.Orecchia. *On Acceleration with Noise-Corrupted Gradients*. **ICML'18**: Proc. Intl. Conf. Machine Learning, pp. 1019–1028, 2018.
- J.Diakonikolas and L.Orecchia. *Alternating Randomized Block Coordinate Descent*. **ICML'18**: Proc. Intl. Conf. Machine Learning, pp. 1224–1232, 2018.
- Z.Allen-Zhu and L.Orecchia. *Nearly linear-time packing and covering LP solvers*. **Mathematical Programming, Series A**, vol. 175, pp. 307-353, 2018.
- J.Diakonikolas and L.Orecchia. *Accelerated Extra-Gradient Descent: A Novel Accelerated First-Order Method*. **ITCS'18**: Innovations in TCS Conf., pp. 23:1-23:19, 2018.
- C.Aksoylar, L.Orecchia and V.Saligrama, *Connected Subgraph Detection with Mirror Descent on SDPs*. **ICML'17**: Proc. Intl. Conf. Machine Learning, pp. 51–59, 2017.
- Z.Allen-Zhu and L.Orecchia. *Linear Coupling of Gradient and Mirror Descent*. **ITCS'17**: Innovations in TCS Conf., pp. 3:1-3:22, 2017.
- Z.Allen-Zhu, A.Bhaskara, S.Lattanzi, V.Mirroknii and L.Orecchia. *Expanders Using Local Edge Flips*. **SODA'16**: Proc. ACM-SIAM Symp. Discrete Algorithms, pp. 269–279, 2016.
- Z.Allen-Zhu, Y.T.Lee and L.Orecchia. *Using Optimization to Obtain a Width-Independent, Parallel, Simpler, and Faster Positive SDP Solver*. **SODA'16**: Proc. ACM-SIAM Symp. Discrete Algorithms, pp. 1824–1831, 2016.
- Z.Allen-Zhu, Z.Liao and L.Orecchia. *Linear-Sized Spectral Sparsification in Almost Quadratic Time and Regret Minimization Beyond Matrix Multiplicative Weight Updates*. **STOC'15**: Proc. ACM Symp. Theory Computing, pp. 237–245, 2015.
- Z.Allen-Zhu and L.Orecchia. *Nearly-Linear Time Packing and Covering LP Solver with Faster Convergence Rate Than $O(1/\epsilon^2)$* . **STOC'15**: Proc. ACM Symp. Theory Computing, pp. 229–236, 2015
- J.A.Kelner, L.Orecchia, Y.T.Lee and A.Sidford. *An Almost-Linear-Time Algorithm for Approximate Max Flow in Undirected Graphs, and its Multicommodity Generalizations*. **SODA'14**: Proc. ACM-SIAM Symp. Discrete Algorithms, pp. 217–226, 2014. **Co-winner of best paper award. Invited to J. ACM.**
- Z.Allen-Zhu and L.Orecchia. *Flow-Based Algorithms for Local Graph Clustering*. **SODA'14**: Proc. ACM-SIAM Symp. Discrete Algorithms, pp. 1267–1286, 2014.
- Z.Allen-Zhu, J.A.Kelner, L.Orecchia and A.Sidford. *A simple, combinatorial algorithm for solving SDD systems in nearly-linear time*. **STOC'13**: Proc. ACM Symp. Theory Computing, pp. 911–920, 2013.
- R.P.Smith, S.J.Riesenfeld, A.K.Holloway, Q.Li, K.K.Murphy, N.M.Feliciano, L.Orecchia, N.Oksenberg, K.S.Pollard and N.Ahituv. *A compact, in vivo screen of all 6-mers reveals drivers of tissue-specific expression and guides synthetic regulatory element design*. **Genome Biology**, 14:R72, 2013.
- L.Orecchia, S.Sachdeva and N.K.Vishnoi. *Approximating the Exponential, the Lanczos Method and an $\tilde{O}(m)$ -Time Spectral Algorithm for Balanced Separator*. **STOC'12**: Proc. ACM Symp. Theory Computing, pp. 1141–1160, 2012.

- M.W.Mahoney, L.Orecchia and N.K.Vishnoi. *Spectral Algorithms to Explore Graphs in a Local Manner*. **J. Machine Learning Research**, 13, 2339–2365, 2012.
- L.Orecchia and N.K.Vishnoi. *Towards an SDP-Based Approach to Spectral Methods: A Nearly-Linear Time Algorithm for Graph Partitioning and Decomposition*. **SODA’11**: Proc. ACM-SIAM Symp. Discrete Algorithms, pp. 532–545, 2011.
- M.W.Mahoney and L.Orecchia. *Implementing Regularization Implicitly via Approximate Eigenvector Computation*. **ICML’11**: Proc. Intl. Conf. Machine Learning, pp. 121–128, 2011.
- K.J.Lang, M.W.Mahoney and L.Orecchia. *Empirical Evaluation of Graph Partitioning Using Spectral Embeddings and Flow*. **SEA’09**: Proc. Intl. Symp. Experimental Algorithms, pp. 197–208, 2009.
- L.Orecchia, L.Schulman, U.V.Vazirani and N.K.Vishnoi. *On Partitioning Graphs via Single Commodity Flows*. **STOC’08**: ACM Proc. Symp. Theory of Computing, pp. 461–470, 2008.
- D.Dubhashi, O.Häggström, L.Orecchia, A.Panconesi, C.Petrioli and A.Vitaletti. *Localized Techniques for Broadcasting in Wireless Sensor Networks*. **Algorithmica**, 49–4, pp. 412–446, 2007.
- L.Orecchia, A.Panconesi, C.Petrioli and A.Vitaletti. *Localized Techniques for Broadcasting in Wireless Sensor Networks*. **DIALM-POMC’04**: Joint Workshop Foundations Mobile Computing, p. 41–51, 2004.
- A.Cavalcanti, T.Doak, L.Landweber, L.Orecchia and N.Stover. *Coding Properties of *Oxytricha trifallax* (Sterkiella histriomuscorum) Macronuclear Chromosomes: Analysis of a Pilot Genome Project*. **Chromosoma**, 113–2, pp. 69–76, 2004.

TEACHING

Instructor, The University of Chicago

“CMSC25460: Introduction to Optimization”

Spring 2020, 2021

“CMSC27200: Theory of Algorithms”

Winter 2020, 2021, Spring 2022, 2023

“CMSC35410: Spectral Methods”

Fall 2019

Instructor, Boston University

“CS131: Combinatoric Structures”

Fall 2015, Spring 2017

“CS330: Introduction to Algorithms”

Fall 2018

“CS507: Convex Optimization Algorithms”

Spring 2018, Spring 2019

“CS591: Iterative Methods for Graph Algorithms”

Spring 2015, Fall 2016

Instructor, MIT

“18.310C: Principles of Discrete Applied Mathematics”

Fall 2012, 2013

Developed communication-intensive class with M.X.Goemans, S.Ruff and P.Shor.

“18.434: Undergraduate Seminar in Theoretical Computer Science”

Spring 2013, 2014

ADVISING AND MENTORING

Current Ph.D. students: Erasmo Tani (Computer Science), Konstantinos Ameranis (CS), Antares Chen (CS), Ryan Robinett (CS), Ruimin Zhang (CS), Adela DePavia (Computational and Applied Math).

Co-advised **Ph.D. student Cem Aksoylar** in Electrical and Computer Engineering at Boston University from 2015 to 2016. Cem graduated in May 2016 and is now an Applied Scientist at Microsoft in Sunnyvale, CA.

Advised **Ph.D. student Zhenyu Liao** from 2015 to 2018. Zhenyu graduated in December 2018 and is now a Research Scientist at ByteDance AI Lab in Menlo Park, CA.

PROFESSIONAL
SERVICE AND
OUTREACH

Supervised and mentored **postdoctoral associate Jelena Diakonikolas** née Marasëvić from 2016 to 2018. Jelena is now an Assistant Professor in Department of Computer Sciences at University of Wisconsin-Madison.

Program Committees: ICALP 2016, SODA 2017, SODA 2020, ITCS 2021, FOCS 2021, NeurIPS 2021.

Organizer of semester-long program “Bridging Continuous and Discrete Optimization” at the Simons Institute for Theoretical Computer Science, to run in Fall 2017.

Organizer of the workshop “User-Friendly Tools from Continuous Optimization” at STOC’2017.

“Messaggeri della Conoscenza 2013”: Taught a summer school in Bari, Italy, as part of a government program aiming to expose undergraduates in underdeveloped regions of Italy to teaching methods from internationally recognized universities.]