

# JOHN WILMES

## Machine Learning Researcher

📍 Chicago, IL

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## SUMMARY

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- Experienced **algorithms researcher** with Deep Learning and Markov chain Monte Carlo expertise
- **Project management** skills demonstrated by leading team of researchers producing two Ph.D. theses, an NSF grant, and publications in top computer science venues

## EXPERIENCE

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### Machine Learning Consultant

📅 February 2018 – August 2018 and March 2023 – present

- Medical AI startup: Designed and implemented deep learning algorithms for categorizing human activities from motion sensor data using Python, Tensorflow, and AWS, improving accuracy by 20%
- Scientific membership organization: Integrated 11 data sources to build predictive model of member retention and identify key causal factors

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### Assistant Professor of Mathematics

#### Brandeis University

📅 July 2018 – June 2021

📍 Waltham, MA

- Collaborated across departments and with university administration to win approval for my revision of Applied Mathematics major
- Designed curriculum on communicating and presenting mathematical results, used by 100+ students
- Awarded \$175k NSF grant “Guarantees for Training Neural Networks” producing first-in-class training guarantees for convolutional graph neural networks and resulting in two Ph.D. theses

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### Research Scientist

#### Georgia Institute of Technology

📅 September 2016 – June 2018

📍 Atlanta, GA

- Outstanding Post-Doctoral Research Award for advances in machine learning and Markov chain Monte Carlo algorithms
- NeurIPS “spotlight” talk on provable guarantees for training neural networks, and invited presentations worldwide

## SKILLS

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### Communication

- Taught over a dozen university courses, from introductory to graduate-level
- Over 40 research talks, including cross-disciplinary and non-technical audiences

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### Collaboration

- Built cross-departmental relationships to revise Applied Mathematics major
- Over a dozen co-authors; led team of five student research assistants

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### Machine Learning

PyTorch, Tensorflow

- Led research on deep learning guarantees and graph neural networks, published in NeurIPS, COLT, ICLR
- Designed and taught courses to 100+ students on big data, optimization, and machine learning in Python using numpy, pandas, and scikit-learn

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### Programming

C, Python, R, Lua, SQL

- 15 years experience writing Python scripts for research and teaching, including machine learning experiments
- Refactored user interface for Vim text editor, *keyfactor.nvim*; wrote keyboard firmware in C for efficient chording

## EDUCATION

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### Ph.D. and M.S. in Mathematics

#### University of Chicago

📅 September 2010 – August 2016

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### B.A. in Mathematics

#### Reed College

📅 September 2006 – June 2010

## PAPERS

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1. Will Burstein and John Wilmes. Obstacles to depth compression of neural networks. In *Proceedings of the 29th International Conference on Artificial Neural Networks (ICANN)*, 2020.
2. Santosh Vempala and John Wilmes. Gradient descent for one-hidden-layer neural networks: Polynomial convergence and SQ lower bounds. In *Proceedings of the 32nd Conference on Learning Theory (COLT)*, 2019.
3. Daniel Štefankovič, Eric Vigoda, and John Wilmes. On counting perfect matchings in general graphs. In *Proceedings of the 13th Latin American Symposium on Theoretical Informatics (LATIN)*, pages 873–885, 2018.
4. Le Song, Santosh Vempala, John Wilmes, and Bo Xie. On the complexity of learning neural networks. In *Advances in Neural Information Processing Systems (NeurIPS)*, pages 5514–5522, 2017.
5. László Babai and John Wilmes. Asymptotic Delsarte cliques in distance-regular graphs. *Journal of Algebraic Combinatorics*, 43(4):771–782, 2016.
6. Xiaorui Sun and John Wilmes. Faster canonical forms for primitive coherent configurations. In *Proceedings of the 47th ACM on Symposium on Theory of Computing (STOC)*, pages 693–702, 2015.
7. Madhusudan Manjunath, Frank-Olaf Schreyer, and John Wilmes. Minimal free resolutions of the  $G$ -parking function ideal and the toppling ideal. *Transactions of the American Mathematical Society*, 367(4):2853–2874, 2015.
8. László Babai, Xi Chen, Xiaorui Sun, Shang-Hua Teng, and John Wilmes. Faster canonical forms for strongly regular graphs. In *Proceedings of the 54th IEEE Symposium on Foundations of Computer Science (FOCS)*, pages 157–166, 2013.
9. Laszlo Babai and John Wilmes. Quasipolynomial-time canonical form for Steiner designs. In *Proceedings of the 45th ACM Symposium on Theory of Computing (STOC)*, pages 261–270, 2013.
10. David Perkinson, Jacob Perlman, and John Wilmes. Primer for the algebraic geometry of sandpiles. *Tropical and non-Archimedean geometry*, 605:211–256, 2013.

## PRESENTATIONS

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### Selected Invited Talks

- 2019 Combinatorics Seminar, Dartmouth College, Hanover, NH
- 2018 WL2018: Symmetry vs. Regularity, Pilsen, Czech Republic
- 2017 Computational Challenges in Machine Learning, Simons Institute for the Theory of Computing, Berkeley, CA
- 2015 Max Planck Institute for Informatics, Saarbrücken, Germany
- 2015 China Theory Week, Shanghai Jiao Tong University, Shanghai, China
- 2015 Theory Seminar, Northwestern University, Evanston, IL
- 2014 Theory of Computing and Probability Seminars, Cornell University, Ithaca, NY
- 2014 Modern Trends in Algebraic Graph Theory, Villanova University, Villanova, PA
- 2013 AMS Special Session on Topological Combinatorics, Joint Meetings of Mathematics, San Diego, CA

### Selected Contributed Talks

- 2017 Spotlight Presentation, Neural Information Processing Systems, Long Beach, CA
- 2015 Dagstuhl Seminar on the Graph Isomorphism Problem, Wadern, Germany