

JUSTIN WHITEHOUSE

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EDUCATION

Carnegie Mellon University, School of Computer Science, Pittsburgh, PA *Expected May 2024*
PhD in Computer Science
Supported by the National Science Foundation Graduate Research Fellowship Program (NSF GRFP)

Columbia University, Columbia College, New York, NY *September 2015 – May 2019*
Bachelor of Arts in Mathematics, Computer Science, GPA 4.02
Honors: Summa Cum Laude, Phi Beta Kappa, I. I. Rabi Fellow (4 year scholarship), Dean's List (All Semesters)

PUBLICATIONS

A Tradeoff Between Privacy and Accuracy: Noise Reduction via Brownian Motion. **J. Whitehouse**, A. Ramdas, S. Wu, R. Rogers. **In Progress, 2021.**

Improved Privacy Filters and Odometers: Time-Uniform Bounds in Privacy Composition. **J. Whitehouse**, A. Ramdas, S. Wu, R. Rogers. **Theory and Practice of Differential Privacy (TPDP), 2021.**

The Case for Phase-Aware Scheduling of Parallelizable Jobs. **J. Whitehouse**, B. Berg, M. Harchol-Balter, B. Moseley, W. Wang. **39th International Symposium on Computer Performance, Modeling, Measurements and Evaluation, 2021.**

Optimal Resource Allocation for Elastic and Inelastic Jobs. B. Berg, M. Harchol-Balter, B. Moseley, W. Wang, **J. Whitehouse**. **ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2020).**

Bring Engineering Rigor to Deep Learning. K. Pei, S. Wang, Y. Tian, **J. Whitehouse**, C. Vondrick, Y. Cao, B. Ray, S. Jana, J. Yang. **ACM SIGOPS Operating Systems Review, Volume 53 Issue 1 (SIGOPS 2019).**

Efficient Formal Safety Analysis of Neural Networks. S. Wang, K. Pei, **J. Whitehouse**, J. Yang, S. Jana. **Conference on Neural Information Processing Systems (NEURIPS), 2018.**

Formal Security Analysis of Neural Networks Using Symbolic Intervals. S. Wang, K. Pei, **J. Whitehouse**, J. Yang, S. Jana. **27th USENIX Security Symposium, 2018.**

RESEARCH EXPERIENCE

Department of Computer Science, Carnegie Mellon University, Pittsburgh, PA *April 2021-Present*
Improved Privacy Filters and Odometers: Time-Uniform Bounds in Privacy Composition
Mentors: Professors Aaditya Ramdas and Steven Wu

- Used advances in supermartingale concentration to improve privacy filters and odometers, objects used for adaptive composition in differential privacy.
- Constructed fully adaptive composition rules which recover the tightness of traditional, un-adaptive advanced privacy composition as a special case.
- Investigated statistical applications of fully-adaptive privacy composition.

Department of Computer Science, Carnegie Mellon University, Pittsburgh, PA *September 2019 – Present*
Scheduling Parallel Jobs to Minimize Response Time
Mentors: Professors Mor Harchol-Balter, Weina Wang, and Benjamin Moseley

- Devised algorithms for optimally scheduling inelastic and elastic jobs in stochastic multiserver systems.
- Developed Markov Decision Process (MDP) based techniques for solving problems in queueing contexts.

- Leveraged state-of-the-art methods for modeling busy periods to solve infinite state Markov Chains for the mean response time of parallel scheduling policies.

Department of Computer Science, Columbia University, New York, NY

September 2017 – May 2019

Formal Verification of Neural Networks

Mentors: Professor Suman Jana

- Applied aspects of abstract interpretation and interval analysis to prove security of neural networks commonly used in autonomous vehicles against adversarial examples.
- Helped formalize symbolic intervals and proved correctness of linear relaxation, both techniques used to keep track of input dependency that is typically lost due to the concretization of abstract domains.
- Formally proved convergence and correctness of directed constraint refinement, a technique introduced to reduce overestimation error by splitting abstract domains on intermediate neural network nodes.
- Obtained a 1,500x speedup over *Reluplex*, a state-of-the-art verification tool for neural networks.

PROFESSIONAL EXPERIENCE

Extreme Blue Internship Program, IBM, Durham, NC

May – August 2018

Technical Intern

- Developed RESTful API error checking services in Flask using microservice architectures as part of an existing IBM financial data providing service.
- Engineered normalized bi-temporal databases using IBM's SQL interface.
- Practiced Agile Development with demos every two weeks and daily scrum meetings to ensure a working product at all stages of development.
- Pitched my product every week to IBM executives, and answered any corresponding questions from said executives.

Knowledge Lab, University of Chicago, Chicago, IL

May 2016 – January 2017

Data Scientist/Developer

- Used Python-based Latent Dirichlet Allocation topic modeling along with word embedding techniques on over 10 million *Web of Science* paper abstracts.
- Created a research analytics platform that captures publication information and similarities for over 2,000 individuals at the University of Chicago.

TEACHING & LEADERSHIP EXPERIENCE

Departments of Computer Science/Mathematics, Columbia University, New York, NY

January 2018 – May 2019

Teaching Assistant/Instructional Assistant

- Served as teaching assistant for five classes: *Introduction to Cryptography*, *Introduction to Computational Complexity*, *Computer Science Theory*, *Modern Algebra II*, and *Number Theory and Cryptography*.
- Organized weekly homework assignments and provided comprehensive feedback on solution quality including proof style and rigor.

Columbia Science Review, Columbia University, New York, NY

Editor-in-Chief (elected) & Member of Executive Board

January 2016 – August 2018

- Organized teams of authors, editors, reviewers, and illustrators for the publication of the CSR magazine each semester.
- Worked with advertisers, printers, and school officials to organize the publication, distribution, and flow of funds for the magazine.
- Managed teams of blog writers and editors which post frequently about relevant scientific news on Columbia's campus.

RELEVANT COURSEWORK

Computer Science Courses: *Algorithms for Private Data Analysis, Analytical Performance Modeling, Graduate Algorithms, Algorithms and Analysis for Scalable Computing Systems, Machine Learning, Computational Learning Theory, Advanced Cryptography, Computational Complexity.*

Mathematics Courses: *Game-theoretic Statistical Inference, Stochastic Calculus, Measure-Theoretic Probability, Real Analysis, Modern Algebra, Algebraic Number Theory, Topology.*