Seth Neel

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Date of Birth	4^{th} June 1993	**GitHub:**	sethneel
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Biosketch

Seth Neel is an Assistant Professor in the Department of Technology and Operations Management at Harvard, and co-founder at Welligence Energy Analytics. His primary research interest is in the theory and application of machine learning, where he is focused on building algorithmic tools that incorporate ethical notions of fairness and privacy. Specifically, he has worked on fairness in supervised learning, bandit problems and online learning, differential privacy, and adaptive data analysis.

Education

2015-2020 The Wharton School, University of Pennsylvania

PhD in Statistics
Thesis: *Towards Ethical Machine Learning: New Algorithms for Fairness and Privacy*

2011-2015 Harvard University

B.A. in Mathematics *Cum Laude* with High Honors Thesis
Thesis: *Mahalanobis Matching and Equal Percent Bias Reduction*

Employment History

2021 - Present Harvard Business School, Department of Technology and Operations Management
Assistant Professor

Tenure-track Assistant Professor studying artificial intelligence, fairness, and privacy.

2018 - Present Welligence Energy Analytics, New York, NY, United States
Co-founder and Chief Data Scientist

As technical co-founder I take responsibility for the teams that deliver all technology-enabled aspects of the business from research, to data science, to software engineering.

Jun 2014 - Aug 2014 The Goldman Sachs Group, New York, NY, United States
Securities Division, Summer Analyst.

- Summer Analyst on the Interest Rate Products & Equities Exotics Trading desks. Delivered statistical analysis, trade ideas, and hedging strategies for various financial derivatives.

Jun 2013 - Aug 2013 The University of Minnesota, Minneapolis, MN, United States
Research Experience for Undergraduates (REU)

- Coauthored paper *Aztec Castles and the dP3 Quiver*, at the intersection of string theory and graph theory. *The Journal of Physics A: Mathematical and Theoretical,* November 2014.

Jun 2012 - Aug 2012 Harvard University Department of Mathematics, Cambridge, MA, United States
Harvard College Research Program

Awards & Fellowships

- Forbes 30 under 30 in Energy List, 2019.
- Graduate Research Fellowship (**NSF GRFP**), National Science Foundation, $\sim \$132,000, 2017 - 2020$.
- Penn Wharton Startup Challenge, Semifinalist, 2018.
- Wharton Doctoral Programs 1st Year Fellowship, $\$5000, 2015 - 2016$.
- 2011 Intel Science Talent Search Semifinalist
- 2010 USA Mathematical Olympiad

Preprints

[Preprint19] Christopher Jung et al. "Eliciting and Enforcing Subjective Individual Fairness". In: *CoRR* abs/1905.10660 (2019). arXiv: 1905.10660. URL: http://arxiv.org/abs/1905.10660.

Conference Publications

[FAT*19b] Hadi Elzayn et al. "Fair Algorithms for Learning in Allocation Problems". In: *Proceedings of the Conference on Fairness, Accountability, and Transparency, FAT* 2019, Atlanta, GA, USA, January 29-31, 2019*. 2019, pp. 170–179. DOI: 10.1145/3287560.3287571. URL: https://doi.org/10.1145/3287560.3287571.

[AIES18] Matthew Joseph et al. "Meritocratic Fairness for Infinite and Contextual Bandits". In: *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society, AIES 2018, New Orleans, LA, USA, February 02-03, 2018*. 2018, pp. 158–163. DOI: 10.1145/3278721.3278764. URL: https://doi.org/10.1145/3278721.3278764.

[FOCS19a] Matthew Joseph et al. "The Role of Interactivity in Local Differential Privacy". In: *CoRR* abs/1904.03564 (2019). arXiv: 1904.03564. URL: http://arxiv.org/abs/1904.03564.

[ITCS20] Christopher Jung et al. "A New Analysis of Differential Privacy's Generalization Guarantees". In: *arXiv e-prints*, arXiv:1909.03577 (Sept. 2019), arXiv:1909.03577. arXiv: 1909.03577 [cs.LG].

[FAT*19a] Michael J. Kearns et al. "An Empirical Study of Rich Subgroup Fairness for Machine Learning". In: *Proceedings of the Conference on Fairness, Accountability, and Transparency, FAT* 2019, Atlanta, GA, USA, January 29-31, 2019*. 2019, pp. 100–109. DOI: 10.1145/3287560.3287592. URL: https://doi.org/10.1145/3287560.3287592.

[ICML18a] Michael J. Kearns et al. "Preventing Fairness Gerrymandering: Auditing and Learning for Subgroup Fairness". In: *Proceedings of the 35th International Conference on Machine Learning, ICML 2018, Stockholmsmässan, Stockholm, Sweden, July 10-15, 2018*. 2018, pp. 2569–2577. URL: http://proceedings.mlr.press/v80/kearns18a.html.

[NEURIPS17] Katrina Ligett et al. "Accuracy First: Selecting a Differential Privacy Level for Accuracy Constrained ERM". In: *Advances in Neural Information Processing Systems 30: Annual Conference on Neural Information Processing Systems 2017, 4-9 December 2017, Long Beach, CA, USA*. 2017, pp. 2566–2576. URL: http://papers.nips.cc/paper/6850-accuracy-first-selecting-a-differential-privacy-level-for-accuracy-constrained-erm.

[ICML18b] Seth Neel and Aaron Roth. "Mitigating Bias in Adaptive Data Gathering via Differential Privacy". In: *Proceedings of the 35th International Conference on Machine Learning, ICML 2018, Stockholmsmässan, Stockholm, Sweden, July 10-15, 2018*. 2018, pp. 3717–3726. URL: http://proceedings.mlr.press/v80/neel18a.html.

[FOCS19b] Seth Neel, Aaron Roth, and Zhiwei Steven Wu. "How to Use Heuristics for Differential Privacy". In: *CoRR* abs/1811.07765 (2018). arXiv: 1811.07765. URL: http://arxiv.org/abs/1811.07765.

Journal Publications

[JPhysA14] Megan Leoni et al. "Aztec castles and the dP3 quiver". In: *Journal of Physics A: Mathematical and Theoretical* 47.47 (2014), p. 474011.

[JPC19] Steven Wu et al. "Accuracy First: Selecting a Differential Privacy Level for Accuracy-Constrained ERM". In: *Journal of Privacy and Confidentiality* 9.2 (Sept. 2019). DOI: 10.29012/jpc.682. URL: https://journalprivacyconfidentiality.org/index.php/jpc/article/view/682.

Highly-Reviewed Workshops

[FATML17a] Richard Berk et al. "A Convex Framework for Fair Regression". In: *CoRR* abs/1706.02409 (2017). arXiv: 1706.02409. URL: http://arxiv.org/abs/1706.02409.

[FATML17b] Matthew Joseph et al. "Better Fair Algorithms for Contextual Bandits". In: *Fairness, Accountability, and Transparency in Machine Learning (FATML 17)* (2017).

[FATML17c] Matthew Joseph et al. "Fair Algorithms for Infinite Contextual Bandits". In: *Fairness, Accountability, and Transparency in Machine Learning (FATML 17)* (2017).

[FATML16] Matthew Joseph et al. "Rawlsian Fairness for Machine Learning". In: *Fairness, Accountability, and Transparency in Machine Learning (FATML 16)* (2016).

[WNEURIPS19a] Seth Neel et al. "Differentially Private Objective Perturbation: Beyond Smoothness and Convexity". In: *Neural Information Processing Systems Workshop on Privacy in Machine Learning*, arXiv:1909.01783 (Sept. 2019), arXiv:1909.01783. arXiv: 1909.01783 [cs.LG].

[WNEURIPS19b] Seth Neel et al. "Optimal, Truthful, and Private Securities". In: *Neural Information Processing Systems Workshop on Robust AI for Financial Services* (Sept. 2019).

Invited External Talks

- Columbia University Computer Science Department Seminar, New York, NY. 11.21.19.
- New York University Computer Science Department Seminar, New York, NY. 11.15.19.
- Symposium on Foundations of Computer Science, Baltimore, Maryland. 11.9.19.
- Stanford Computer Science Department Seminar, Stanford, CA. 3.5.19.
- ACM Conference on Fairness, Accountability, and Transparency, Atlanta Georgia. 1.29.18
- Temple Computer Science Department, Invited Speaker. 11.29.18.
- Boston University Computer Science Department Seminar, 11.19.18.
- Northeastern University Computer Science Department Seminar, 11.8.18.
- MIT CSAIL Algorithms and Complexity Seminar, 11.7.18.
- Penn Research in Machine Learning, seminar series. 11.7.18.
- International Conference on Machine Learning, Stockholm Sweden. 2 Contributed Talks. 7.11.18.
- Economics and Computation Mechanism Design for Social Good Workshop, Ithaca, NY. Contributed Talk. 6.22.18.
- BIRS Mathematical Foundations of Data Privacy Workshop, Banff, Alberta. 2 Invited Talks. 4.29.18.

- AAAI Workshop on Artificial Intelligence, Ethics, and Society, New Orleans, LA. Poster Presentatioin. 2.3.18.
- Neural Information Processing Systems, Long Beach, CA. Poster Presentation. 12.8.17.
- Facebook Privacy Ethics Workshop, NY, NY. 11.2.17.
- Theory and Practice of Differential Privacy, Dallas, TX. Contributed Talk. 10.30.17.
- Fairness Accountability and Transparency in Machine Learning, NYU. 11.1.16.

Service

- Program Committee Neural Information Processing Systems 2020.
- Program Committee ACM Conference on Fairness, Accountability, and Transparency 2019.
- Reviewer: ACM Conference on Fairness, Accountability, and Transparency, Neural Information Processing Systems, Journal of Machine Learning Research, International Conference on Machine Learning.

Media

Algorithmic Fairness:

- Wrote Op-ed in **WIRED Magazine**: Facebook's Race-Targeted Ads Aren't As Racist As You Think (https://www.wired.com/2016/11/facebooks-race-targeted-ads-arent-racist-think/)
- Covered by Penn Computer Science Department (https://highlights.cis.upenn.edu/fairness-in-machine-learning/)
- Covered by the Warren Center for Network and Data Sciences (https://medium.com/penn-engineering/combatting-fairness-gerrymandering-with-socially-conscious-algorithms-17e3e63cdbd1)

Entrepreneurship:

- **Forbes** 30 under 30 in Energy 2019 (https://www.forbes.com/profile/seth-neel)
- Covered in **Forbes** (https://www.forbes.com/sites/karlulrich/2018/05/24/the-future-of-entrepreneurship-is-students), **PhillyMag** (https://www.phillymag.com/business/2018/11/19/forbes-30-under-30-philadelphia-2/), others.
- Interview on **LaunchPad** on Sirius Radio (https://shows.pippa.io/wbr-guest/episodes/seth-neel)

Teaching & Mentoring

- Spring 2019: Co-advised the University of Pennsylvania undergraduate senior theses of William Brown, Aaron Hallac, Adel Boyarsky, Arnab Sarker. Their project built upon code I wrote for a recent paper, and ended up winning the senior design prize for best computer science thesis.
- Fall 2016: Head TA for Stat 613: Regression Analysis for Business (Wharton)
- Spring 2016: Head TA for Stat 430: Introduction to Probability (Penn)

Coding

- Languages: Python, Ruby, R, SQL, Git.
- Projects:
  - Led development of GerryFair: Implementing fair algorithms for learning with respect to rich sub-groups. Released as package (https://github.com/sethneel/GerryFair) and incorporated into IBM's AI Fairness 360 Package (https://github.com/IBM/AIF360).

- Built SubFair app to collect data from a human-subject experiment on fairness (https://github.com/sethneel/SubFairApp) as part of [Preprint19].
- Differentially Private Bandit Algorithms (https://github.com/sethneel/PrivGath) for ICML 18' paper
- Co-developer: Private search for ML algorithm (https://github.com/sethneel/Accuracy-First-Differential-Privacy) for our NEURIPS 17' paper.
- Led ideation, prototyping, and enterprise development of Welligence Inc.'s proprietary well forecasting algorithm, creating millions of dollars in value for the company.