

# JOSHUA A. KROLL

94 Spring Grove Avenue, San Anselmo, CA 94960

(831) 521-2260 • jkroll@jkroll.com

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## EDUCATION

**Princeton University** Princeton, NJ • PhD (2015): Computer Science

Dissertation: *Accountable Algorithms*

Advisors: Edward W. Felten and Andrew Appel

**Princeton University** Princeton, NJ • MA (2011): Computer Science

**Harvard College** Cambridge, MA • AB (2009): Physics and Mathematics. Secondary Field: Computer Science

John Wood Science Prize, Adams House Arms

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## PUBLICATIONS

### PEER-REVIEWED

- **Kroll, J. A.** “The Fallacy of Inscrutability.” *Philosophical Transactions of the Royal Society A* (Special issue on “Governing Artificial Intelligence: Ethical, Legal, and Technical Opportunities and Challenges”). *Forthcoming*.
- **Kroll, J. A.** “Data Science Data Governance.” *IEEE Security & Privacy* (Special issue on “AI Ethics: The Privacy Challenge”). Vol 16, No. 3 2018.
- Desai, D. and **J. A. Kroll**, “Trust But Verify: A Guide to Algorithms and the Law”. *Harvard Journal of Law and Technology*, Vol 31, Issue 1, 2018.
- **Kroll, J. A.**, J. Huey, S. Barocas, E. W. Felten, J. Reidenberg, D. Robinson, and H. Yu. “Accountable Algorithms”. *University of Pennsylvania Law Journal*, Vol. 165, Issue 3. 2016. *Future of Privacy Forum Privacy Papers for Policymakers Award, 2016*.
- Bonneau, J., A. Miller, J. Clark, A. Narayanan, **J. A. Kroll**, and E. W. Felten, “SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies”, 36th IEEE Symposium on Security and Privacy, San Jose, CA, May 2015.
- **Kroll, J. A.**, E. W. Felten, and J. A. Haldermann, “Efficiently Auditing Multi-Level Elections”, 6th International Conference on Electronic Voting, October, 2014.
- A. Edmundsen, A. K. Simpson, **J. A. Kroll**, and E. W. Felten, “Security Audit of Safeplug ‘Tor in a Box’”, 4th USENIX Workshop on Free and Open Communication on the Internet, August, 2014.
- **Kroll, J. A.**, J. Stewart, and A. Appel “Portable Software Fault Isolation”, Computer Security Foundations, July 2014.
- Clark, J., J. Bonneau, E. W. Felten, **J. A. Kroll**, A. Miller, and A. Narayanan, “On Decentralizing Prediction Markets and Order Books”, Workshop on the Economics of Information Security, June 2014.
- Bonneau, J., A. Narayanan, A. Miller, J. Clark, **J. A. Kroll**, and E. W. Felten “Mixcoin: Anonymity for Bitcoin with accountable mixes”, Financial Cryptography, March 2014.
- **Kroll, J. A.**, I. Davey and E. W. Felten, “The Economics of Bitcoin Mining, or Bitcoin in the Presence of Adversaries”, Workshop on the Economics of Information Security, June 2013.
- **Kroll, J. A.** and D. Dean, “BakerSFied: Bringing Software Fault Isolation to the x64”, SRI Computer Science Laboratory Technical Report, 2009.
- Martell, C. and **J. A. Kroll**, “Corpus-Based Gesture Analysis: An extension of the FORM dataset for the automatic detection of phases in a gesture”, *Int. J. Semantic Computing*, 1(4): 521-536 (2007).
- Martell, C. and **J. A. Kroll**, “Using FORM to Predict Phase Labels”, *Proceedings of the Language Resources and Evaluation Conference, Workshop on Multimodal Corpora*, June 2006.

### BOOK CHAPTERS

- **Kroll, J. A.**, I. Davey, and E. W. Felten, “The Economics of Bitcoin Mining, or Bitcoin in the Presence of Adversaries”, *Economics of Information Security and Privacy*, Springer 2015.

### OTHER

- **Kroll, J. A.**, Kohli, N., and Mulligan, D. “Lost in Translation: Disciplinary Confusion in Conceptions of Values in Technology”, Manuscript. September, 2018.
- **Kroll, J. A.**, Zimmerman, J., Wu, D., Nikolaenko, V., Felten, E., and Boneh, D., “Accountable Cryptographic Access Control”, Workshop on Encryption and Surveillance, August 19, 2018.

- **Kroll, J. A.**, N. Kohli, W. Monge, N. Good, and P. Laskowski, “Provable Privacy: Modern Methods and the FTC’s Role”. Comment to the FTC Competition and Consumer Protection in the 21<sup>st</sup> Century Hearings, 83 Fed. Reg. 38307. August 6, 2018.
- **Kroll, J. A.**, “Accountable Algorithms”. *PhD Dissertation*, Princeton University, August, 2015.
- **Kroll, J. A.**, “The Cyber Conundrum”, *The American Prospect*, Vol 26, No. 2. Spring 2015.
- **Kroll, J. A.**, “The Cyber Conundrum: A security update”, *The American Prospect Online* June 3, 2015.
- Goldfeder, S., R. Gennaro, H. Kalodner, J. Bonneau, **J. A. Kroll**, E. W. Felten, and A. Narayanan, “Securing Bitcoin wallets via a new DSA/ECDSA threshold signature scheme,” *Manuscript*. March, 2015.
- Barocas, S., E. W. Felten, J. Huey, **J.A. Kroll**, and A. Narayanan, “Big Data and Consumer Privacy in the Internet Economy”. Comment to the NTIA Big Data Request for Comments, 79 Fed. Reg. 32714. August 5, 2014.
- E. W. Felten and **J. A. Kroll**, “Heartbleed Shows Government Must Lead on Internet Security”, *Scientific American*, April 16, 2014.
- **Kroll, J. A.**, E. W. Felten, and D. Boneh, “Secure Protocols for Accountable Warrant Execution,” *Manuscript*. April, 2014.

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## WORK HISTORY

### **UC Berkeley School of Information** (2017-Present)

#### *Postdoctoral Research Scholar*

- Research on public policy, governance, ethics, and fairness in systems using machine learning and artificial intelligence, especially for automated decision making, supervised by Deirdre Mulligan.
- Wrote successful grant applications totalling over \$100,000 in research funding.
- Press mentions: WIRED, AP, National Journal, BuzzFeed News, PC Magazine, Deutschlandradio

### **Rocky Coast Research, LLC** (2017-Present)

#### *Founder and Principal Computer Scientist*

- Consulting on data responsibility, accountability in software systems, machine learning fairness, and technology policy.

### **Cloudflare, Inc.** (2015-2017)

#### *Systems Engineer (Software Engineer, Security Team)*

- Developed and launched “Origin CA”, a Go microservice to sign TLS certificates for customer origin servers using Cloudflare-trusted certificates.
- Designed, implemented, and deployed PAL, a container identity attestation and secrets management system for Docker based on cryptographic access control via Cloudflare’s Red October and PGP.

### **Princeton University** (2009-2015)

#### *Graduate Research Fellow/PhD Candidate*

- PhD research under Edward W. Felten and Andrew Appel. Work on accountable algorithms, cryptography, Bitcoin, electronic voting
- 9 peer reviewed papers. 1 law review article. 2 regulatory filings. 3 magazine articles. 1 book chapter. 8 invited talks.
- NSF Graduate Research Fellowship. Competitive award carrying university prize. 2000 given nationally.
- Press mentions: WIRED, MIT Technology Review, New Scientist, Scientific American

### **Norwegian Blue, LLC** (2014-2015)

#### *Principal Computer Scientist*

- Contract litigation support consulting for client Elysium Digital, LLC, a premier boutique technical expertise consulting firm focusing on intellectual property (patent, trademark) issues.

### **Google, Inc.** (Summer 2012)

#### *Intern, Engineering*

- Worked on driver sandboxing and kernel-level memory integrity in Linux on the ChromeOS security team.

### **Google, Inc.** (Summer 2011)

#### *Intern, Engineering*

- Worked on infrastructure-level projects involving security and privacy.

### **Google, Inc.** (Summer 2010)

#### *Intern, Public Policy Group*

- Provided technical assessment of product privacy issues with legal and policy implications.

**SRI International** (Summer 2008, 2009)

*Student Associate, Computer Science Lab*

- Research in software-based containment solutions (“Sandboxing”) for 64-bit x86 architectures, pairing-based cryptography, and formal systems analysis.

**Akamai Technologies, Inc.** (June 2007-June 2008)

*Software Engineering Intern, Mapping Division*

- Designed & developed tools to monitor health/performance of the worldwide Domain Name System (DNS). Evaluated performance, failure modes, and security of common client-side DNS software.

**Monterey Bay Aquarium Research Institute** (Summer 2006)

*Intern, Software Engineering*

- Designed, implemented, and tested automated image classification unit for a computer vision system.

**Naval Postgraduate School - Department of Computer Science** (June 2004-August 2005)

*Research Intern*

- Performed research in Artificial Intelligence/Natural Language Processing as applied to human gestures.

**Monterey Bay Aquarium** (June 2001-August 2006)

*Volunteer Guide*

- Educated visitors as docent, presenter (6-7 shows/month; audiences of 150-450). Mentor and Tour Guide Certifications; 1000-Hour Service Award.

#### HONORS, AWARDS, AND SELECTED ACTIVITIES

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- Member, Partnership on AI Working Group on Fair, Transparent, and Accountable AI
- Michigan State University and National Science Foundation “Workshop on Trustworthy Algorithmic Decision-Making”, Washington, D.C., December 2017 (*Invited*)
- 2017 Transatlantic Digital Debates Fellowship
- Metric Geometry and Gerrymandering Group “Geometry of Redistricting” Summer School, Tufts University, August 2017
- Future of Privacy Forum Privacy Papers for Policymakers award, 2016
- Affiliate, Princeton University Center for Information Technology Policy (2015-2017)
- National Science Foundation Graduate Research Fellowship (Award: 2011-2014; Honorable Mention: 2010)
- Member, NSF CISE Pathways to Revitalized Undergraduate Computing Education (CPATH) Rebooting Computing Summit Design Committee (Peter J. Denning, Chair) (2008-2009).

#### TEACHING

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##### GRADUATE

- UC Berkeley: Guest lectures on Data Ethics in the School of Information (INFO 188), the Division of Data Science (DS 100), and Science, Technology, and Society (STS C100).
- Princeton University, Department of Computer Science. Assistant in Instruction, Computer Science 226: Algorithms and Data Structures. Professor Robert Sedgwick, Instructor. Spring 2011.
  - Second-semester computer science course covering basic algorithms, data structures, and programming principles in Java.
  - Taught and graded for a precept of around 20 students
- Princeton University, Department of Computer Science. Assistant in Instruction, Computer Science 432: Information Security. Professor Edward Felten, Instructor. Fall 2010.
  - Upper-division course covering a wide landscape of computer and Internet security issues, including cryptography, web/Internet security, and system security.
- Harvard University, Department of Mathematics. Head Course Assistant (of 6), Mathematics 23a/b: Linear Algebra and Real Analysis I/II. Dr. Paul G. Bamberg, Instructor. 2006-2007.
  - Advanced first-year course in mathematics, designed to provide the foundation for study in a quantitative field.
  - Taught and graded for a precept of around 20 students.
  - Supervised course staff of six.

- **Kroll, J. A.**, Nitin Kohli, and Deirdre Mulligan, “Common Pitfalls for Studying the Human Side of Machine Learning,” Tutorial presented at the Neural Information Processing Symposium (NIPS), Montréal, Canada, December 2, 2018. (*Selected by competitive review*)
- **Kroll, J. A.**, “Three Principles for the Responsible Use of Artificial Intelligence,” AI Summit, San Francisco, September 19, 2018. (*Invited*)
- Clare Garvie, **J. A. Kroll**, and Kaitlin Jackson, “Face-off: Recognizing and Challenging Uses of Face Recognition Technology,” CLE credit seminar for the National Association of Criminal Defense Lawyers, Washington, DC, September 18, 2018. (*Invited*)
- **Kroll, J. A.**, “Flexible Cryptographic Access Control Through Accountability,” First Workshop on Encryption and Surveillance (co-located with CRYPTO’18), Santa Barbara, CA, 19 August 2018. (*Invited*)
- Nitin Kohli, Renata Barreto, and **J. A. Kroll**, “A Shared Lexicon for Research and Practice in Human-Centered Software Systems.” Tutorial presented at the first Conference on Fairness, Accountability, and Transparency (FAT\*), New York, February 23, 2018. (*Selected by competitive review*)
- **Kroll, J. A.** “Targeted Disclosure to Support Auditing and Accountability for Automated Decision-Making,” Machine Learning@Cambridge, Computational and Biological Learning Lab, Cambridge University, Cambridge, UK, November 1, 2017.
- **Kroll, J. A.** “Targeted Disclosure to Support Auditing and Accountability for Automated Decision-Making,” Ethical Auditing for Accountable Automated Decision-Making Workshop, Oxford Internet Institute, Oxford University, Oxford, UK, October 30, 2017.
- Kwon, Y., **J. A. Kroll**, M. Thomson, S. Wachter, A. Selbst, and M. Jayaram. “Accountability in Algorithmic Decision Making,” Policy Issues Surrounding Artificial Intelligence, Algorithms, and Privacy. Seoul National University, Seoul, Korea, August 23, 2017. (*Invited*)
- **Kroll, J. A.** and Steven Roosa, “The Algorithm Made Me Do It: Predictive Power, Ethics and the Law in the Age of Machine Learning, Artificial Intelligence, and Mathematical Perplexity,” Highmark Health All-Hands Privacy Workshop, Pittsburgh, PA, January 11, 2017. (*Invited*).
- **Kroll, J. A.**, J. Huey, S. Barocas, E. W. Felten, J. Reidenberg, D. Robinson, and H. Yu, “Accountable Algorithms,” Workshop on Data and Algorithmic Transparency. NYU Law School. November 19, 2016. (*Selected by peer review*)
- **Kroll, J. A.** “Accountable Algorithms,” SRI International Computer Science Lab Formal Topics Seminar, Menlo Park, CA, October 19, 2016. (*Invited*)
- **Kroll, J. A.** and A. Powell, “Algorithmic Accountability,” Big Boulder Conference, Boulder, CO, June 24, 2016. (*Invited*).
- **Kroll, J. A.** “Accountable Algorithms,” Yale Law School Information Society Project Workshop on Unlocking the Black Box. April 1, 2016. (*Selected by competitive review*)
- **Kroll, J. A.**, “Accountable Algorithms,” London School of Economics Media Policy Project Workshop on Algorithmic Power in Black-Box Platforms, London School of Economics, January 25, 2016. (*Invited*)
- **Kroll, J. A.**, “Accountable Algorithms,” Princeton Center for Information Technology Policy and University of Vienna Media Innovation Lab Doctoral Workshop, Princeton University, April 8, 2015. (*Selected by competitive review*)
- **Kroll, J. A.**, “Accountable Algorithms,” Center for Information Technology Policy Luncheon Series, Princeton University, February 17, 2015.
- Felten, E. W. and **J. A. Kroll**, “Accountable Algorithms,” Fairness, Accountability, and Transparency in Machine Learning Workshop, Neural Information Processing Systems Conference, Montreal, Quebec, Canada, December 12, 2014. (*Invited*)
- **Kroll, J. A.**, “Big Data, Fairness, and Nondiscrimination”. New Jersey Attorney General’s Advocacy Institute In-Service Training, August 7, 2014.
- **Kroll, J. A.**, “Accountable Algorithms,” Princeton Joint ACM/IEEE Professional Society Chapter Meeting, April 17, 2014.
- **Kroll, J. A.**, “The Economics of Bitcoin Mining, or Bitcoin in the Presence of Adversaries,” Center For Information Technology Policy Luncheon Series, Princeton University, November 14, 2013.
- **Kroll, J. A.**, and G. Barber, “Drones: Not Just for Military Use,” New Jersey Attorney General’s Advocacy Institute In-Service Training, August 8, 2013. (*CLE credit course*).
- **Kroll, J. A.**, and E. W. Felten, “The State of Electronic Voting,” Center For Information Technology Policy Luncheon Series, Princeton University, October 18, 2012.

- **Kroll, J. A.**, “Seeing Under Sea: Applications of Computer Vision in Underwater Video,” *Plenary Address*, Harvard Undergraduate Research Symposium, Nov. 2006 (Accepted by faculty review; top 3 of 140 papers).

PROFESSIONAL SERVICE

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- Founding Steering Committee Member, ACM Conference on Fairness, Accountability and Transparency (FAT\*’18-20)
- Technical Program Committee, ACM Conference on Fairness, Accountability, and Transparency (FAT\*’19)
- Executive Committee, Conference on Fairness, Accountability, and Transparency (FAT\*’18)
- Technical Program Committee, Conference on Fairness, Accountability, and Transparency (FAT\*’18)
- **Program Chair**, 2017 Workshop on Fairness, Accountability, and Transparency in Machine Learning (FAT/ML’17)
- Technical Program Committee, 2017 Workshop on Fairness, Accountability, and Transparency on the Web (FAT/WEB’17)
- Organizer, Workshop on Fairness, Accountability, and Transparency in Machine Learning (FATML’16)
- External Reviewer, Journal of Big Data Special Issue on Social and Technical Trade-Offs
- Organizer, Workshop on Fairness, Accountability, and Transparency in Machine Learning (FATML’15)
- Technical Program Committee, 2015 Workshop on Fairness, Accountability, and Transparency in Machine Learning (FATML’15)
- Technical Program Committee, 2015 Workshop on Surveillance and Technology (SAT’15)
- Technical Program Committee, 2015 Workshop on Bitcoin Research (BITCOIN’15)
- Technical Program Committee, 2014 Workshop on Bitcoin Research (BITCOIN’14)
- External Reviewer, 2014 International Conference on Financial Cryptography and Data Security (FC’14)
- Member, Princeton University Faculty-Student Committee on Discipline (2011-2014)
- Member, Judicial Committee, Committee of the Princeton University Community (2010-2011)
- Student member (2009), Harvard Faculty of Arts and Sciences Committee on Information Technology