Daniel Smullen

Curriculum Vitae

"Don't have good ideas if you aren't willing to be responsible for them." —Alan Perlis

About Me

I solve socio-technical problems using interdisciplinary research methods.
I want to help the world to develop more usable, secure, privacy-preserving, trustworthy software.

Education

2021 **Doctor of Philosophy (Software Engineering)**, *Carnegie Mellon University School of Computer Science*, Pittsburgh.
Institute for Software Research, Committee: Norman Sadeh (Chair), Lorrie Faith Cranor, Alessandro Acquisti, Rebecca Weiss (External, Mozilla), Yaxing Yao (External, UMBC)

- My research is focused on Usable Privacy and Security, incorporating qualitative and quantitative (mixed-methods) methodologies seen in behavioral economics, user-centered design, requirements engineering, machine learning, and empirical software engineering.
- My thesis investigates a broad cross section of privacy and security decisions in browsers and mobile apps; systematically assessing their effectiveness and manageability, exploring standardization, discussing public policy issues, and generalizability to other domains (e.g., Internet of Things).
- My work demonstrates that when the settings are well-aligned with people's mental models, machine learning can leverage the predictive power in models of more complex settings to help people manage their preferences more easily – this can effectively mitigate trade-offs between accuracy and increased user burden as settings proliferate.

2018 **Master of Science (Software Engineering)**, *Carnegie Mellon University*, Pittsburgh, Institute for Software Research.

2014 **Bachelor of Engineering (Honours, Software Engineering)**, *Ontario Tech, Formerly: University of Ontario Institute of Technology*, Oshawa, *With Distinction*.

Industrial Work Experience

2021 – Present **Applied Scientist**, *Amazon.com Trust and Privacy*, Remote.

2015 **334F Affiliate (Radar Science and Instrument Engineering)**, *NASA Jet Propulsion Laboratory*, Pasadena.
Supervisor: Razi Ahmed

- Developed a high-performance distributed radar image processing system.
- Developed an efficient interferometry filtering algorithm; processing time was reduced from weeks to minutes.
- Developed a portable implementation for heterogeneous computing platforms at NASA Ames high performance compute cluster (Pleiades) and commodity desktop hardware.
- Deployed interferometry software in production radar applications for UAVSAR program.

2012 **Engineer in Training**, *SNC-Lavalin Global Information Technologies*, Toronto.

- Conducted a reliability study on mission-critical data center systems.
- Established new guidelines for disaster recovery and emergency response planning.
- Conducted an infrastructure improvement planning study using Splunk.
- Developed a streamlined workstation staging infrastructure; deployment times reduced from hours to minutes.
- Developed replacement systems for legacy DOS systems infrastructure.

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2011 **Support Technician**, *SNC-Lavalin Global Mining and Metallurgy*, Toronto.
- Provided dedicated technical support for high-value clients and senior executive management.
- Conducted seminars on computer and network security, repair, open source software, and computer forensics.
- Developed automated data recovery systems.
- Performed high-risk data forensics and recovery on destroyed hardware.

2009 **Laboratory Systems Administrator**, *DESSAU, LVM-Technisol*, Toronto.
- Managed migration and replacement of legacy laboratory information management systems.
- Conducted field work in geotechnical engineering, subsurface sampling, concrete and asphalt QA/QC testing.
- Performed in-situ quality testing on major airport and highway resurfacing projects.
- Managed migration and integration of systems during LVM-JEGEL company merger.

2009 **Laboratory Systems Administrator**, *John Emery Geotechnical Engineering Limited (JEGEL)*, Toronto.
- Acted as liaison for City of Toronto special projects.
- Managed 2009 Trans-Canada Highway Rehabilitation geoinformatics.
- Managed 2009 Toronto Capital Works Program utility location and geotechnical subsurface sampling safety program.
- Developed ISO 9001 certified laboratory information management software.
- Performed debugging and repair of legacy pavement analysis embedded systems software.
- Performed engineering, design and construction of a file storage and database systems datacenter.

Academic Work Experience

2021 **Postdoctoral Researcher**, *Carnegie Mellon University*, Pittsburgh, Institute for Software Research.

2014 – 2021 **PhD Candidate**, *Carnegie Mellon University*, Pittsburgh, Institute for Software Research.

2017 – 2021 **Research Advisor**, *Carnegie Mellon University*, Pittsburgh, Institute for Software Research.
Mentor for 3 undergraduate research programmers and 3 masters students.
- Employed pair programming and extreme programming techniques.
- Employed Agile software development methodologies.
- Provided practical training on test driven development, debugging, and version control techniques.
- Provided hands-on training with research methods, including crowd-sourcing, survey design, contextual interviews, and grounded/thematic analysis on a variety of data.

2016 – 2020 **Teaching Assistant**, *Carnegie Mellon University*, Pittsburgh, Institute for Software Research.
- 17-655/17-755: Architectures for Software Systems
- 17-781/45-887: Mobile and IoT Computing Services

2013 – 2014 **Research Associate**, *University of Ontario Institute of Technology*, Oshawa.
Software Quality Research Lab, Advisor: Jeremy Bradbury
- Investigated privacy in meta-data unknowingly released through Internet traffic, in an ethics board approved user study.
- Investigated the software testing coupling effect using mutation testing tools and automation.
- Research funded by NSERC/CRSNG (Canada).

2013 **Undergraduate Researcher**, *University of Ontario Institute of Technology*, Oshawa.
Software Engineering Lab, Advisor: Ramiro Liscano
- Studied tinyOS-based wireless sensor networks, applying policy-based programming to create a new development environment (Policy IDE).
- Developed remote development environments for embedded ubiquitous computing on tinyOS using IPv6.
- Research funded by NSERC/CRSNG (Canada) Undergraduate Student Research Award.

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Funded Research Projects

2020-2021 **Engineering Usable Privacy and Security Affordances For Notice and Choice**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: Defense Advanced Research Projects Agency, US Air Force Research Laboratory (FA8750-15-2-0277), National Science Foundation Secure and Trustworthy Computing program (CNS-15-13957, CNS-1801316, CNS-1914486)

2019-2020 **Design and Evaluation of Security and Privacy Nudges**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: National Science Foundation Secure and Trustworthy Computing program (CNS-1330596, SES-1513957, CNS-1801316)

2018-2019 **Internet of Things Privacy Infrastructure (Patent Pending)**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: Defense Advanced Research Projects Agency, US Air Force Research Laboratory (FA8750-15-2-0277), National Science Foundation Secure and Trustworthy Computing program (CNS-15-13957, CNS-1801316, CNS-1914486)

2017-2019 **DARPA Brandeis: A Privacy Assistant for the Internet of Things**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: Defense Advanced Research Projects Agency, US Air Force Research Laboratory (FA8750-15-2-0277), National Science Foundation Secure and Trustworthy Computing program (CNS-15-13957, CNS-1801316, CNS-1914486)

2017-2019 **The Usable Privacy Policy Project**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: National Science Foundation Frontier Grant on Usable Privacy Policies (CNS-1330596, CNS-1330141, CNS-1330214)

2017 **Mobile App Privacy Compliance System (Patent Pending)**, *Carnegie Mellon University*, Pittsburgh, Advisor: Norman Sadeh.
Funded by: National Science Foundation Frontier Grant on Usable Privacy Policies (CNS-1330596, CNS-1330141, CNS-1330214), National Science Foundation XSEDE: Extreme Science and Engineering Discovery Environment (ACI-1548562)

2016 **Eddy: A Privacy Requirements Specification Language**, *Carnegie Mellon University*, Pittsburgh, Advisor: Travis Breaux.
Funded by: National Science Foundation (CNS-1330596), US Office of Naval Research (N002441410028), National Security Agency

2015 **Non-local Interferometric Synthetic Aperture Radar Parameter Estimator**, *NASA Jet Propulsion Laboratory*, Pasadena, Advisor: Razi Ahmed.
Funded by: National Aeronautics and Space Administration JPL PhD Fellowship

2014 **Incident Recognition and Intelligence System (IRIS)**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Shahryar Rahnamayan.
Funded by: University of Toronto Intelligent Transportation Systems Laboratory, University of Ontario Institute of Technology, NSERC/CRSNG (Canada)

2014 **Automated Marking System (AMS)**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Kamran Sartipi.
Funded by: University of Ontario Institute of Technology

2013 **Policy IDE**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Ramiro Liscano.
Funded by: NSERC/CRSNG (Canada)

2013 **TOSServ**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Ramiro Liscano.
Funded by: NSERC/CRSNG (Canada)

2013 **Finger2IPv6**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Ramiro Liscano.
Funded by: NSERC/CRSNG (Canada)

2013 **Military Logistics Management System (MLMS)**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Eyhab Al-Masri.
Funded by: University of Ontario Institute of Technology

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2012 **sneakyFS Secure Journaling Encrypted File System**, *University of Ontario Institute of Technology*, Oshawa, Advisor: Kamran Sartipi.
Funded by: University of Ontario Institute of Technology

2012 **Datacenter Utilization Research Study**, *SNC-Lavalin Global Information Technologies*, Toronto, Advisor: Marc Ross.
Funded by: SNC-Lavalin

Refereed Publications

D. Smullen, "Informing the design and refinement of privacy and security controls," *Carnegie Mellon University KiltHub: Theses and Dissertations*, no. CMU-ISR-21-111, September 2021.

D. Smullen, Y. Yao, Y. Feng, N. Sadeh, A. Edelstein, and R. Weiss, "Managing potentially intrusive practices in the browser: A user-centered perspective," *Proceedings on Privacy Enhancing Technologies*, vol. 2021, no. 4, pp. 500–527, 2021.

P. Story, **D. Smullen**, Y. Yao, A. Acquisti, L. Cranor, N. Sadeh, and F. Schaub, "Awareness, adoption, and misconceptions of web privacy tools," *Proceedings on Privacy Enhancing Technologies*, vol. 2021, pp. 308–333, 07 2021.

D. Smullen, Y. Feng, S. A. Zhang, and N. Sadeh, "The best of both worlds: Mitigating trade-offs between accuracy and user burden in capturing mobile app privacy preferences," *Proceedings on Privacy Enhancing Technologies*, vol. 2020, no. 1, pp. 195–215, 2020.

P. Story, **D. Smullen**, A. Acquisti, L. F. Cranor, N. Sadeh, and F. Schaub, "From intent to action: Nudging users towards secure mobile payments," in *Sixteenth Symposium on Usable Privacy and Security (SOUPS 2020)*, 2020, pp. 379–415.

S. Zimmeck, P. Story, **D. Smullen**, A. Ravichander, Z. Wang, J. Reidenberg, N. C. Russell, and N. Sadeh, "Maps: Scaling privacy compliance analysis to a million apps," *Proceedings on Privacy Enhancing Technologies*, vol. 2019, no. 3, pp. 66–86, 2019.

P. Story, S. Zimmeck, A. Ravichander, **D. Smullen**, Z. Wang, J. Reidenberg, N. C. Russell, and N. Sadeh, "Natural language processing for mobile app privacy compliance," in *AAAI Spring Symposium on Privacy-Enhancing Artificial Intelligence and Language Technologies*, 2019.

S. Wilson, F. Schaub, F. Liu, K. M. Sathyendra, **D. Smullen**, S. Zimmeck, R. Ramanath, P. Story, F. Liu, N. Sadeh, and N. A. Smith, "Analyzing privacy policies at scale: From crowdsourcing to automated annotations," *ACM Transactions On The Web*, vol. 13, no. 1, Dec. 2018.

A. Das, M. Degeling, **D. Smullen**, and N. Sadeh, "Personalized privacy assistants for the internet of things: providing users with notice and choice," *IEEE Pervasive Computing*, vol. 17, no. 3, pp. 35–46, 2018.

D. Smullen and T. Breaux, "Improving security in software acquisition with data retention specifications," 2017. [Online]. Available: https://calhoun.nps.edu/handle/10945/58892

D. Smullen and T. Breaux, "Towards rapid re-certification using formal analysis," 2015. [Online]. Available: https://calhoun.nps.edu/handle/10945/53561

J. Bhatia, T. Breaux, L. Friedberg, H. Hibshi, and **D. Smullen**, "Privacy risk in cybersecurity data sharing," in *Proceedings of the 2016 ACM on Workshop on Information Sharing and Collaborative Security*, 2016, pp. 57–64.

D. Smullen and T. Breaux, "Modeling, analyzing, and consistency checking privacy requirements using eddy," in *Proceedings of the Symposium and Bootcamp on the Science of Security*, 2016, pp. 118–120.

T. Breaux, **D. Smullen**, and H. Hibshi, "Detecting repurposing and over-collection in multi-party privacy requirements specifications," in *2015 IEEE 23rd international requirements engineering conference (RE)*. IEEE, 2015, pp. 166–175.

D. Smullen, J. Gillett, J. Heron, and S. Rahnamayan, "Genetic algorithm with self-adaptive mutation controlled by chromosome similarity," in *2014 IEEE Congress on Evolutionary Computation (CEC)*. IEEE, 2014, pp. 504–511.

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N. Qwasmi, **D. Smullen**, and R. Liscano, "Integrated development environment for debugging policy-based applications in wireless sensor networks," *Procedia Computer Science*, vol. 21, pp. 225–233, 2013.

Invited Talks

2020 **The Best of Both Worlds: Mitigating Trade-offs Between Accuracy and User Burden in Capturing Mobile App Privacy Preferences**, *20th Privacy Enhancing Technologies Symposium (PETS 2020)*, Online, Conference.
- Presented conference talk for peer reviewed publication and participated in panel discussions.

2019 **Digital Data Flows Masterclass: Mobile Apps**, *Future of Privacy Forum*, Online, Conference.
- Provided lectures and discussion session as featured expert.

2018 **Personalized Privacy Assistant Project**, *US Federal Trade Commission PrivacyCon*, Washington D.C., Conference.
- Presented poster with oral presentation and participated in panel discussions.

2017 **Assisting Users in a World Full of Cameras: A Privacy-aware Infrastructure for Computer Vision Applications**, *US Federal Trade Commission PrivacyCon*, Washington D.C., Conference.
- Presented poster with oral presentation and participated in panel discussions.

2017 **A Privacy Assistant for the Internet of Things**, *13th Symposium On Usable Privacy and Security (SOUPS 2017)*, San Jose, Conference.
- Presented poster with oral presentation and participated in panel discussions.

2016 **Toward a Semantics for Data Retention in Eddy**, *National Institute of Standards and Technology (NIST)*, Gaithersburg.
- Delivered an invited research talk, hosted by NIST Applied Cybersecurity Division.

2015 **Privacy Engineering Tool Clinic**, *Computing Community Consortium Catalyst, Privacy by Design Workshop*, Pittsburgh.
- Delivered an invited talk with tool demonstration and discussion panel session.

2015 **Detecting Repurposing and Over-Collection in Multi-party Privacy Requirements Specifications**, *23rd IEEE International Requirements Engineering Conference*, Ottawa, Conference.
- Presented conference talk for peer reviewed publication and participated in panel discussions.

2015 **Towards Rapid Re-Certification Using Formal Analysis**, *United States Navy Postgraduate School 12th Annual Acquisition Research Symposium*, Monterey, Conference.
- Presented conference talk for peer reviewed publication and participated in panel discussions.

2014 **Genetic Algorithm with Self-Adaptive Mutation Controlled by Chromosome Similarity**, *IEEE World Congress on Computational Intelligence (WCCI 2014), Evolutionary Computation Conference (CEC 2014)*, Beijing, Conference.
- Presented conference talk for peer reviewed publication and participated in panel discussions.

2013 **How Much Do We Reveal Through Metadata? An Assessment of Online Privacy**, *IBM Consortium for Software Engineering Research (CSER 2013)*, Toronto, Conference.
- Presented poster with oral presentation and participated in panel discussions.

2013 **Policy IDE... and Lessons Learned Since**, *The 4th International Conference on Emerging Ubiquitous Systems and Pervasive Networks (EUSPN 2013)*, Niagara Falls, Conference.
- Presented conference talk for peer reviewed publication and participated in panel discussions.

2013 **Facilitating the Internet of Things with Policy Programming**, *UOIT Undergraduate Research Showcase*, Oshawa, Conference.
- Presented poster with oral presentation and participated in panel discussions.

Professional Service

2021 **Reviewer**, *ACM Transactions on Privacy and Security (TOPS, formerly known as TISSEC)*, Online, Journal.
- Reviewed submissions and participated in discussions.

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2021 **Program Chair**, *ACM SIGBOVIK*, Online, Conference.
- Organized conference and webcast, acting as moderation chair for Q&A.

2021 **External Program Committee Member**, *Conference on Human Factors in Computing Systems (CHI 2021)*, Online, Conference.
- Refereed submissions and participated in discussions.

2020-2021 **Council Member**, *Cylab Justice Equity Diversity and Inclusion (JEDI) Council*, Carnegie Mellon University.
- Helped establish a new committee to promote justice, equity, diversity, and inclusion in faculty candidates, talks, hiring and student affairs.

2020 **External Program Committee Member**, *Conference on Human Factors in Computing Systems (CHI 2020)*, Honolulu, Conference.
- Refereed submissions, and participated in discussions and shepherding in the Late Breaking Works track.

2019-2020 **Committee Member**, *Institute for Software Research Branding Committee*, Carnegie Mellon University.
- Participated in coordinating and analyzing the results of a market research campaign for re-branding the department, establishing a new messaging/communications strategy, and developing a novel recruiting strategy for diverse faculty and doctoral students.

2018-2021 **Co-Founder**, *Institute for Software Research Forge Makerspace*, Carnegie Mellon University.
- Performed layout, development, maintenance, and instruction for the makerspace, leading safety training and other projects related to developing CNC machining, 3D printing, and CAD capabilities for the department.

2018-2020 **Co-Founder**, *Institute for Software Research Lunch and Learn Seminar Series*, Carnegie Mellon University, Seminar.
- Managed and taught weekly seminars concerning a variety of software engineering topics, aimed at improving software development best practices among researchers.

2018 **Program Committee Member**, *European Conference on Information Systems (ECIS2018)*, Portsmouth, Conference.
- Refereed submissions, and participated in discussions and shepherding.

2016 **Program Committee Member**, *International Workshop on Privacy Engineering (IWPE '16)*, San Jose.
- Refereed submissions, and participated in discussions and shepherding.

2015 **Web Chair**, *International Conference on Multicore Software Engineering, Performance, and Tools (MUSEPAT 2014)*, Hong Kong, Conference.
- Organized conference website and coordinated program committee.

2015 **Review Committee Member**, *Institute for Software Research PhD Applicant Review Committee*, Carnegie Mellon University.
- Reviewed applications for incoming doctoral students, and participated in the final acceptance decision making panel.

Awards

2017 **Distinguished Poster Award**, *13th Symposium On Usable Privacy and Security (SOUPS 2017)*, San Jose.

2017 **Hima and Jive Fellowship in Computer Science for International Students**, *Carnegie Mellon University*, Pittsburgh, Pennsylvania.

2015 **Ready-Set-Transfer Award**, *23rd IEEE International Requirements Engineering Conference*, Ottawa, *"Eddy: A privacy requirements specification language"*.
- Awarded first place in competitive industrial panel talks.

2014 **Faculty of Engineering and Applied Science Undergraduate Capstone Design Challenge Winner**, *University of Ontario Institute of Technology*, Oshawa, *"Incident Recognition and Intelligence System (IRIS)"*.
- Awarded first place in capstone research project competition, evaluated by a panel of academic and industrial experts.

2012–2014 **President's Honours List**, *University of Ontario Institute of Technology*, Oshawa.
- Awarded for exceptional academic achievement, with greater than 3.7 GPA.

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2013 **National Science and Engineering Research Council (NSERC/CRSNG) Undergraduate Research Award**, *University of Ontario Institute of Technology*, Oshawa.
- Awarded federally funded research grant with competitive review process, funding 1 year of undergraduate research in engineering.

2011 **Dean's Honours List**, *University of Ontario Institute of Technology*, Oshawa.
- Awarded for exceptional academic achievement, with greater than 3.5 GPA.

2008 **Engineers Without Borders Design Challenge Winner**, *McMaster University*, Hamilton.
- Awarded first place in a software requirements specification competition for distribution of AIDS medication in rural Africa.

2007 **DaVinci Engineering Design Challenge Winner**, *University of Toronto*, Toronto.
- Awarded first place in an engineering design challenge for remote controlled electric motorized aquatic vehicles, in Electrical Engineering and Fluid Dynamics competition stream.

Languages and Technologies

English **Native Proficiency**.

French **Verbal, Written Proficiency**.

German **Verbal, Written Proficiency**.

Python **Preferred Language**, *My default programming language, used for everything from web applications with django and django-rest, to data analysis and machine learning with scikit-learn, to performance analysis and scalability optimization with Cython in combination with several different multiprocessing and multithreading libraries.*

Docker **Preferred Technology**, *My approach is to containerize as much as possible, employing a DevOps approach to research projects, prototypes, and larger-scale projects alike. Docker makes managing dependencies quicker and easier, and streamlines deployment across different platforms and architectures.*

R **Preferred Language**, *Used in several research projects for statistical analysis, regression modelling, data mining, exploration and visualization.*

JavaScript **Secondary Preference**, *Used in the development of full-stack web applications using MongoDB, Express Angular, and Node, geo-spatial mapping libraries, and cross-platform hybrid mobile applications using a variety of technologies such as Ionic.*

C++ **Secondary Preference**, *Used in high performance computing work for optimized image processing kernels and computer vision applications, a useful alternative when performance is a primary architectural driver.*

Java **Secondary Preference**, *Used to develop parsers, lexers, and compilers for domain specific languages such as Eddy, as well as interact with a variety of Java-based research tools such as OWL-DL and other logic engines.*

Professional Memberships

Since 2020 **HACK Pittsburgh**, *Member and Educator.*

Since 2018 **Institute for Software Research Forge Makerspace**, *Founding Member.*

Since 2014 **Collaborative Institutional Training Initiative**, *Responsible Conduct of Research (Physical Science, Social & Behavioral Research)*, Carnegie Mellon University.

Since 2014 **The Corporation of the Seven Wardens**, *Order of the Calling of the Engineer*, Camp 1, Toronto, Ontario.

Since 2013 **Institute of Electrical and Electronics Engineers (IEEE)**, *Student Member.*
- IEEE Communications Society
- IEEE Internet of Things
- IEEE Sensors Council
- IEEE Software Defined Networks

Since 2011 **International Red Cross**, *Class C Emergency First Aid, CPR and Defibrillator Certification.*

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