

Nicolas Papernot

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Academic and Research Appointments

University of Toronto

Assistant Professor

- Department of Electrical & Computer Engineering
- Department of Computer Science

Toronto, ON, Canada

Since 09/2019

Vector Institute

Canada CIFAR AI Chair and Faculty Member

Toronto, ON, Canada

Since 09/2019

Google Brain

Research Scientist

Mountain View, CA, USA

Since 08/2018

Google Brain

Research Intern (mentored by Ilya Mironov)

Mountain View, CA, USA

05/2017–12/2017

Google Research

Research Intern (mentored by Ulfar Erlingsson and Martin Abadi)

Mountain View, CA, USA

05/2016–08/2016

Education

Pennsylvania State University

Ph.D. in Computer Science and Engineering

University Park, PA, USA

2016–2018

- Dissertation: *Characterizing the Limits and Defenses of Machine Learning in Adversarial Settings*
- Advisor: Prof. Patrick McDaniel
- Dissertation committee: Prof. Patrick McDaniel, Prof. Trent Jaeger, Prof. Thomas F. LaPorta, Prof. Aleksandra Slavkovic, Prof. Dan Boneh, Dr. Ian J. Goodfellow

Pennsylvania State University

M.S. in Computer Science and Engineering

University Park, PA, USA

2014–2016

- Thesis: *On The Integrity Of Deep Learning Systems in Adversarial Settings*
- Advisor: Prof. Patrick McDaniel
- Thesis committee: Prof. Patrick McDaniel, Prof. Adam D. Smith

École Centrale de Lyon

Diplôme d'Ingénieur (M.S. and B.S. in Engineering Sciences)

Lyon, France

2012–2016

Lycée Louis-le-Grand

Classe Préparatoire (equivalent to first two years of B.S. in the US and Canada)

Paris, France

2010–2012

Honors

Early Researcher Award: Ministry of Colleges and Universities

2022

Outstanding Paper Award: 10th International Conference on Learning Representations

2022

Alfred P. Sloan Research Fellow in Computer Science: Sloan Foundation

2022

Outstanding Performance Discretionary Research Grant: Vector Institute	2021
Faculty Affiliate: Schwartz Reisman Institute	2020-2023
Connaught New Researcher Award: University of Toronto	2020
Canada CIFAR AI Chair: Canadian Institute for Advanced Research	2019
Top 30% Reviewers Award: Neural Information Processing Systems	2018
Wormley Family Graduate Fellowship: Pennsylvania State University	2018
CSE Research Assistant Award: Pennsylvania State University	2018
Student Travel Award: 6th International Conference on Learning Representations	2018
Student Travel Award: 34th International Conference on Machine Learning	2017
Best Paper Award: 5th International Conference on Learning Representations	2017
Student Travel Award: 5th International Conference on Learning Representations	2017
CSE Graduate Research Award: Pennsylvania State University	2016
Google PhD Fellowship in Security: Google Research	2016-2018
CyberSpace 2025 Essay Contest (2nd place): Microsoft	2015
Scholarship for Exceptional Academic Achievements: McGill	2010

Publications

Invited publications.....

How Relevant Is the Turing Test in the Age of Sophisbots?. *Dan Boneh, Andrew J. Grotto, Patrick McDaniel, Nicolas Papernot.* IEEE Security and Privacy Magazine. (2019)

A Marauder’s Map of Security and Privacy in Machine Learning: An overview of current and future research directions for making machine learning secure and private. *Nicolas Papernot.* Keynote at the 11th ACM Workshop on Artificial Intelligence and Security colocated with the 25th ACM Conference on Computer and Communications Security, Toronto, Canada. (2018)

Making Machine Learning Robust against Adversarial Inputs. *Ian Goodfellow, Patrick McDaniel, Nicolas Papernot.* Communications of the ACM. (2018)

On the Protection of Private Information in Machine Learning Systems: Two Recent Approaches. *Martin Abadi, Ulfar Erlingsson, Ian Goodfellow, H. Brendan McMahan, Ilya Mironov, Nicolas Papernot, Kunal Talwar, Li Zhang.* Proceedings of the 30th IEEE Computer Security Foundations Symposium, Santa Barbara, CA, USA. (2017)

Machine Learning in Adversarial Settings. *Patrick McDaniel, Nicolas Papernot, Z. Berkay Celik.* IEEE Security and Privacy Magazine . (2016)

Conference proceedings.....

The Privacy Onion Effect: Memorization is Relative. *Nicholas Carlini, Matthew Jagielski, Chiyuan Zhang, Nicolas Papernot, Andreas Terzis, Florian Tramèr.* Proceedings of the 36th Conference on Neural Information Processing Systems. (2022)

Washing The Unwashable: On The (Im)possibility of Fairwashing Detection. *Ali Shahin Shamsabadi, Mohammad Yaghini, Natalie Dullerud, Sierra Wyllie, Ulrich Aïvoudji, Aisha Alaagib Alryeh Mkean, Sébastien Gambs, Nicolas Papernot.* Proceedings of the 36th Conference on Neural Information Processing Systems. (2022)

Dataset Inference for Self-Supervised Models. *Adam Dziedzic, Haonan Duan, Muhammad Ahmad Kaleem, Nikita Dhawan, Jonas Guan, Yannis Cattan, Franziska Boenisch, Nicolas Papernot.* Proceedings of the 36th Conference on Neural Information Processing Systems. (2022)

In Differential Privacy, There is Truth: on Vote-Histogram Leakage in Ensemble Private Learning. *Jiaqi*

Wang, Roei Schuster, Ilia Shumailov, David Lie, Nicolas Papernot. Proceedings of the 36th Conference on Neural Information Processing Systems. (2022)

On the Limitations of Stochastic Pre-processing Defenses. Yue Gao, Ilia Shumailov, Kassem Fawaz, Nicolas Papernot. Proceedings of the 36th Conference on Neural Information Processing Systems. (2022)

Private Multi-Winner Voting for Machine Learning. Adam Dziedzic, Christopher A. Choquette-Choo, Natalie Dullerud, Vinith Menon Suriyakumar, Ali Shahin Shamsabadi, Muhammad Ahmad Kaleem, Somesh Jha, Nicolas Papernot, Xiao Wang. Proceedings on Privacy Enhancing Technologies. (2023)

Differentially Private Speaker Anonymization. Ali Shahin Shamsabadi, Brij Mohan Lal Srivastava, Aurelien Bellet, Nathalie Vauquier, Emmanuel Vincent, Mohamed Maouche, Marc Tommasi, Nicolas Papernot. Proceedings on Privacy Enhancing Technologies. (2023)

On the Difficulty of Defending Self-Supervised Learning against Model Extraction. Adam Dziedzic, Nikita Dhawan, Muhammad Ahmad Kaleem, Jonas Guan, Nicolas Papernot. Proceedings of the 39th International Conference on Machine Learning. (2022)

Unrolling SGD: Understanding Factors Influencing Machine Unlearning. Anwith Thudi, Gabriel Deza, Varun Chandrasekaran, Nicolas Papernot. Proceedings of the 7th IEEE European Symposium on Security and Privacy, Genoa, Italy. (2022)

On the Necessity of Auditable Algorithmic Definitions for Machine Unlearning. Anwith Thudi, Hengrui Jia, Ilia Shumailov, Nicolas Papernot. Proceedings of the 31st USENIX Security Symposium. (2022)

Increasing the Cost of Model Extraction with Calibrated Proof of Work. Adam Dziedzic, Muhammad Ahmad Kaleem, Yu Shen Lu, Nicolas Papernot. Proceedings of the 10th International Conference on Learning Representations. [Spotlight Paper Award] (2022)

A Zest of LIME: Towards Architecture-Independent Model Distances. Hengrui Jia, Hongyu Chen, Jonas Guan, Ali Shahin Shamsabadi, Nicolas Papernot. Proceedings of the 10th International Conference on Learning Representations. (2022)

Hyperparameter Tuning with Renyi Differential Privacy. Nicolas Papernot, Thomas Steinke. Proceedings of the 10th International Conference on Learning Representations. [Outstanding Paper Award] (2022)

Is Fairness Only Metric Deep? Evaluating and Addressing Subgroup Gaps in Deep Metric Learning. Natalie Dullerud, Karsten Roth, Kimia Hamidieh, Nicolas Papernot, Marzyeh Ghassemi. Proceedings of the 10th International Conference on Learning Representations. (2022)

Bad Character Injection: Imperceptible Attacks on NLP Models. Nicholas Boucher, Ilia Shumailov, Ross Anderson, Nicolas Papernot. Proceedings of the 43rd IEEE Symposium on Security and Privacy, San Francisco, CA. (2022)

Towards More Robust Keyword Spotting for Voice Assistants. Shimaa Ahmed, Ilia Shumailov, Nicolas Papernot, Kassem Fawaz. Proceedings of the 31st USENIX Security Symposium. (2022)

Manipulating SGD with Data Ordering Attacks. Ilia Shumailov, Zakhar Shumaylov, Dmitry Kazhdan, Yiren Zhao, Nicolas Papernot, Murat A. Erdogdu, Ross Anderson. Proceedings of the 35th Conference on Neural Information Processing Systems. (2021)

Markpainting: Adversarial Machine Learning meets Inpainting. David Khachaturov, Ilia Shumailov, Yiren Zhao, Nicolas Papernot, Ross Anderson. Proceedings of the 38th International Conference on Machine Learning. (2021)

Label-Only Membership Inference Attacks. Christopher A. Choquette-Choo, Florian Tramer, Nicholas Carlini, Nicolas Papernot. Proceedings of the 38th International Conference on Machine Learning. (2021)

Data-Free Model Extraction. Jean-Baptiste Truong, Pratyush Maini, Robert Walls, Nicolas Papernot. Proceedings of the 2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition, Nashville, TN. (2021)

Proof-of-Learning: Definitions and Practice. Hengrui Jia, Mohammad Yaghini, Christopher A. Choquette-

Choo, Natalie Dullerud, Anwith Thudi, Varun Chandrasekaran, Nicolas Papernot. Proceedings of the 42nd IEEE Symposium on Security and Privacy, San Francisco, CA. (2021)

Entangled Watermarks as a Defense against Model Extraction. Hengrui Jia, Christopher A. Choquette-Choo, Varun Chandrasekaran, Nicolas Papernot. Proceedings of the 30th USENIX Security Symposium. (2021)

Sponge Examples: Energy-Latency Attacks on Neural Networks. Iliia Shumailov, Yiren Zhao, Daniel Bates, Nicolas Papernot, Robert Mullins, Ross Anderson. Proceedings of the 6th IEEE European Symposium on Security and Privacy, Vienna, Austria. (2021)

CaPC Learning: Confidential and Private Collaborative Learning. Christopher A. Choquette-Choo, Natalie Dullerud, Adam Dziedzic, Yunxiang Zhang, Somesh Jha, Nicolas Papernot, Xiao Wang. Proceedings of the 9th International Conference on Learning Representations. (2021)

Dataset Inference: Ownership Resolution in Machine Learning. Pratyush Maini, Mohammad Yaghini, Nicolas Papernot. Proceedings of the 9th International Conference on Learning Representations. [**Spotlight Paper Award**] (2021)

Chasing Your Long Tails: Differentially Private Prediction in Health Care Settings. Vinith Suriyakumar, Nicolas Papernot, Anna Goldenberg, Marzyeh Ghassemi. Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency. (2021)

Adversary Instantiation: Lower bounds for differentially private machine learning. Milad Nasr, Shuang Song, Abhradeep Guha Thakurta, Nicolas Papernot, Nicholas Carlini. Proceedings of the 42nd IEEE Symposium on Security and Privacy, San Francisco, CA. (2021)

Tempered Sigmoids for Deep Learning with Differential Privacy. Nicolas Papernot, Abhradeep Thakurta, Shuang Song, Steve Chien, Ulfar Erlingsson. Proceedings of the 35th AAAI Conference on Artificial Intelligence. (2021)

Neighbors From Hell: Voltage Attacks Against Deep Learning Accelerators on Multi-Tenant FPGAs. Andrew Boutros, Mathew Hall, Nicolas Papernot, Vaughn Betz. Proceedings of the 2020 International Conference on Field-Programmable Technology. (2020)

Machine Unlearning. Lucas Bourtole, Varun Chandrasekaran, Christopher A. Choquette-Choo, Hengrui Jia, Adelin Travers, Baiwu Zhang, David Lie, Nicolas Papernot. Proceedings of the 42nd IEEE Symposium on Security and Privacy, San Francisco, CA. (2021)

SoK: The Faults in our ASRs: An Overview of Attacks against Automatic Speech Recognition and Speaker Identification Systems. Hadi Abdullah, Kevin Warren, Vincent Bindschaedler, Nicolas Papernot, Patrick Traynor. Proceedings of the 42nd IEEE Symposium on Security and Privacy, San Francisco, CA. (2021)

Fundamental Tradeoffs between Invariance and Sensitivity to Adversarial Perturbations. Florian Tramer, Jens Behrmann, Nicholas Carlini, Nicolas Papernot, Jorn-Henrik Jacobsen. Proceedings of the 37th International Conference on Machine Learning, Vienna, Austria. (2020)

Thieves of Sesame Street: Model Extraction on BERT-based APIs. Kalpesh Krishna, Gaurav Singh Tomar, Ankur P. Parikh, Nicolas Papernot, Mohit Iyyer. Proceedings of the 8th International Conference on Learning Representations, Addis Ababa, Ethiopia. (2020)

High Accuracy and High Fidelity Extraction of Neural Networks. Matthew Jagielski, Nicholas Carlini, David Berthelot, Alex Kurakin, Nicolas Papernot. Proceedings of the 29th USENIX Security Symposium. Boston, MA. (2020)

MixMatch: A Holistic Approach to Semi-Supervised Learning. David Berthelot, Nicholas Carlini, Ian Goodfellow, Nicolas Papernot, Avital Oliver, Colin Raffel. Proceedings of the 33rd Conference on Neural Information Processing Systems, Vancouver, Canada. (2019)

Analyzing and Improving Representations with the Soft Nearest Neighbor Loss. Nicholas Frosst, Nicolas Papernot, Geoffrey Hinton. Proceedings of the 36th International Conference on Machine Learning, Long Beach, CA. (2019)

Adversarial Examples Influence Human Visual Perception. Gamaleldin F. Elsayed, Shreya Shankar, Brian Cheung, Nicolas Papernot, Alex Kurakin, Ian Goodfellow, Jascha Sohl-Dickstein. Proceedings of the 2019 Computational and Systems Neuroscience meeting, Lisbon, Portugal. (2019)

Adversarial Examples that Fool both Computer Vision and Time-Limited Humans. Gamaleldin F. Elsayed, Shreya Shankar, Brian Cheung, Nicolas Papernot, Alex Kurakin, Ian Goodfellow, Jascha Sohl-Dickstein. Proceedings of the 32nd Conference on Neural Information Processing Systems, Montreal, Canada. (2018)

Scalable Private Learning with PATE. Nicolas Papernot, Shuang Song, Ilya Mironov, Ananth Raghunathan, Kunal Talwar, Ulfar Erlingsson. Proceedings of the 6th International Conference on Learning Representations, Vancouver, Canada. (2018)

Ensemble Adversarial Training: Attacks and Defenses. Florian Tramer, Alexey Kurakin, Nicolas Papernot, Ian Goodfellow, Dan Boneh, Patrick McDaniel. Proceedings of the 6th International Conference on Learning Representations, Vancouver, Canada. (2018)

Towards the Science of Security and Privacy in Machine Learning. Nicolas Papernot, Patrick McDaniel, Arunesh Sinha, and Michael Wellman. Proceedings of the 3rd IEEE European Symposium on Security and Privacy, London, UK. (2018)

Adversarial Examples for Malware Detection. Kathrin Grosse, Nicolas Papernot, Praveen Manoharan, Michael Backes, and Patrick McDaniel. Proceedings of the 2017 European Symposium on Research in Computer Security, Oslo, Norway. (2017)

Semi-supervised Knowledge Transfer for Deep Learning from Private Training Data. Nicolas Papernot, Martin Abadi, Ulfar Erlingsson, Ian Goodfellow, and Kunal Talwar. Proceedings of the 5th International Conference on Learning Representations, Toulon, France. [**Best Paper Award**] (2017)

Practical Black-Box Attacks against Machine Learning. Nicolas Papernot, Patrick McDaniel, Ian Goodfellow, Somesh Jha, Z. Berkay Celik, and Ananthram Swami. Proceedings of the 2017 ACM Asia Conference on Computer and Communications Security, Abu Dhabi, UAE. (2017)

Crafting Adversarial Input Sequences for Recurrent Neural Networks. Nicolas Papernot, Patrick McDaniel, Ananthram Swami, and Richard Harang. Proceedings of the 2016 Military Communications Conference (MILCOM), Baltimore, MD. (2016)

Distillation as a Defense to Adversarial Perturbations against Deep Neural Networks. Nicolas Papernot, Patrick McDaniel, Xi Wu, Somesh Jha, and Ananthram Swami. Proceedings of the 37th IEEE Symposium on Security and Privacy, San Jose, CA. (2016)

The Limitations of Deep Learning in Adversarial Settings. Nicolas Papernot, Patrick McDaniel, Somesh Jha, Matt Fredrikson, Z. Berkay Celik, and Ananthram Swami. Proceedings of the 1st IEEE European Symposium on Security and Privacy, Saarbrücken, Germany. (2016)

Enforcing Agile Access Control Policies in Relational Databases using Views. Nicolas Papernot, Patrick McDaniel, and Robert Walls. Proceedings of the 2015 Military Communications Conference (MILCOM), Tampa, FL. (2015)

Journals.....

Subtle adversarial image manipulations influence both human and machine perception. Vijay Veerabadraran, Josh Goldman, Shreya Shankar, Brian Cheung, Nicolas Papernot, Alexey Kurakin, Ian Goodfellow, Jonathon Shlens, Jascha Sohl-Dickstein, Michael C. Mozer, Gamaleldin F. Elsayed. Nature Communications. (2022)

Adversarial Examples for Network Intrusion Detection Systems. Ryan Sheatsley and Nicolas Papernot and Michael J. Weisman and Gunjan Verma and Patrick McDaniel. Journal of Computer Security. (2022)

Workshop publications.....

Accelerating Symbolic Analysis for Android Apps. Mingyue Yang, David Lie, Nicolas Papernot. 4th International Workshop on Advances in Mobile App Analysis. (2021)

Dataset Inference: Ownership Resolution in Machine Learning. Pratyush Maini, Mohammad Yaghini, Nicolas Papernot. NeurIPS 2020 workshop on Privacy-preserving Machine Learning. (2020)

Tempered Sigmoids for Deep Learning with Differential Privacy. Nicolas Papernot, Abhradeep Thakurta, Shuang Song, Steve Chien, Ulfar Erlingsson. Theory and Practice of Differential Privacy. (2020)

The Pitfalls of Differentially Private Prediction in Healthcare. Vinith Suriyakumar, Nicolas Papernot, Anna Goldenberg and Marzyeh Ghassemi. Theory and Practice of Differential Privacy. (2020)

On the Robustness of Cooperative Multi-Agent Reinforcement Learning. Jieyu Lin, Kristina Dzevaroska, Sai Qian Zhang, Alberto Leon-Garcia, Nicolas Papernot. Proceedings of the 3rd Deep Learning and Security workshop colocated with the 41st IEEE Symposium on Security and Privacy. (2020)

Improving Differentially Private Models via Active Learning. Zhengli Zhao, Nicolas Papernot, Sameer Singh, Neoklis Polyzotis, and Augustus Odena. Presented at the NeurIPS 2019 Workshop on Privacy in Machine Learning. (2019)

Exploiting Excessive Invariance caused by Norm-Bounded Adversarial Robustness. Jorn-Henrik Jacobsen, Jens Behrmann, Nicholas Carlini, Florian Tramèr, Nicolas Papernot. Presented at the ICLR 2019 workshop on Safe ML, New Orleans, Louisiana. (2019)

A General Approach to Adding Differential Privacy to Iterative Training Procedures. Brendan McMahan, Galen Andrew, Ulfar Erlingsson, Steve Chien, Ilya Mironov, Nicolas Papernot, Peter Kairouz. Presented at the NeurIPS 2018 workshop on Privacy Preserving Machine Learning, Montreal, Canada. (2019)

Extending Defensive Distillation. Nicolas Papernot and Patrick McDaniel. Presented at the Workshop track of the 38th IEEE Symposium on Security and Privacy, San Jose, CA. (2017)

Adversarial Attacks on Neural Network Policies. Sandy Huang, Nicolas Papernot, Ian Goodfellow, Yan Duan, Pieter Abbeel. Presented at the Workshop Track of the 5th International Conference on Learning Representations, Toulon, France. (2017)

Security and Science of Agility. Patrick McDaniel, T. Jaeger, T. F. La Porta, Nicolas Papernot, R. J. Walls, A. Kott, L. Marvel, A. Swami, P. Mohapatra, S. V. Krishnamurthy, I. Neamtiu. Presented at the 2014 ACM Workshop on Moving Target Defense. (2014)

Technical reports.....

Intrinsic Anomaly Detection for Multi-Variate Time Series. Stephan Rabanser, Tim Januschowski, Kashif Rasul, Oliver Borchert, Richard Kurle, Jan Gasthaus, Michael Bohlke-Schneider, Nicolas Papernot, Valentin Flunkert. (2022)

Interpretability in Safety-Critical Financial Trading Systems. Gabriel Deza, Adelin Travers, Colin Rowat, Nicolas Papernot. (2021)

On the Exploitability of Audio Machine Learning Pipelines to Surreptitious Adversarial Examples. Adelin Travers, Lorna Licollari, Guanghan Wang, Varun Chandrasekaran, Adam Dziedzic, David Lie, Nicolas Papernot. (2021)

p-DkNN: Out-of-Distribution Detection through Statistical Testing of Deep Representation. Adam Dziedzic, Stephan Rabanser, Mohammad Yaghini, Armin Ale, Murat A Erdogdu, Nicolas Papernot. (2022)

Generative Extraction of Audio Classifiers for Speaker Identification. Tejumade Afonja, Lucas Bourtole, Varun Chandrasekaran, Sageev Oore, Nicolas Papernot. (2022)

Rearchitecting Classification Frameworks For Increased Robustness. Varun Chandrasekaran, Brian Tang, Nicolas Papernot, Kassem Fawaz, Somesh Jha, Xi Wu. (2019)

On Evaluating Adversarial Robustness. Nicholas Carlini, Anish Athalye, Nicolas Papernot, Wieland Brendel, Jonas Rauber, Dimitris Tsipras, Ian Goodfellow, Aleksander Madry. (2019)

Distribution Density, Tails, and Outliers in Machine Learning: Metrics and Applications. Nicholas Carlini, Ulfar Erlingsson, Nicolas Papernot. (2019)

CleverHans v2.1.0: an adversarial machine learning library. *Nicolas Papernot, Fartash Faghri, Nicholas Carlini, Ian Goodfellow, Reuben Feinman, Alexey Kurakin et al..* (2018)

Deep k-Nearest Neighbors: Towards Confident, Interpretable and Robust Deep Learning. *Nicolas Papernot and Patrick McDaniel.* (2018)

The Space of Transferable Adversarial Examples. *Florian Tramèr, Nicolas Papernot, Ian Goodfellow, Dan Boneh, Patrick McDaniel.* (2017)

On the (Statistical) Detection of Adversarial Examples. *Kathrin Grosse, Praveen Manoharan, Nicolas Papernot, Michael Backes, and Patrick McDaniel.* (2017)

Transferability in Machine Learning: from Phenomena to Black-Box Attacks using Adversarial Samples. *Nicolas Papernot, Patrick McDaniel, and Ian Goodfellow.* (2016)

Policy Briefings.....

Why We Should Regulate Information About Persons. *Lisa Austin, David Lie, Nicolas Papernot, Aleksandar Nikolov.* Privacy Law Scholars Conference. (2021)

Commentary on Data and Algorithm Privacy. *Aleksandar Nikolov, Nicolas Papernot.* Government of Canada Consultation on the Privacy Act. (2021)

Preparing for the Age of Deepfakes and Disinformation. *Dan Boneh, Andrew J. Grotto, Patrick McDaniel, Nicolas Papernot.* Stanford HAI Policy Brief. (2020)

Dissertation and Thesis.....

Characterizing the Limits and Defenses of Machine Learning in Adversarial Settings. *Nicolas Papernot.* (2018)

On The Integrity Of Deep Learning Systems In Adversarial Settings. *Nicolas Papernot.* (2016)

Book Chapters.....

Adversarial Machine Learning. *Nicolas Papernot.* Encyclopedia of Cryptography, Security and Privacy. (2021)

Students and postdoctoral fellows

Current group.....

Haonan Duan (co-advised with Chris Maddison): started Fall 2021 *PhD student*

Camille Bruckmann: Fall 2022 - Summer 2023 *Engineering Science student*

Si Cheng (Steven) Zhong: Fall 2022 - Summer 2023 *Engineering Science student*

Franziska Boenisch: started Fall 2022 *Postdoctoral Fellow*

David Glukhov (co-advised with Vardan Papyan) [OGS Scholar]: started Fall 2022 *MS student*

Anvith Thudi (co-advised with Chris Maddison): started Fall 2022 *PhD student*

Patty Liu: Started May 2022 *Research Intern*

Ilia Shumailov (co-advised with Kassem Fawaz): started Fall 2021 *Postdoctoral Fellow*

Aditi Misra: started Fall 2021 *Engineering Science student*

Sierra Wyllie: started Summer 2021 *Engineering Science student*

Muhammad Ahmad Kaleem: started Summer 2021 *Engineering Science student*

Emmy Fang (co-advised with Bo Wang) [DeepMind Scholar]: started Fall 2021 *MS student*

Adam Dziedzic: started Fall 2020 *Postdoctoral Fellow*

Mohammad Yaghini [Meta PhD Fellow]: started Fall 2020 *PhD student*

Stephan Rabanser: started Fall 2020	<i>PhD student</i>
Jonas Guan: started Fall 2020	<i>PhD student</i>
Jiaqi Wang (co-advised with David Lie) [OGS Scholar]: started Fall 2020	<i>MASc student</i>
Nick Jia [Mary H. Beatty Fellow]: started Fall 2020	<i>PhD student</i>
Mingyue Yang (co-advised with David Lie): started Winter 2020	<i>PhD student</i>

Alumni.....

Shimaa Ahmed <i>Currently PhD student at University of Wisconsin-Madison</i>	Research Intern <i>Summer 2022</i>
Roy Rinberg <i>Currently Masters student at Columbia University</i>	Research Intern <i>Summer 2022</i>
Mark Thomas <i>Currently Honors Computing Science student at the University of Alberta</i>	Research Intern <i>Summer 2022</i>
Avital Shafran <i>Currently PhD student at the Hebrew University of Jerusalem</i>	Research Intern <i>Summer 2022</i>
Thorsten Eisenhofer <i>Currently PhD student at Ruhr University Bochum</i>	Research Intern <i>Summer 2022</i>
Yannis Cattan <i>Currently Masters student at ENS Paris-Saclay (MVA)</i>	Research Intern <i>Summer 2022</i>
Roei Schuster <i>Currently CTO at Context AI</i>	Postdoctoral Fellow <i>2021-2022</i>
Franziska Boenisch <i>Currently Postdoctoral Fellow at Vector Institute</i>	Research Intern <i>Summer 2021 - Spring 2022</i>
Hongyu (Charlie) Chen <i>Currently Machine Learning Engineer at Cohere.ai</i>	Engineering Science student <i>Fall 2021 - Summer 2022</i>
Aisha Alaagib <i>Currently PhD student at MILA</i>	Research Intern <i>Summer 2021</i>
Armin Ale <i>Currently Software Engineer at Intel</i>	Engineering Science student <i>Summer 2021 - Summer 2022</i>
Ali Shahin Shamsabadi <i>Currently Research Associate at the Turing Institute</i>	Research Intern <i>Winter 2021 - Fall 2021</i>
Anvith Thudi <i>Currently PhD student at the University of Toronto</i>	Mathematics Specialist Undergraduate student <i>Fall 2020 - Summer 2022</i>
Natalie Dullerud <i>Currently PhD Student at Stanford</i>	MS student <i>Fall 2020 - Summer 2022</i>
Steven Xia (co-advised with Shurui Zhou) <i>Currently PhD student at UIUC</i>	Undergraduate student <i>Fall 2020 - Summer 2021</i>
Jin Zhou <i>Currently PhD student at Cornell</i>	Engineering Science student <i>Fall 2020 - Summer 2021</i>
Lucy Lu <i>Currently MS student at Stanford</i>	Engineering Science student <i>Fall 2020 - Summer 2021</i>
Marko Huang <i>Currently MS student at University of Toronto</i>	Engineering Science student <i>Fall 2020 - Summer 2021</i>

Gabriel Deza
Currently MS student at UC Berkeley

Tejumade Afonja
Currently MS student at Saarland University

Iliia Shumailov
Currently PhD student at University of Cambridge

Milad Nasr (co-hosted with Nicholas Carlini)
Currently Research Scientist at Google Brain

Gabriel Deza
Currently PhD student at UC Berkeley

Lorna Licollari
Currently Engineering Science student at University of Toronto

Pratyush Maini
Currently PhD student at CMU

Yunxiang Zhang
Currently PhD student at Chinese University of Hong Kong

Saina Asani
Currently AI Researcher at Huawei

Laura Zhukas
Currently BSc student at the University of Waterloo

Christopher Choquette-Choo
Currently Research Engineer at Google Brain

Nick Jia
Currently MAsC student at University of Toronto

Baiwu Zhang
Currently ML Engineer at Twitter

Varun Chandrasekaran
Currently Assistant Professor at UIUC

Vinith Suriyakumar (co-advised with M. Ghassemi and A. Goldenberg)
Currently PhD student at MIT

Lucas Bourtole
Currently Cybersecurity Software Engineer at Mithril Security

Adelin Travers (co-advised with David Lie)
Currently Senior Pentester at Verizon

Hadi Abdullah (co-hosted with Damien Ocateau)
Currently Researcher at Visa Research

Matthew Jagielski
Currently Research Scientist at Google Brain

Engineering Science student
Fall 2020 - Summer 2021

Research Intern
Summer 2020

Visiting PhD student
Summer 2020

Google Brain Intern
Summer 2020

Research Intern
Summer 2020

Research Intern
Summer 2020

Research Intern
Summer 2020

Research Intern
Spring 2020

Research Assistant
Winter 2020 - Summer 2020

Undergraduate Student Researcher
Fall 2019

Engineering Science student
Fall 2019 - Summer 2020

Engineering Science student
Fall 2019 - Summer 2020

MEng student
Fall 2019 - Summer 2020

Visiting PhD student
Fall 2019

MS student
Fall 2019 - Summer 2021

MAsC student
started Fall 2019

PhD student
Fall 2019 - Summer 2021

Google Intern
Summer 2019

Google Brain intern
Summer 2019

Selected Professional Activities

Chair (Conferences)

IEEE Conference on Secure and Trustworthy Machine Learning

2023

Associate Chair or Area Chair (Conferences)	
Oakland: IEEE Symposium on Security and Privacy	2022, 2023
NeurIPS: Neural Information Processing Systems	2021, 2022
Program Committee Member (Conferences)	
Oakland: IEEE Symposium on Security and Privacy	2020, 2021
USENIX Security: USENIX Security Symposium	2019, 2020, 2021
CCS: ACM Conference on Computer and Communications Security	2018, 2019, 2020
NeurIPS: Workshop Committee Member	2020
PETS: Privacy Enhancing Technologies Symposium	2019
NDSS: Network and Distributed System Security Symposium	2018
Reviewer (Conferences)	
ICLR: International Conference on Learning Representations	2019, 2020, 2021
NeurIPS: Neural Information Processing Systems	2017, 2018, 2020
CHIL: ACM Conference on Health, Conference, and Learning	2020
ICML: International Conference on Machine Learning	2017, 2018, 2019
AAAI: AAAI Conference on Artificial Intelligence	2019
USENIX Security: USENIX Security Symposium	2018
Oakland: IEEE Symposium on Security and Privacy	2017, 2018
Action Editor (Journals)	
TMLR: Transactions on Machine Learning Research	2022
Reviewer (Journals)	
Nature	2020
Journal of Computer Security	2018
IEEE Pervasive special issue on "Securing the IoT"	2017
IEEE Transactions on Information Forensics and Security	2017
IEEE Transactions on Dependable and Secure Computing	2017
IEEE Security and Privacy Magazine	2017
Chair (Workshops)	
ICLR workshop on "Towards Trustworthy ML: Rethinking Security and Privacy for ML"	2020
NeurIPS workshop on Security in ML	2018
Organizing Committee (Workshops)	
Oakland (IEEE S&P) Workshop: Deep Learning and Security (DLS)	2021
DSN Workshop: Dependable and Secure ML	2019, 2020, 2021, 2022
ICML Workshop: Security and Privacy of ML	2019
NeurIPS Competition: Adversarial ML	2018
NeurIPS Workshop: Secure ML	2017
Reviewer (Funding)	
AI Xprize	2017-2020
Google Faculty Research Awards	2017, 2018, 2019
Agence Nationale de la Recherche	2017

Invited Participant and Consultations

Advisory Board for the TESTABLE EU H2020 Consortium: Member	2022-2025
CIFAR Pan-Canadian AI Strategy National Program Committee: Member	2022-
Audition: Rhone-Alpes Conseil economique, social et environnemental	2022
Machine Learning and Logical Reasoning: The New Frontier: Dagstuhl Seminar	2022
Briefing: Microsoft Azure CTO	2022
Interview: French National Data Protection Authority (CNIL)	2022
Consultation: Robert O. Work and Michele Flournoy	2021
Consultation: National Security and Intelligence Review Agency	2021
AI Governance Workshop: Rockefeller and Mozilla Foundations	2021
Consultation: Nathaniel Erskine-Smith (Member of Parliament)	2021
Consultation: Chief Privacy Officer of Ontario	2021
Privacy and ML interest group: Alan Turing Institute	2021
Robust Artificial Intelligence: Lorentz Center	2021
Advisory Board Member: mytrace.ca	2020
Privacy and ML: socml.org	2020
Security of Machine Learning: Dagstuhl Seminar (declined due to COVID)	2020
Consultation: Privacy Commissionner of Canada	2020
NSTC Workshop on AI and Cybersecurity: University of Maryland	2019
Briefing: JASON advisory group	2018
"When Humans Attack" workshop: Data and Society Research Institute	2018
ARO/IARPA Workshop on Adversarial Machine Learning: University of Maryland	2018
ARO Workshop on Adversarial Machine Learning: Stanford	2017
DARPA Workshop on Safe Machine Learning: Simons Institute	2017

Service at the University of Toronto

Deep Learning Faculty Hiring Committee: Member	2019-2022
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Service at the Vector Institute

Faculty Affiliate Hiring Committee: Chair	2022-2023
Faculty Hiring Committee: Member	2020-2022
Faculty Affiliate Hiring Committee: Member	2019-2022

Defense Committee

Malik Altkrori: PhD, McGill University	2022
Amr Mohamed: PhD, University of Toronto	TBD
Martiya Zare Jahromi: PhD, University of Toronto	2022
Raphael Franck Olivier: PhD, Carnegie Mellon University	TBD
Michael Zhang: PhD, University of Toronto	TBD
Yangjun Ruan: PhD, University of Toronto	TBD
Hillary Ngai: MSc, University of Toronto	2022
Philip Fradkin: PhD transfer, University of Toronto	2022
Imtihan Ahmed: MASc, University of Toronto	2021
Boyue Caroline Hu: PhD, University of Toronto	TBD

Avery Ma: PhD, University of Toronto	TBD
Sana Tonekaboni: PhD, University of Toronto	TBD
George-Alexandru Adam: PhD, University of Toronto	TBD
David Sommer: PhD, ETH Zurich	2021
Elsa Riachi: MSc, University of Toronto	2021
Mathew Hildebrand: MASc, University of Toronto	2020
Wendy Qiu: MASc, University of Toronto	2020
Mahdieh Abbasi: PhD, Universite Laval	2020
Andrew Jung: MASc, University of Toronto	2020
Weicheng Cao: MASc, University of Toronto	2020
Tom Wei: MASc, University of Toronto	2020
Sanghyun Hong: PhD, University of Maryland	2020
Mingyue Yang: MASc, University of Toronto	2019
Yeming Wen: MSc, University of Toronto	2019
Ryan Sheatsley: MSc, Pennsylvania State University	2018

Keynotes, Panels and Invited Talks

Keynotes

The Role of Randomization in Trustworthy ML: ACM CCS Workshop on Moving Target Defense	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: 35th Canadian Conference on AI	2022
What does it mean for ML to be trustworthy?: CAMLIS 2021	2021
What does it mean for ML to be trustworthy?: ESORICS 2021	2021
What does it mean for ML to be trustworthy?: EVOKE CASCON 2020	2020
What does it mean for ML to be trustworthy?: AsiaCCS Workshop of Security and Privacy in AI	2020
What does it mean for ML to be trustworthy?: RAISA3 at the European Conference on AI	2020
What does it mean for ML to be trustworthy?: Samsung Security Tech Forum	2020
What does it mean for ML to be trustworthy?: NSERC COHESA Annual Meeting	2020
What does it mean for ML to be trustworthy?: ICML Workshop on Participatory ML	2020
How Relevant Is the Turing Test in the Age of Sophisbots?: CVPR Workshop on Media Forensics	2020
Security and Privacy in Machine Learning: France is AI 2019	2019
A Marauder's Map of Security and Privacy in ML: CVPR workshop on Privacy and Security	2019
A Marauder's Map of Security and Privacy in ML: AISEC '18	2018

Tutorials

Security and Privacy in ML: INRIA Data Institute	2018
Security and Privacy in ML: IEEE WIFS 2017	2017
Adversarial ML with CleverHans: ODSC West (joint with Nicholas Carlini)	2017
Adversarial ML with CleverHans: ICML workshop on Reproducibility in ML	2017

Guest Lectures

What does it mean for ML to be trustworthy?: University of Pittsburgh	2022
What does it mean for ML to be trustworthy?: Korea Institute of Inf. Security and Cryptology	2022

What does it mean for ML to be trustworthy?: Purdue University	2020
What does it mean for ML to be trustworthy?: University of Wisconsin-Madison	2020
Security and Privacy in Machine Learning: Los Alamos National Laboratory	2020
The Limitations of Deep Learning in Adversarial Settings: Carnegie Mellon University	2020
Machine Learning Security: Adversarial Examples: Stanford	2019
A Marauder's Map of Security and Privacy in ML: UC Berkeley - CS294-131	2019
Security and Privacy in ML: Penn State University - CSE 543	2017
Invited Talks	
What does it mean for ML to be trustworthy?: Google	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: ACM CIKM Workshop on Federated Learning with Graphs	2022
What does it mean for ML to be trustworthy?: CISPA	2022
What does it mean to unlearn?: Georgetown University	2022
What does it mean to unlearn?: ICML 2022 Workshop on Updatable ML	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: Alan Turing Institute	2022
When the Curious Abandon Honesty: Federated Learning Is Not Private: Apple	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: UK Security and Privacy Seminar	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: Princeton University	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: UofT AI Conference	2022
Is Differential Privacy a Silver Bullet for Machine Learning?: Microsoft Research Summit	2021
What can trustworthy ML learn from cryptography?: CRYPTO Workshop on PPML	2021
What does it mean for ML to be trustworthy?: IBM	2021
What does it mean for ML to be trustworthy?: ICML 2021 Workshop on Socially Responsible ML	2021
What does it mean for ML to be trustworthy?: CVPR 2021 Workshop on Adversarial ML	2021
Three Flavors of Private Machine Learning: Google	2021
What does it mean for ML to be trustworthy?: Turing Institute	2021
Three Flavors of Private Machine Learning: Second AAAI Workshop of Privacy Preserving AI	2021
What does it mean for ML to be trustworthy?: MIT	2021
What does it mean for ML to be trustworthy?: Schwartz Reisman Institute	2021
What does it mean for ML to be trustworthy?: University of Waterloo	2021
What does it mean for ML to be trustworthy?: Vector Institute AI Masters Summit	2020
What does it mean for ML to be trustworthy?: OpenMined Privacy Conference	2020
Tempered Sigmoids for Deep Learning with Differential Privacy: Apple	2020
PhD Career Paths (Academic v. Non-academic): Google PhD Intern Research Conference	2020
What does it mean for ML to be trustworthy?: Vector Institute Endless Summer School	2020
Machine Unlearning: Facebook	2020
What does it mean for ML to be trustworthy?: USENIX Enigma	2020
Security and Privacy in Machine Learning: King's College London	2020
TensorFlow Privacy: TensorFlow Roadshow Paris	2019
Security and Privacy in Machine Learning: Columbia University	2019
Security and Privacy in Machine Learning: Fields Institute	2019

A Marauder's Map of Security and Privacy in ML: Cybersecurity AI Prague	2019
Security and Privacy in ML: Carleton University	2019
A Marauder's Map of Security and Privacy in ML: Princeton University	2019
A Marauder's Map of Security and Privacy in ML: University of British Columbia	2019
A Marauder's Map of Security and Privacy in ML: IBM AI week security symposium	2019
Security and Privacy in Machine Learning: Waterloo ML + Security + Verification Workshop	2019
Machine Learning at Scale with Differential Privacy in TensorFlow: USENIX PEPR 2019	2019
PhD Career Paths (Academic v. Non-academic): Google PhD Intern Research Conference	2019
PhD Career Paths (Academic v. Non-academic): Google PhD Fellowship Summit	2019
Security and Privacy in ML: Microsoft	2019
Security and Privacy in ML: National Academies Workshop on AI and ML for Cybersecurity	2019
A Marauder's Map of Security and Privacy in ML: Palo Alto Networks	2019
A Marauder's Map of Security and Privacy in ML: Google Brain Zurich	2019
A Marauder's Map of Security and Privacy in ML: EPFL Applied ML Days	2019
Security and Privacy in ML: Google Launchpad Studio	2018
Security and Privacy in ML: MSR Cambridge AI Summer School	2018
Characterizing the Space of Adversarial Examples in ML: NVIDIA	2018
Characterizing the Space of Adversarial Examples in ML: 2nd ARO/IARPA Workshop on AML	2018
Characterizing the Space of Adversarial Examples in ML: MIT-IBM Watson AI Lab	2018
Characterizing the Space of Adversarial Examples in ML: MSR Cambridge	2018
Characterizing the Space of Adversarial Examples in ML: University of Toronto	2018
Characterizing the Space of Adversarial Examples in ML: EPFL	2018
Characterizing the Space of Adversarial Examples in ML: University of Southern California	2018
Characterizing the Space of Adversarial Examples in ML: University of Michigan	2018
Characterizing the Space of Adversarial Examples in ML: MPI for Software Systems	2018
Characterizing the Space of Adversarial Examples in ML: Columbia University	2018
Characterizing the Space of Adversarial Examples in ML: University of Virginia	2018
Characterizing the Space of Adversarial Examples in ML: Intel Labs	2018
Characterizing the Space of Adversarial Examples in ML: McGill University	2018
Characterizing the Space of Adversarial Examples in ML: University of Florida	2018
Security and Privacy in ML: Age of AI Conference	2018
Security and Privacy in ML: Bar Ilan University	2018
Security and Privacy in ML: IVADO	2018
Security and Privacy in ML: Ecole Polytechnique Montreal	2018
Security and Privacy in ML: Element AI	2018
Security and Privacy in ML: Georgian Partners	2017
Private Machine Learning with PATE: With the Best online conference	2017
Gradient Masking in ML: Stanford - ARO Adversarial ML Workshop	2017
Security and Privacy in ML: Ecole Centrale de Lyon	2017
Security and Privacy in ML: Oxford University	2017
Adversarial Examples in ML: AI with the Best (joint with Patrick McDaniel)	2017

Security and Privacy in ML: Deep Learning Summit Singapore	2017
Security and Privacy in ML: MSR Cambridge	2017
Security and Privacy in ML: University of Cambridge	2017
Private Aggregation of Teacher Ensembles: Stanford	2017
Adversarial ML: Data Mining for Cyber Security meetup	2017
Private Aggregation of Teacher Ensembles: Symantec	2017
Adversarial Examples in ML: Usenix Enigma 2017	2017
Private Aggregation of Teacher Ensembles: LeapYear	2017
Private Aggregation of Teacher Ensembles: Immuta	2017
Security and Privacy in ML: Ecole Centrale de Lyon	2016
Adversarial Examples in ML: LinkedIn	2016
Adversarial Examples in ML: Stanford	2016
Adversarial Examples in ML: Berkeley	2016
Adversarial Examples in ML: AutoSens (joint with Ian Goodfellow)	2016
Adversarial Examples in ML: Google	2016

Panels

What does it mean to unlearn?: University of Waterloo	2022
Robust and Reliable ML: ICLR 2021 Workshop on Robust and Reliable ML	2021
Adversarial Examples in ML: Stanford AI Salon (joint with Ian Goodfellow)	2017
Machine Learning and Security: NSF 2017 SaTC PIs Meeting	2017
What role will AI play in the future of autonomous vehicles and ADAS?: AutoSens	2016

Teaching and Community Outreach

Teaching at the University of Toronto

ECE1784H/CSC2559H: Trustworthy Machine Learning	Fall 2022
ECE421H: Introduction to Machine Learning	Fall 2022
ECE1784H/CSC2559H: Trustworthy Machine Learning	Fall 2021
ECE421H: Introduction to Machine Learning	Fall 2021
ECE421H: Introduction to Machine Learning	Fall 2020
ECE1513H: Introduction to Machine Learning	Fall 2020
ECE1513H: Introduction to Machine Learning	Winter 2020
ECE1784H: Trustworthy Machine Learning	Fall 2019

Teaching at Pennsylvania State University

CSE 597: Advanced Topics in the Security and Privacy of ML: Co-instructor	2017
CSE 597: Security and Privacy of Machine Learning: Co-instructor	2016

Software

TensorFlow Privacy: Co-author of open-source library for differentially private ML	2019
CleverHans: Co-author of open-source library for adversarial ML	2016

CleverHans Blog

We need a 21st century framework for 21st century problems	2022
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Can stochastic pre-processing defenses protect your models?	2022
Are adversarial examples against proof-of-learning adversarial?	2022
How to Keep a Model Stealing Adversary Busy?	2022
All You Need Is Matplotlib	2022
How to deploy machine learning with differential privacy? (DifferentialPrivacy.org)	2021
Arbitrating the integrity of stochastic gradient descent with proof-of-learning	2021
Beyond federation: collaborating in ML with confidentiality and privacy	2021
Is this model mine?	2021
Why we should regulate information about persons, not personal information	2021
To guarantee privacy, focus on the algorithms, not the data	2021
Teaching Machines to Unlearn	2020
In Model Extraction, Don't Just Ask How?: Ask Why?	2020
How to steal modern NLP systems with gibberish?	2020
The academic job search for computer scientists in 10 questions	2019
How to know when machine learning does not know	2019
Machine Learning with Differential Privacy in TensorFlow	2019
Privacy and machine learning: two unexpected allies?	2018
The challenge of verification and testing of machine learning	2017
Is attacking machine learning easier than defending it?	2017
Breaking things is easy	2016

Selected Media Coverage.....

- Schneier on Security.** Attacking the Performance of Machine Learning Systems
- Schneier on Security.** Manipulating Machine-Learning Systems through the Order of the Training Data
- CACM.** Can AI Learn to Forget?
- New York Times.** As Hackers Take Down Newfoundland's Health Care System, Silence Descends
- RadioCanada.** Ottawa finance la creation d'un outil pour dechiffrer les mots de passe
- Wired.** Now That Machines Can Learn, Can They Unlearn?
- The Register.** Hey, AI software developers, you are taking Unicode into account, right ... right?
- TechSequences Podcast.** Can advances in technology help liberate us from the grip of disinformation?
- Heise.de.** Machine Unlearning: Algorithmen können nichts vergessen
- VentureBeat.** How adversarial attacks reveal machine learning's weakness
- DeepLearning.Ai.** about adv x contest
- Quartz.** OpenAI has a new tool that could keep hackers from wrecking a self-driving car
- Quartz.** AI can learn from data without ever having access to it
- Communications of the ACM.** Learning Securely
- Wired.** How to Steal an AI
- Popular Science.** Fooling the machine
- Die Zeit.** Notwehr against the machine
- Fast Company.** How To Fool A Neural Network
- TheVerge.** Magic AI: these are the optical illusions that trick, fool, and flummox computers

GCN. Machines learning evolves, and hackers stand to gain

MIT Technology Review. Human brains and AIs can be hacked with these weird tweaked photos

TheNextWeb. Google teaches AI to fool humans so it can learn from our mistakes

IEEE Spectrum. Hacking the Brain With Adversarial Images

TWiML. Scalable Differential Privacy for Deep Learning with Nicolas Papernot

Le Monde. Les bugs de l'intelligence artificielle

The Verge. Google is making it easier for AI developers to keep users' data private

VentureBeat. Google introduces TensorFlow Privacy, a machine learning library with strong privacy guarantees