

# VIKASH SEHWAG

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## RESEARCH INTERESTS

My vision is to develop the next generation of Generative Artificial Intelligence (AI) systems safely and responsibly. I am interested in demonstrating the significant potential of modern generative models in enhancing existing AI systems, particularly by distilling knowledge embedded in modern generative models. I also aim to thoroughly investigate the safety risks posed by generative models, including the leaking of private information and amplification of biases in training data, which are further exacerbated by their widespread usage<sup>1</sup>. Overall, my goal is to enhance the potential of generative models while simultaneously limiting their pitfalls.

**Key Topics:** Generative AI, AI safety, Diffusion models, Knowledge distillation from generative models, AI safety risks with generative models, Memorization and privacy leakage, Bias & Fairness, Adversarial robustness, Trustworthy machine learning

**Phd thesis:** Promises and Pitfalls of Generative AI: An AI-Safety Centric Approach

## EDUCATION

Program	Institution	Years
Ph.D., Electrical and Computer Engineering <i>Advisors – Prateek Mittal, Mung Chiang</i>	Princeton University NJ, USA	2017 - 2023
M.A., Electrical Engineering	Princeton University NJ, USA	2017 - 2019
B.Tech., Electronics and Electrical Communication Engg.	Indian Institute of Technology (IIT) Kharagpur, INDIA	2013 - 2017

## HONORS AND AWARDS

- Selected to receive the 2023 Adversarial Machine Learning (AdvML) rising star award 2023
- Graduate student award for excellence in service (ECE department, Princeton University) 2022
- Charlotte Elizabeth Proctor Honorific Fellowship, one of the highest honors at Princeton University 2022
- Best paper honorable mention award at ICLR workshop on Security and Safety in ML Systems 2021
- Winner of Qualcomm Innovation Fellowship, North America Region 2019
- Received best undergraduate thesis award (1 from 72 students) at IIT Kharagpur 2017
- IEEE student award from IEEE student branch of IIT Kharagpur 2016
- Awarded the WISE scholarship from German Academic Exchange Service (DAAD), Germany 2016
- Received Merit-cum-Means Scholarship from MHRD, Government of India 2013-17

## WORK EXPERIENCE

- Research Internship – *Facebook AI*, USA Summer 2021  
*Advisors* – Caner Hazirbas, Cristian Canton Ferrer (AI Red Team)  
*Project:* Generating novel hard instances from low-density regions using generative models.
- Research Internship – *Microsoft Research*, Redmond (USA) Summer 2019  
*Advisors* – Jay Stokes, Cha Zhang  
*Project:* Adversarial attacks and defenses beyond  $\ell_p$  norms

<sup>1</sup>More than 10 million users have used [Stable Diffusion](#).

- Research Assistant – *IIT Kharagpur*, India

Fall 2016

*Advisors* – Indrajit Chakrabarti, Santanu Chattopadhyay

*Project*: Implementing physical unclonable functions with Network-on-chip routers

- Research Internship – *Technische Universität Darmstadt*, Germany

Summer 2016

*Advisor* – Heinz Koepl

*Project*: A study of stochastic SIS disease spreading on random graphs

## PUBLICATIONS

### Preprints and papers under review

- [Differentially Private Generation of High Fidelity Samples From Diffusion Models](#)  
Vikash Sehwar\*, Ashwinee Panda\*, Ashwini Pokle, Xinyu Tang, Saeed Mahloujifar, Mung Chiang, Zico Kolter, Prateek Mittal  
*Under review*
- [Differentially Private Image Classification by Learning Priors from Random Processes](#)  
Xinyu Tang, Ashwinee Panda, Vikash Sehwar, Prateek Mittal  
*Arxiv 2023, Under review*
- [Extracting Training Data from Diffusion Models](#)  
Nicholas Carlini, Jamie Hayes, Milad Nasr, Matthew Jagielski, Vikash Sehwar, Florian Tramèr, Borja Balle, Daphne Ippolito, Eric Wallace  
*Arxiv 2023, Under review*
- [DP-RAFT: A Differentially Private Recipe for Accelerated Fine-Tuning](#)  
Ashwinee Panda, Xinyu Tang, Vikash Sehwar, Saeed Mahloujifar, Prateek Mittal  
*Arxiv 2023, Under review*

### Conference and Journal Publications

- [Uncovering Adversarial Risks of Test-Time Adaptation](#)  
Tong Wu, Feiran Jia, Xiangyu Qi, Jiachen T. Wang, Vikash Sehwar, Saeed Mahloujifar, Prateek Mittal  
*International Conference on Machine Learning (ICML), 2023*
- [MultiRobustBench: Benchmarking Robustness Against Multiple Attacks](#)  
Sihui Dai, Saeed Mahloujifar, Chong Xiang, Vikash Sehwar, Pin-Yu Chen, Prateek Mittal  
*International Conference on Machine Learning (ICML), 2023*
- [A Light Recipe to Train Robust Vision Transformers](#)  
Edoardo Debenedetti, Vikash Sehwar, Prateek Mittal  
*IEEE Conference on Secure and Trustworthy Machine Learning (SaTML), 2023*
- [Generating High Fidelity Data from Low-density Regions using Diffusion Models](#)  
Vikash Sehwar, Caner Hazirbas, Albert Gordo, Firat Ozgenel, Cristian Canton Ferrer  
*Conference on Computer Vision and Pattern Recognition (CVPR), 2022*
- [Robust Learning Meets Generative Models: Can Proxy Distributions Improve Adversarial Robustness?](#)  
Vikash Sehwar, Saeed Mahloujifar, Tinashe Handina, Sihui Dai, Chong Xiang, Mung Chiang, Prateek Mittal  
*International Conference on Learning Representations (ICLR), 2022*
- [Understanding Robust Learning through the Lens of Representation Similarities](#)  
Christian Cianfarani\*, Arjun Nitin Bhagoji\*, Vikash Sehwar\*, Ben Zhao, Prateek Mittal, Haitao Zheng  
*Neural Information Processing Systems (NeurIPS), 2022*
- [RobustBench: a standardized adversarial robustness benchmark](#)  
Francesco Croce\*, Maksym Andriushchenko\*, Vikash Sehwar\*, Edoardo Debenedetti\*, Nicolas Flammarion, Mung Chiang, Prateek Mittal, Matthias Hein  
*Neural Information Processing Systems (NeurIPS), 2021 - Datasets and Benchmarks Track*  
*Won best paper honorable mention prize at ICLR 2021 workshop on Security and Safety in Machine Learning Systems.*

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\* refers to equal contribution.

- [Lower Bounds on Cross-Entropy Loss in the Presence of Test-time Adversaries](#)  
Arjun Nitin Bhagoji, Daniel Cullina, **Vikash Sehwal**, Prateek Mittal  
*International Conference on Machine Learning (ICML)*, 2021
- [SSD: A Unified Framework for Self-Supervised Outlier Detection](#)  
**Vikash Sehwal**, Mung Chiang, Prateek Mittal  
*International Conference on Learning Representations (ICLR)*, 2021  
*Short version accepted at NeurIPS 2020 Workshop on Self-Supervised Learning - Theory and Practice*
- [Beyond  \$\ell\_p\$  Norms: Delving Deeper into Robustness to Physical Image Transformations](#)  
**Vikash Sehwal**, Jay Stokes, Cha Zhang  
*IEEE Military Communications Conference (MILCOM)*, 2021
- [PatchGuard: Provable Defense against Adversarial Patches Using Masks on Small Receptive Fields](#)  
Chong Xiang, Arjun Nitin Bhagoji, **Vikash Sehwal**, Prateek Mittal  
*USENIX Security Symposium*, 2021
- [HYDRA: Pruning Adversarially Robust Neural Networks](#)  
**Vikash Sehwal**, Shiqi Wang, Prateek Mittal, Suman Jana  
*Neural Information Processing Systems (NeurIPS)*, 2020
- [Fast-Convergent Federated Learning](#)  
Hung T. Nguyen, **Vikash Sehwal**, Seyyedali Hosseinalipour, Christopher G. Brinton, Mung Chiang, H. Vincent Poor  
*IEEE Journal on Selected Areas in Communications (J-SAC) - Series on Machine Learning for Communications and Networks*, 2020

#### Peer-reviewed Workshop Publications

- [Just Rotate it: Deploying Backdoor Attacks via Rotation Transformation](#)  
Tong Wu, Tianhao Wang, **Vikash Sehwal**, Saeed Mahloujifar, Prateek Mittal  
*In Proceedings of the 12th ACM Workshop on Artificial Intelligence and Security (AISec)*, 2022
- [Robustness from Perception](#)  
Saeed Mahloujifar, Chong Xiang, **Vikash Sehwal**, Sihui Dai, Prateek Mittal  
*ICLR workshop on Security and Safety in Machine Learning Systems*, 2021
- [Time for a Background Check! Uncovering the impact of Background Features on Deep Neural Networks](#)  
**Vikash Sehwal**, Rajvardhan Oak, Mung Chiang, Prateek Mittal  
*ICML workshop on Object-Oriented Learning*, 2020
- [On separability of self-supervised representations](#)  
**Vikash Sehwal**, Mung Chiang, Prateek Mittal  
*ICML workshop on Uncertainty & Robustness in Deep Learning*, 2020
- [On Pruning Adversarially Robust Neural Networks](#)  
**Vikash Sehwal**, Shiqi Wang, Prateek Mittal, Suman Jana  
*ICLR workshop on Towards Trustworthy ML*, 2020
- [Analyzing the robustness of open-world machine learning](#)  
**Vikash Sehwal**<sup>\*</sup>, Arjun Nitin Bhagoji<sup>\*</sup>, Liwei Song<sup>\*</sup>, Chawin Sitawarin, Daniel Cullina, Mung Chiang, Prateek Mittal  
*In Proceedings of the 12th ACM Workshop on Artificial Intelligence and Security (AISec)*, 2019
- [Not All Pixels are Born Equal: An Analysis of Evasion Attacks under Locality Constraints](#)  
**Vikash Sehwal**, Chawin Sitawarin, Arjun Nitin Bhagoji, Arsalan Mosenia, Mung Chiang, Prateek Mittal  
*Poster at ACM SIGSAC Conference on Computer and Communications Security (CCS)*, 2018.

## ACADEMIC SERVICES

#### Teaching

- Lecture on basics of adversarial machine learning at Princeton-Intel REU Seminar 2021
- Teaching assistant for ECE 574: Security & Privacy Fall 2021
- Taught a mini-course on adversarial attacks & defenses in Wintersession at Princeton University 2020
- Teaching assistant for ECE 535: Machine Learning and Pattern Recognition Fall 2019

## Mentoring

I continue to mentor the next generation of researchers.

- *Christian Cianfarani* - Graduate student at University of Chicago. 2021-now
- *Edoardo Debenedetti* - Master's student at École polytechnique fédérale de Lausanne (EPFL) 2021-2022
- *Rajvardhan Oak* - Master's student at University of California, Berkeley Summer 2020
- *Tinashe Handina* (B.S.E., Electrical Engineering 2021) - now a graduate student at Caltech.
- *Matteo Russo* (B.S.E., Computer Science 2020) - now a masters student at ETH Zurich.

**Peer reviewing** IEEE Conference on Secure and Trustworthy Machine Learning (SaTML) - 2023; Transactions on Machine Learning Research (TMLR) - 2022; International Conference on Machine Learning (ICML) - 2022; International Conference on Learning Representations (ICLR) - 2022; International Conference on Learning Representations (ICLR) - 2022; Conference on Computer Vision and Pattern Recognition (CVPR) - 2022; International Conference on Computer Vision (ICCV) - 2022; Conference on Neural Information Processing Systems (NeurIPS) - 2021, 2022; Privacy Enhancing Technologies Symposium (PETS) - 2021, 2022; Conference on Information Sciences and Systems (CISS) - 2020, 2022; PLOS Computational Biology - 2020; ACM Transactions on Privacy and Security (TOPS) - 2019; USENIX Security Symposium - 2018, 2019

## Other Services

- Program committee member for IEEE Conference on Secure and Trustworthy Machine Learning 2023
- Organized more than 20 talks on security & privacy in machine learning ([SPML seminar series](#)) 2022
- Part of core maintaining team of Adversarial Robustness Benchmark ([robustbench.github.io](#)) 2020-now
- Volunteered for beta-testing of OpenReview submission pipeline for upcoming TMLR journal 2022
- Volunteered as junior mentor at Princeton-OLCF-NVIDIA GPU Hackathon 2020

## INVITED TALKS

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- Promises and pitfalls of modern generative models: An AI safety based perspective Feb 2023  
*NEC Laboratories, Princeton*
- Enhancing machine learning using synthetic data distilled from generative models Jan 2023  
*Microsoft Research, Cambridge*
- Role of synthetic data in trustworthy machine learning May 2022  
*University of Chicago; University of California, Berkeley*
- A generative approach to robust machine learning Mar 2022  
*Annual Conference on Information Sciences and Systems (CISS)*
- A generative approach to robust machine learning (link) Jan 2022  
*RIKEN-AIP TrustML Young Scientist Seminar, Japan*
- Generating novel hard-instances from low-density regions using generative models Aug 2021  
*Facebook AI, USA*
- A primer on adversarial machine learning July 2021  
*Princeton-Intel REU Seminar*
- Embedding data distribution to make machine learning more reliable March 2021  
*Adversarial robustness seminar, École polytechnique fédérale de Lausanne (EPFL)*
- Private Deep Learning Made Practical Oct 2019  
*Qualcomm, San Diego*