

Sameer Wagh | Curriculum Vitae

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Research Interests

Security and Privacy: Number Theory and Applied Cryptography; Multi-Party Computation; Deep Learning; Privacy preserving analytics; Oblivious RAMs; Differential Privacy; Analytics over Tor

Education

Princeton University <i>PhD in Electrical Engineering, GPA – 3.744</i>	Princeton, NJ 2014–
Indian Institute of Technology, Madras <i>BTech in Engineering Physics with Honors, CGPA – 9.11 (Core GPA – 9.39)</i> <i>Minor in Mathematics</i>	TN, India 2010–2014

Scholastic Achievements

2009: **Silver Medalist** and **India's highest scorer** at the **50th International Maths Olympiad, Germany.**

2008: **Youngest student** in India to qualify for the **Regional Maths Olympiad** and the **Indian National Maths Olympiad.**

2011-2013: Among the **top 4** students across India to receive **Nurture program scholarship** by **NBHM.**

2008-2010: Recipient of the prestigious **Kishore Vaidyanik Protsahan Yojana (K.V.P.Y.)** fellowship.

2009: Recipient of the **P.L. Bhatnagar Memorial Award**, as the top scorer of the Indian team at **IMO.**

2013-2014: **Best Solution Award** for analytic mapping of stock prices to 2D-Ising model for the **GS Quantify Competition** by Goldman Sachs.

2019: Winner of the **Qualcomm Innovation Fellowship, North America region.**

Publications

Under submission: Sameer Wagh, Fabrice Benhamouda, Eyal Kushilevitz and Tal Rabin. "Falcon: Maliciously Secure 3-Party Framework for Private Deep Learning"

Under submission: Sameer Wagh, Xi He, Ashwin Machanavajjhala, and Prateek Mittal. "DP-Cryptography: Marrying Differential Privacy and Cryptography in Emerging Applications"

PETS '19: Gerry Wan, Aaron Johnson, Ryan Wails, Sameer Wagh, and Prateek Mittal. "Guard Placement Attacks on Path Selection Algorithms for Tor"

PETS '19: Sameer Wagh, Divya Gupta, and Nishanth Chandran. "SecureNN: 3-Party Secure Computation for Neural Network Training"

PETS '19: Hans Hanley, Yixin Sun, Sameer Wagh, and Prateek Mitta., "DPSelect: A Differential Privacy Based Guard Relay Selection Algorithm for Tor"

PETS '18: Sameer Wagh, Paul Cuff and Prateek Mittal. "Differentially Private Oblivious RAM"

Tech Report: Manuel Costa, Lawrence Esswood, Olya Ohrimenko, Felix Schuster and Sameer Wagh, "The Pyramid Scheme: Oblivious RAM for Trusted Processors"

HPCA '17: Yanqi Zhou, Sameer Wagh, Prateek Mittal and David Wentzlaff, "Camouflage: Memory Traffic Shaping to Mitigate Timing Attacks", *High Performance Computer Architecture (HPCA) '17*

Work Experience

Research Internship at Microsoft Research, Redmond, USA <i>Privacy preserving analytics for machine learning</i>	Summer 2019
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Instructor for MAT 113: Precalculus II <i>Precalculus for students at Garden State Youth Correctional Facility</i>	Spring 2019
Internship in Applied MPC and Implementations, Bar Ilan University, Israel <i>Implementing efficient MPC primitives and protocols.</i>	Summer 2018
Instructor for MAT 030: Intermediate Algebra <i>Beginner Math for students at Garden State Youth Correctional Facility</i>	Spring 2018
Research Internship at Microsoft Research, Bangalore, India <i>Developed efficient cryptographic protocols for privacy preserving machine learning.</i>	Summer 2017
Research Internship at Microsoft Research, Cambridge, UK <i>Efficient ORAM protocol implementation in a secure processor environment (SGX).</i>	Summer 2016
Teaching Assistant for ELE 535: Machine Learning and Pattern Recognition <i>Introduction to the theoretical foundations of machine learning.</i>	Fall 2015
Research Assistant at Princeton University <i>Differentially Private Oblivious RAM protocol design and implementation</i>	Fall 2014
B.Tech Project at IIT Madras <i>Quench dynamics across a first order transition in Ashkin Teller model.</i>	2013 - 2014
Nurture Program by NBHM at TIFR, Bombay. <i>BSc equivalent study in pure Mathematics (Algebra, Analysis and Topology)</i>	Summer 2011 - 2013
Research Internship at Okinawa Institute of Science and Technology, Japan <i>Theoretical imaging of magnetic monopoles in frustrated spin-ice systems.</i>	Summer 2013
Research Internship at Indian Institute of Science Education and Research, Pune <i>Exploring magnetic traps to manipulate Bose Einstein Condensates.</i>	Summer 2012
Research Internship at Oneirix Labs, Pune, India <i>Efficient signal processing for noise cancellation.</i>	Summer 2012
Teaching assistant for PH 101 and MA 101 <i>Teaching Assistant for introductory Physics and Mathematics courses at IIT-Madras</i>	Fall 2012

Developer Experience

<https://github.com/snwagh/securenn-public.git> 2017-2018

Single-handed implementation and deployment of the above private deep learning library based on SecureNN protocols. The library is implemented in about 7400 lines of C++ code, currently supports dynamic addition of convolutional and fully connected layers, and can be deployed as-is over Amazon EC2 servers. Also facilitated in the early adoption of SecureNN protocols at DropoutLabs ([here](#), [here](#)) over TensorFlow and at OpenMined ([here](#)) over PyTorch.

Patents

Private Deep Neural Network Training <i>Sameer Wagh, Divya Gupta and Nishanth Chandran</i> Patent number: 403629-US-PSP / SLW Ref: 1777.778PRV	February 2018
Tunable Oblivious RAM <i>Sameer Wagh, Paul Cuff and Prateek Mittal</i> Patent number: US20170185534 A1 granted to Princeton University.	January 2015

Talks

(Invited) Facebook FAIR, NYC <i>SecureNN: 3-Party Secure Computation for Neural Network Training</i>	Feb 2019
(Invited) Google DeepMind, London <i>SecureNN: 3-Party Secure Computation for Neural Network Training</i>	Oct 2018

(Invited) Cryptography Group, IBM <i>SecureNN: 3-Party Secure Computation for Neural Network Training</i>	Sept 2018
Privacy Enhancing Technologies Symposium, Barcelona <i>Differentially Private Oblivious RAM</i>	July 2018
Keller Center Innovation Forum <i>CoverTrack: Incognito Mode for Data Access</i>	Feb 2016
INSPIRE Meetings, Electrical Engineering, Princeton <i>Understanding the Mysterious: Bitcoin</i>	Jan 2016
GSS, Math Department, Princeton <i>Consensus and Byzantine Fault Tolerance</i>	Feb 2015
Boltzmann Club, IIT Madras <i>Path Integrals: Techniques and Applications</i> <i>Quench Dynamics in the Ashkin Teller Model</i>	2012-2014
Advanced Statistical Mechanics of Fields, IIT-Madras <i>Introduction to Groups, Group Representation, Character Theory and Applications in Physics</i>	Nov 2013
Advanced Dynamical Systems, IIT-Madras <i>Fractals: A Measure Theoretic Introduction</i>	Oct 2012

Course Work

Security and Privacy in Computing and Communications	Cryptography
Information Theory	Designing Secure Systems
Introduction to Information Retrieval	Linear Systems Theory
Computer Networks	Introduction to Analytic Combinatorics
Information Theoretic Security	Quantum Mechanics
Beginner Spanish	Probabilistic Methods in Combinatorics
Quantum Mechanics I	Quantum Mechanics II
Statistical Mechanics of Fields	Advanced Statistical Physics
Advanced Dynamical Systems	Statistical Mechanics
Advanced Mathematical Physics	Mathematical Physics I
General Relativity and Cosmology	Quantum Information and Quantum Computing
Classical Field Theory	Contemporary Physics
Advanced Dynamical Systems	Statistical Mechanics
Engineering Optics	Solid State Physics
Probability, Stochastic and Random processes	Electromagnetics and Applications

Positions of Responsibility

2012 - 2013: Institute Football Captain, IIT Madras.

Description: Led the Institute Football team in the Inter IIT's, a sports tournament among all the IIT's. Responsibilities included organizing Sports Fest (IIT Madras's annual sports tournament), Schroeter (Inter hostel tournaments) and all other Institute level tournaments.

2011 - 2012: Sports Secretary, Tamraparni Hostel

Description: In-charge of the sporting activities of one complete dormitory. Was also a part of the organizing team for the Terry Fox run, a fund raising marathon for Cancer research held across 53 other countries.

Volunteer Work

Prison Teaching Initiative **2017 -**
Initiative to reduce incarceration rates by increasing access to post-secondary education.

Organizing MelodEE

2017, 2018

Planning and organizing MelodEE, the annual talent show of ELE department.

PH101, MA101 Coaching Initiative

2013-2014

Initiative to improve the performance of freshmen in introductory Math and Physics courses.