Krystal Maughan

Krystal.maughan@gmail.com
Github: https://github.com/kammitama5
Tel: 607.342. 6970
Blog: https://kammitama5.github.io/

Research Interests: Isogeny-Based Cryptography, Mathematical Cryptography

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University of Vermont, PhD candidate	***2019-present***

Computer Science PhD student, minor in Pure Mathematics

RESEARCH EXPERIENCE:

Research Assistant (Vermont)	***2021-2024***

Supervisors: C. Vincent, J. Near: Research on Isogeny Graph Cryptography, Mathematical Cryptography

Research Assistant (Vermont)	***2019-2021***

Supervisor: Joe Near: Research on Provable Fairness and Privacy Using Machine Learning.
Funded via Amazon Research Award (2020-2022 PI: J. Near, D. Darais)

Conference Publications:

- *"Continual Audit of Individual Fairness in Deployed Classifiers via Prediction Sensitivity"* (**Maughan, K**, *I. Ngong and J. Near) (under review)* — *2021*

Workshop Publications:

- *"Attribute Differential Privacy"* **(Pre-print available upon request)** (**Maughan, K.** *and Near, J.)* — *2021*
- *"Towards a Measure of Individual Fairness for Deep Learning"* (**Maughan, K.** *and Near, J.) - presented as poster for* **MD4SG 2020** — *2020*
- *"Towards Auditability for Fairness in Deep Learning"* (*Ngong, I.,* **Maughan, K.** *and Near, J.)- presented as poster for* **AFCI at NeurIPS** — *2020*
- *"Archipelago Penseé"* (**Maughan, K**.) *presented artwork and writing as a poster:* **RAIS (Resistance AI) at NeurIPS** — *2020*

Graduate Teacher's Assistant, Fall/Spring 2019-2020 (Vermont)	***2019-2020***
Compiler Construction with Haskell (taught by Joe Near)	*2020*
Advanced Web Design (taught by Bob Erickson)	
Programming with Matlab (taught by Radhakrishna Dasari)	*2019*
Data Privacy with Jupyter, Python (taught by Joe Near)	

GRANT WRITING / PROPOSALS

- *COST Action Proposal OC-2021-1-25315 "Mathematics and Algorithmics of Group actions and Isogenies for Cryptography" (Secondary Proposer)* — *2021*
- *Microsoft Research, Reinforcement Learning Open Source Festival Proposal (Awarded $10,000)* — *2021*
- *Meta: Building Tools to Enhance Privacy and Fairness (as co-PI with PI J. Near and PI J. Onaolapo) (not awarded)* — *2021*

GRANT WRITING / PROPOSALS

- ❖ *CDS&E Computational and Data-Enabled Science and Engineering*   *2020*
  Database Grant Proposal for SageMaths (as Key Personnel)
  (PI B. Hutz, PhD) (not awarded)
- ❖ *Google Summer of Code, Proposal to Haskell.org*   *2018*
  (Awarded $6,000)
- ❖ *Helium Grant, (for exploring questions on the edge of mainstream thinking)*   *2018*
  (Awarded $1000)

MERIT-BASED MENTORSHIPS / RESEARCH MENTORSHIPS

Mentee, Microsoft's Tech Resilience (mentors: O. Kroshkina, M. Ward)	*2022*
Mentee, Google's CS Research Mentorship Program (CSRMP) with A. Lees, PhD	*2021*
Mentee, AiC Connectors Program with Facebook with O. Dalleleau, PhD	*2021*
Mentee, She256 Blockchain Group with P. Mishra, PhD	*2021*
Mentee, Women in Privacy and Security (WISP), D. Sharma, PhD	*2021*
Mentee, Global Outreach Mentorship with S. Gupta, PhD (EC 2020)	*2020*
Mentee, LatinX in AI Research Workshop Mentorship, C. White, PhD (NeurIPS 2021)	*2021*
Mentee, LatinX in AI Research Workshop Mentorship with J. Barajas, PhD (ICML 2020)	*2020*
Mentee, Mentored by Amal Ahmed, PhD (ICFP 2020)	*2020*
Mentee, Lighthouse3 AI Ethics Mentoring Externship with F. McEvoy (1 of 20 chosen)	*2020*
Mentee, Code2040 Fellowship with Ben Waber, PhD	*2020*

ACADEMIC REVIEWER

Reviewer, Springer AI and Ethics Journal	*2020 - present*
Reviewer, PML4DC (Practical Machine Learning for Developing Countries), ICLR	*2021- 2022*
Reviewer, BlackAIR Summer Research Grant Program	*2021*
Reviewer, ICLR Distributed and Private Machine Learning workshop	*2021*
Committee Reviewer, HCI Track, GHC (Grace Hopper Conference)	*2021*
Reviewer for AFCR workshop at NeurIPS (Fairness, Accountability, Robustness)	*2021*
Reviewer for AFCI workshop at NeurIPS (Fairness and Accountability)	*2020*
Reviewer for Black in AI at NeurIPS workshop	*2020-2021*
Reviewer and Programme Committee Member, LXAI@ICML Workshop	*2020*
Committee Reviewer, HCI Track, GHC (Grace Hopper Conference)	*2020*
Chair Reviewer, PML4DC (Practical ML for Developing Countries) workshop, ICLR	*2020*
Reviewer, Tapia Conference (Panels and Workshops)	*2020 - 2022*
Reviewer, Travel Grant Applications, Black in AI for AAAI	*2020*

ACADEMIC JOURNALS (AI/Machine Learning)

Board Member, AI and Ethics, Springer	*2020*

REVIEWER (NON-ACADEMIC PEDAGOGICAL)

Published Book, "Effective Haskell" by R. Skinner	*2022*

RESEARCH PhD INVITATIONS (ABRIDGED)

Virtual Participant, MSRI: Connections Workshop:	*2023*

- *Algebraic Cycles, L-Values and Euler Systems*
- *Introductory Workshop: Algebraic Cycles, L-Values and Euler Systems*
- *Shimura Varieties and L-Functions*

Virtual Participant, BIRS, Algebraic Methods in Coding Theory and Communication	*2022*
Virtual Participant, Arizona Winter School	*2022*

- *Automorphic Forms beyond GL2 (mentor E. Eischen)*

Virtual Participant, West Coast Number Theory (WCNT): Problems in Number Theory	*2021*
Participant, GREPSEC V:	*2021*

- *(Graduate Students in Privacy and Security Early Career Workshop)*

Participant, Isogeny-Based Cryptography Winter School	*2021*
Participant, Post-Quantum Networks Workshop	*2021*
Participant, PRIMA Summer School	*2021*

- *Rational curves and moduli spaces in arithmetic geometry*

Initiative for Cryptocurrencies and Contracts (IC3) Blockchain Bootcamp	*2021*

- *Worked on group project : Fairness consensus for Miner Extractable Value (MEVs)*
- *Implemented Aequitas protocol from paper with authors for fairness simulation*
- *One of top four winning teams chosen*

Participant, Scottish Programming Languages and Verification School	*2021*
Invited Participant,"Key themes for informing a Research Roadmap",	*2021*
The Alan Turing Institute:	

- *Invited Participant,"Threats and Opportunities for AI in Cybersecurity"*   *2021*
- *Invited Participant,"Society-centric approaches to AI challenges in*   *2021*
- *Invited Participant, "Environmental Enables for AI challenges in*   *2021*

Participant, Self Organizing Conference on Machine Learning (SOCML)	*2021*

- *Machine Learning, and Privacy session, Moderated by U. Erlingsson*   *2021*
- *organized by I. Goodfellow (1 of 9 chosen)*

Simons Institute, Average-Case Complexity: From Cryptography to Statistical Learning	*2021*
Simons Institute, Optimization Under Symmetry	*2021*
Simons Institute, Innovations in Theoretical Computer Science (ITCS)	*2021*
Simons Institute, Geometric Methods in Optimization and Sampling Bootcamp	*2021*
Participant, Community-Driven Cryptography Seminar (Brown / John Hopkins)	*2021*

MERIT-BASED GRANTS / SCHOLARSHIPS (ABRIDGED)

Google Grace Hopper Conference (GHC) Scholarship	*2021*
NCWIT Collegiate Award Finalist (1 of 80)	*2021*
WISP & Black Hat USA Briefings Scholarship (1 of 25)	*2021*
Kernel Fellowship Block III via Gitcoin (Security: Zero Knowledge Proofs project)	*2021*
Gitcoin Scholarship for Women (for Kernel Fellowship Block III)	*2021*
She256 Mentorship focused on ZK Snarks (6 months)	*2021*
USENIX Security Conference 2021 (via USENIX Diversity Grant via GREPSEC V)	*2021*
TechX Social Impact / Harvard Franklin Fellowship (1 of 12)	*2020*
USENIX Enigma Grant	*2021*
NCAS Workshop participant (NASA Community College Aerospace Scholars)	*2016*
Who's Who/ Peggy Williams Memorial Scholarship/ Best BFA Award (Best of Major)	*2008*

OTHER GRANTS/ FELLOWSHIPS (ABRIDGED)

Upstate Number Theory Conference 2021 (lodging provided)	2021
IEEE Symposium on Security and Privacy (student travel grant, complimentary ticket)	2021
4th Annual ZK-Proof Workshop (complimentary ticket)	2021
WISP Privacy+Security Conference	2021

- EU Data Law / De-Identification Workshop (Scholarship via WISP)

ICERM (Brown University) Variable Precision in Mathematical & Scientific Thinking	2020
RWC2020 (Real World Crypto: registration, flight, lodging) Grant via IACR	2020
Sage-Days-104 : To work on SageMath Software: Arithmetic Dynamics	2019
Simons Institute (Berkeley) Error-Correcting Codes and High-Dimensional Expansion Boot Camp (attendee)	2019
ICERM (Brown University) Encrypted Search Workshop Grant (Lodging provided)	2019
Cornell Number Theory Conference Grant (Lodging provided)	2019
MSRI (Mathematical Sciences Research Institute) Grants to attend:	
Optimal Transport and applications to machine learning and statistics	2020
Connections for Women:	2019

- Derived Algebraic Geometry, Birational Geometry and Moduli Spaces workshop
- Introductory Workshop: Derived Algebraic Geometry and Birational Geometry
  And Moduli Spaces

Racket Summer School (National Science Foundation Grant)	2018-2019
PLMW (Programming Languages Mentorship Workshop)	2018
ICFP (International Conference Functional Programming)	
PLMW(Programming Languages Mentorship Workshop)	2018
PLDI (Programming Languages Design and Implementation)	
OPLSS (Oregon Programming Languages Summer School Grant) - declined offer	2018

ACADEMIC SERVICE (ABRIDGED)

Panelist, PhD recruiting event (included multiple schools, sponsored by CodePath)	2020
Student Volunteer, ICFP (International Conference Functional Programming)	2020
Student volunteer, ICFP (International Conference Functional Programming)	2018
Student volunteer, PLDI (Programming Languages Design and Implementation)	2018
Student volunteer, POPL (Principles of Programming Languages)	2018
Student volunteer, SPLASH	2018

(Systems, Programming, Languages, and Applications) (declined offer)

INDUSTRY PhD INVITATIONS (ABRIDGED)

Fellow, JP Morgan, Advancing Black Pathways in AI & Quantitative Modelling Program	2022
Virtual Participant, Jane Street's Preview Program, The Game Show / Trading Games	2022
Participant, JP Morgan, Advancing Black Pathways in AI & Quant Modeling Summit	2021
Participant, Facebook, Amplified: Above & Beyond Computer Science Program (PhDs)	2021
Participant, Facebook's Amplified: Virtual Vivid in Research (1 of 30)	2021
Participant, Galois 1st Summer School on Trustworthy Machine Learning (1 of 35)	2021
Participant (via CSRMP), Google PhD Fellowship Summit	2021
Participant, Jane Street PhD Symposium (New York, remote) (Quant Research)	2021
Participant, JP Morgan, Advancing Black Pathways in Data Science	2021
Participant, TwoSigma Mock Interview Day for Early Career Women (Quant Research)	2021

INDUSTRY PhD INVITATIONS (ABRIDGED)

Participant, Hudson River Trading (HRT) Systems Engineering Tech Talks (1 of 14)	2021
Participant, Adobe, "The Future of Creativity" (Virtual)	2020
Participant, Microsoft Research, Frontiers in Machine Learning (Redmond, remote)	2020
Participant, Discover Bloomberg: Women in Engineering event (New York, remote)	2020
Participant, Twitter PhD ML Flock Event (New York, Boston office)	2019

GRADUATE SCHOOL INTERNSHIPS

JP Morgan, *Quantitative AI Research, Summer 2022 (New York) (1 of 10)*	2022
Microsoft Research, *Independent Contractor, Summer 2021 (New York: remote)*	2021
Microsoft, *PhD Intern, Summer 2021 (Redmond: remote)*	2021
Autodesk, *PhD Intern, Summer 2020 (Pier 9, San Francisco: remote)*	2020

RELEVANT WORK / INDUSTRY EXPERIENCE

Mercury Banking (Haskell fintech) : *Software Engineering Intern (San Francisco)*	2019
Apple, Inc.: *Software Engineering Intern (Sunnyvale)*	2019
Google Summer of Code: *Developer for Haskell.org (remote)*	2018
Mozilla: *Increasing Rust's Reach Developer (remote)*	2018

NON-ACADEMIC SERVICE (ABRIDGED)

Invited Finalist Judge, Technovation, AI for Good	2021
Participant, Git Contributors Inclusion Summit	2020
Reviewer, Code2040 Application Essays	2020
Reviewer, OpenMined Differential Privacy articles	2020
Judge, DataKind, Data.org, Inclusive Growth and Recovery Challenge	2020
Google Developer Student Club Lead (for University of Vermont)	2019
Reviewer, Travel Grant Applications, Clojure Conj (2 rounds)	2017

OTHER (NON-INDUSTRY) TALKS (ABRIDGED)

Brown University, Fair February talk on Security, Privacy, Fairness	2022
"Composable Forgetful Isogenies", Google CSRMP Research Alumni Talk	2022
"Composable Forgetful Isogeny Graph Cryptography", Google CSRMP Research	2021
"Isogeny Graph Cryptography", School for Poetic Computation, Re-learning to love Maths 2021	
"Isogeny Graph Cryptography", School for Poetic Computation,"Learning to Love Maths" 2021	
Invited Panelist, Peer-connected Undergraduate Research Exploration in Computer and Information Science and Engineering (PRE.CISE)	2021
University of Vermont, CIS196, Privacy Law Research Talk	2021
PLAID Lab speaker, "What Scientists can learn from Artists"	2020
PLAID Lab Speaker, "Information Theory: from Spacecraft to Blockchain"	2021
CS Crew Project talk : contributing to Maths software (CodeWorld, SageMaths)	2019

CLASSES (PhD)

Doctoral Research with advisors Joe Near and Christelle Vincent	2021-present
Random Probabilistic Graphs, taught by Puck Rombach (Spring)	2022
Abstract Algebra IV A: (Ring & Module Theory, Category Theory) taught by Taylor Dupuy	2022
Abstract Algebra IV C: (Elliptic Curves & Modular Forms), taught by Christelle Vincent	2022

CLASSES (PhD)

Abstract Algebra I taught by Puck Rombach (Commutative Group theory) (Fall)	2021
Abstract Algebra III taught by Christelle Vincent : (Fields, Rings, Galois Theory) (Fall)	2021
(Post-quantum) Mathematical Cryptography, taught by Christelle Vincent (Spring)	2021
Privacy, Law and Policy, taught by Ryan Kriger (Spring)	2021
Secure Distributed Computation; taught by Joe Near using Python (Fall)	2020
Machine Learning; taught by Safwan Wshah using Python (Spring)	2020
Doctoral Research with advisors Joe Near and David Darais (Spring, Fall)	2019-2020
Data Privacy; taught by Joe Near using Python (Fall)	2019
Software Verification; taught by David Darais using Agda (Fall)	2019
Computer Human Interaction; taught by Josh Bongard (Fall)	2019

CLASSES (AUDIT)

UVM: Elementary Number Theory taught by Christelle Vincent (Spring)	2022
Stanford EE 374 : Internet-Scale Consensus in the Blockchain Era	2021

- Information Theory class focused on scalability and protocols in Blockchain
- Taught by D. Tse, PhD through Stanford University
- Audited class, scribed for Lecture 11, Spring 2021

CLASSES (RELATED)

Rewriting the Code (RTC) Blockchain Basics + Developer Workshop	2021

HACKATHONS

R Data Hackathon 2021, <u>First Place</u>, "Cast and Gender Roles in Movie Data"	2021

- Our group won First place at the R Data Hackathon 2021 for Best Visualization

Initiative for Cryptocurrencies and Contracts (IC3) Blockchain Bootcamp	2021

- Worked on group project : Fairness consensus for Miner Extractable Value ([MEVs](#))
- Implemented Aequitas protocol from [paper](#) with authors for fairness simulation
- One of [top four winning teams](#) chosen

Skills: Python, Haskell, Matlab, Sage, (learning Rust and R), LaTeX, Jupyter, SQL, AWS, PySpark, Sparklyr, Maplesoft, Tensorflow, Git

ACADEMIC ASSOCIATION FOR COMPUTING MACHINERY (ACM) MEMBERSHIPS

Student Member, International Association of Cryptologic Research (IACR)	2020-present
SIGecom Special Interest Group on Economics and Computation	2020-2021

NON-ACADEMIC MEMBERSHIP

Member, Women in Number Theory	2018-present
Member, QVNTS (Quebec-Vermont Number Theory Seminar)	2021-present
Member, Women in Combinatorics	2021-present
Member, Association for Women in Mathematics	2021-present
Member, She256	2021-present
Member, Women in Security and Privacy (WISP)	2020-present