

Cait Harrigan, MSc, PhD

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I am a postdoctoral researcher in the Park lab at Harvard Medical School. I use machine learning to study cancer evolution and the selective forces shaping tumor development. I earned my PhD in Computer Science from the University of Toronto in 2026, supervised by Quaid Morris and Kieran Campbell. I was a Doctoral Fellow at the UofT Data Sciences Institute and a graduate researcher at the Vector Institute and Ontario Institute for Cancer Research. In my thesis, I developed probabilistic models and Bayesian optimization approaches to study DNA repair deficiencies using genomic sequencing and spatial proteomic data. I'm passionate about open science, and promoting great mentorship in the sciences.

RESEARCH INTERESTS

My research focuses on developing machine learning methods to understand cancer evolution through patterns in somatic mutations. I combine computational biology, statistical modeling, and large-scale genomic data analysis to identify the evolutionary constraints that underlie mutation, and identify therapeutically targetable DNA repair deficiencies. With expertise in: cancer genomics, spatial proteomics, deep learning, probabilistic modelling, and programming in python & R in HPC environments.

EDUCATION

PhD in Computer Science, University of Toronto <i>Supervised by Quaid Morris and Kieran Campbell</i>	01/21 - present
MSc in Computer Science, University of Toronto <i>Supervised by Quaid Morris</i>	09/19 - 03/21
Honours BSc. in Computational Biology, University of Toronto <i>Awarded with distinction</i>	09/15 - 06/19

RESEARCH EXPERIENCE

Visiting graduate researcher The Francis Crick Institute, London, England <i>Hosted by Nicholas McGranahan</i>	03/24 - 05/24
Visiting graduate researcher Memorial Sloan Kettering Cancer Center, New York, USA <i>Hosted by Quaid Morris</i>	05/21 - 09/21

PUBLICATIONS

* Indicates joint first authorship, † co-corresponding authorship

- 1. Damage and misrepair signatures: compact representations of pan-cancer mutational processes**, [Caitlin F. Harrigan](#), Kieran R. Campbell, Quaid Morris†, Tyler Funnell†, *bioRxiv*
- 2. Automated registration of spatial expression data scales multimodal integration to large cohorts**, [Caitlin F. Harrigan](#), Ching Yeung Lam, Danian Chen, Christian Lai, Rod Bremner, Hartland W. Jackson, Kieran R. Campbell, *bioRxiv*
- 3. Measuring scientific capabilities of language models with a systems biology dry lab**, Haonan Duan*, Stephen Zhewen Lu*, [Caitlin F. Harrigan](#), Nishkrit Desai, Jiarui Lu, Michał Koziarski, Leonardo Cotta, Chris J. Maddison, *bioRxiv*, *Workshop paper at ICML 2025*, *Poster at NeurIPS 2025*
- 4. Bacterial ADP-heptose initiates a revival stem cell program in the intestinal epithelium**, Shawn Goyal, Cynthia X. Guo, Adrienne Ranger, Derek K. Tsang, Ojas Singh, [Caitlin F. Harrigan](#), Olga Zaslaver, Hannes L. Rost, Herbert Y. Gaisano, Scott A. Yuzwa, Nan Gao, Jeffrey L. Wrana, Dana J. Philpott, Scott D. Gray-Owen and Stephen E. Girardin, *Cell Stem Cell*, 2025

5. Whole slide Imaging Mass Cytometry allows the rapid profiling of the immune landscape of histopathologically aggressive prostate tumors, Jennifer L. Gorman, Lydia Y. Liu, Jordan P. Hartig, Nikesh Parsotam, Amanda Khoo, Vladimir Ignatchenko, Sarah Asbury, Somi Afiani, Ricardo Gonzalez, Michael J. Geuenich, [Caitlin F. Harrigan](#), Yuju Lee, Jianan Chen, Liang Lim, Qanber Raza, Pegg M. Angel, Kieran Campbell, Stanley K. Liu, Michelle R. Downes, Richard R. Drake, Thomas Kislinger, David King, Hartland W. Jackson, *ACR annual meeting proceedings, 2024*

6. Regional mutational signature activities in cancer genomes, Caitlin Timmons, Quaid Morris[†], and [Caitlin F. Harrigan](#)[†], *PLOS Computational Biology, 2022*

7. Activating mTOR mutations are detrimental in nutrient-poor conditions, Agata A. Bielska, [Caitlin F. Harrigan](#), Yeon Ju Kyung, Quaid Morris, Wilhelm Palm, and Craig B. Thompson, *Cancer Research, 2022*

8. Considerations for visualizing uncertainty in clinical machine learning models, [Caitlin F. Harrigan](#)^{*}, Gabriella Morgenshtern^{*}, Anna Goldenberg, and Fanny Chevalier, *Workshop paper at CHI 2021*

9. Reconstructing evolutionary trajectories of mutation signature activities in cancer using TrackSig, Yulia Rubanova, Ruian Shi, [Caitlin F. Harrigan](#), Roujia Li, Jeff Wintersinger, Nil Sahin, Amit Deshwar, and Quaid Morris, *Nature Communications, 2020*

10. TrackSigFreq: subclonal reconstructions based on mutation signatures and allele frequencies, [Caitlin F. Harrigan](#), Yulia Rubanova, Quaid Morris, and Alina Selega, *Pacific Symposium on Biocomputing, 2020*

ACADEMIC TALKS

Mutational Signatures for DNA Damage and Misrepair , BIRS: Mathematical Methods in Cancer Biology, Evolution and Therapy, <i>Invited talk</i>	05/23
DAMUTA: Dirichlet allocation of mutations as a function of both damage and DNA repair , Cold Spring Harbour Laboratory Meeting: Genome Informatics, <i>Selected Talk</i>	11/21
TrackSigFreq: subclonal reconstructions based on mutation signatures and allele frequencies , Pacific Symposium on Biocomputing, <i>Selected Talk, Poster</i>	01/20

ACADEMIC AWARDS

Doctoral Student Fellowship Award Data Science Institute, University of Toronto	09/22 - 09/25
NSERC Postgraduate Scholarship - Doctoral Natural Sciences and Engineering Research Council of Canada	09/22 - 09/25
Graduate Research Award Mitacs, in partnership with UKRI	03/24 - 05/24
Queen Elizabeth II Graduate Scholarship in Science & Technology Province of Ontario	09/22
Ontario Graduate Scholarship Province of Ontario	09/21 - 09/22
ACM SIGHPC Computational & Data Science Fellowship Special Interest Group on High Performance Computing of the Association for Computing Machinery	07/20 - 07/22
JXTX foundation Genome Informatics Scholarship James P. Taylor Foundation for Open Science	08/21
General Motors Women in Science and Mathematics Award University of Toronto	09/20
NIH Conference Travel Fellowship International Society for Computational Biology	11/19
The Audrey Taylor Award for co-curricular contribution to the New College community University of Toronto	07/17

GRANTS

Emergent Data Sciences Program Grant Data Science Institute, University of Toronto <i>Awarded for CrossTALK drug discovery bootcamp</i>	09/24
Student initiative fund University of Toronto <i>Awarded for Bioinformatics and Computational Biology Hackathon</i>	02/18

Event grant	02/18
New College Student council	
<i>Awarded for Bioinformatics and Computational Biology Hackathon</i>	
ACADEMIC SERVICE	
Journal peer review: Genome Biology (2023), Genome Medicine (2021), Nature Cancer (2024), PLOS Computational Biology (2023 x2), iScience (2021)	
Conference referee: CODEML @ ICML (2025)	
Conference program committee: MLCB (2019), Pacific Symposium on Biocomputing (2020)	
PROFESSIONAL TRAINING	
The Carpentries certified instructor	10/23
Oxford ML summer school (health track)	07/23
STUDENT SUPERVISION	
Kiki Zhang , Combined BS/MSE Student; Biomedical Engineering. Research internship via Computational Biology Student Program at MSKCC, <i>Topic: Mutational signatures in the context of branching evolution</i>	06/23 - 08/23
Fedir Zhydok , BS Student; Computer Science. Artificial intelligence in medicine, global classroom program at University of Toronto, <i>Topic: Identifying metastatic tumours from mutational signatures</i>	09/22 - 12/22
Caitlin Timmons , BA Student; Statistical and Datasciences, Biology. Research internship via Computational Biology Student Program at MSKCC. Went on to a Research Technician position at Dana-Farber Cancer Institute., <i>Topic: Modelling spatial distribution of mutational signatures in cancer genomes.</i>	05/21 - 08/22
Haritha Lakshmanan , Highschool Student. Independent study at MSKCC. Went on to a combined BA/MD at Brooklyn College., <i>Topic: Automatic discovery of mutations predictive of survival in breast cancer patients</i>	05/20 - 11/20
GUEST LECTURES	
Feature engineering & data loaders , CrossTALK drug discovery bootcamp	06/25
Exploring & Explaining Data in the Wild , AI & Data Science Post-Graduate Program, Loyalist College, <i>Invited by Prof. Peter Papadakos as an annual guest lecturer in 2023 & 2024</i>	03/23
Data Collection & Analysis , PRISM research & mentorship program, University of Toronto, <i>Invited by Prof. Sadia Sharmin</i>	02/22
Environmental & Life Sciences Workshop Series , STEMHub Foundation	01/20
R for bioinformatics workshop , Global Society for Genetics and Genome Biology	01/20
OTHER TALKS	
Machine Learning for Cancer Genomics , Artificial Intelligence in Healthcare Society Case Competition, York University, <i>Invited keynote</i>	03/24
Finding the 'I' in science , ACM Canadian Celebration of Women in Computing, <i>Selected Workshop</i>	10/22
Undergraduate research opportunities: how to find them and make them work for you , UofT Bioinformatics and Computational Biology Student Union, <i>Invited by the BCBSU</i>	02/20
How to hack your degree , Computer Science Student Union, University of Toronto, <i>Invited by the CSSU</i>	05/19
PROGAM & EVENT ORGANIZATION	
Program Organizer	09/21 - 01/25
UofT Graduate Application Assistance Program	
Project Manager	10/20 - 05/21
STEMHub Foundation, Toronto, Canada	
Volunteer Coordinator	03/20
Computer science grad visit day, University of Toronto	
Founder and treasurer	05/18 - 05/19
Bioinformatics and Computational Biology Student Union, University of Toronto	
Program information session	06/17 - 06/19
UofT Bioinformatics and Computational Biology Student Union	
Planning executive	03/18

TEACHING ASSISTANT POSITIONS

Unless otherwise noted, school is University of Toronto

CSC2541: Topics in Machine Learning: AI for Drug Discovery , Head prep TA	04/25 - 09/25
CrossTALK drug discovery bootcamp , Head TA	01/25 - 12/25
JSC370: Data Science II	01/23 - 05/23
JSC270: Data Science I	01/23 - 05/23
STA313: Data Visualization	09/22 - 12/22
JSC370: Data Science II	01/22 - 05/22
CSC197: Privacy in the Age of Big Data Collection	09/21 - 12/21
STA4273: Minimizing Expectations	01/21 - 05/21
CSC197: Privacy in the Age of Big Data Collection	09/20 - 12/20
JSC270: Data Science I	01/20 - 05/20
CSC373: Algorithm Design, Analysis & Complexity	09/19 - 12/19

MENTORSHIP ACTIVITIES

As part of my ongoing commitment to supporting students at all levels and background in engaging with computational biology, I make an effort to be available to provide guidance and resources to students, with a particular focus on creating an inclusive environment that fosters diverse perspectives and experiences. In addition to being a mentor through the organized programs listed here, I set aside ~2h/month for by-request 30 minute meetings.

Graduate Application Assistance Program , University of Toronto	09/21 - 01/25
Computer Science Alumni Mentorship Program , University of Toronto	01/23 - 05/23
Statistical Science Alumni Mentorship Program , University of Toronto	10/21 - 05/22
ProjectX machine learning research competition , UofT AI club	09/20 - 02/21
Her Code Camp , Toronto, Canada	08/20 - 08/21
Department of Statistics Mentorship Program , University of Toronto	10/18 - 05/19
SPROUT Peer Mentorship Program , University of Toronto	09/16 - 05/19
New College E-Mentorship Program , University of Toronto	09/16 - 05/19

HACKATHONS

Silver medal , Toronto Bioinformatics Hackathon	09/24
Silver medal , American Statistical Association DataFest Competition	05/18

COMMUNITY ACTIVITIES

Webmaster , Project Galiwatch	03/20 - present
Graduate student ambassador , Computer science grad visit day, University of Toronto	03/25
Judge , Lunenfeld-Tanenbaum Research Institute Summer Poster Session	07/24
Webmaster , IMERSS Xetthecum ecocultural digital mapping project	10/23 - 12/24
Volunteer , Meals on wheels	06/23 - 09/23
Volunteer , Billion oysters project	05/21 - 09/21
Communications and Marketing Executive , UofT Women in Computer Science	09/16 - 05/17