# Taylor W. Killian

twkillian.github.io
**twkillian@cs.toronto.edu**

| | |
|---|---|
| **RESEARCH INTERESTS** | Techniques for efficient and effective *sequential decision making* in the presence of uncertainty: particularly toward improved *robustness* and *generalization*, motivated by challenges in *healthcare*. |

**SUBJECT AREAS**

- Reinforcement Learning
  - Offline RL
  - Risk-sensitive RL
  - Model-based RL
- Representation Learning
- Causal Inference
- Approximate Bayesian Inference

**EDUCATION**

**Ph.D., Computer Science** — **Expected June 2024**
*University of Toronto*, Toronto, ON, Canada
- GPA: 4.0

*Advisor:* Marzyeh Ghassemi
*Thesis:* Counterfactually Guided Reinforcement Learning and State
Representation Learning in Partially Observed Clinical Environments

**M.Eng, Computational Science and Engineering** — **May 2017**
*Harvard University*, Cambridge, MA
- GPA: 3.92

*Advisor:* Finale Doshi-Velez
*Thesis:* Robust and Efficient Transfer Learning by Accounting for and Modeling Parameter Variation

**BS, Mathematics** — **April 2013**
*Brigham Young University*, Provo, Utah
- GPA: 3.83

**SKILLS AND LANGUAGES**
- Python
- Tensorflow, Pytorch, Jax
- LaTeX, MATLAB
- Java, CUDA, C++
- Fluent in Swedish

**AWARDS**
- ICML, NeurIPS, ICLR: Top Reviewer Award, 2019 - 21
- AAAI, Student Abstract Best Presentation, 2017
- MIT LL Lincoln Scholar, 2015-2017
- NDSEG Fellowship Award, 2013 (Declined)
- SMART Fellowship Finalist, 2011
- BYU ORCA Grant Recipient, 2010

**PUBLICATIONS**

- McCoy, L., **Killian, T.**, Finlayson, S., Chen, S., Celi, L.A., Ghassemi, M., Kohane, Z. "Futility and Utility: Patient Values, Shared Decision Making, and Machine Learning in the Intensive Care Unit", *In Preparation*.

- Zhang, H., **Killian, T.**, Hartvigsen, T., Ghassemi, M., "Active Feature Selection in Time Series with Optimal Early Stopping". *in Preparation*

- **Killian, T.**, Parbhoo, S., Ghassemi, M., "Risk-Sensitive and Robust Dead-end Identification in Safety-Critical Offline Reinforcement Learning", *in Preparation*

- Hulkund, N., Suriyakumar, V., **Killian, T.**, Shamsabadi, A., Papernot, N., Ghassemi, M., "Improving Robustness to Distribution Shift with Differential Privacy", *In Submission*.

- **Killian, T.**, Ghassemi, M., Joshi, S., "Counterfactually Guided Off-policy Transfer in Clinical Settings", *Conference on Health, Inference and Learning (CHIL)*. April 2022.

- Fatemi, M., **Killian, T.**, Subramanian, J., Ghassemi, M., "Medical Dead-ends and Learning to Identify High-Risk States and Treatments", *Advances in Neural Information Processing Systems*. December 2021

- **Killian, T.**, Zhang, H., Subramanian, J., Fatemi, M., Ghassemi, M., "An Empirical Study of Representation Learning for Reinforcement Learning in Healthcare" *Machine Learning for Health Workshop, NeurIPS,* December 2020

- D'Costa, A., Denkovski, S., Malyska, M., Moon, S.Y., Rufino, B., Yang, Z., **Killian, T.**, Ghassemi, M., "Multiple Sclerosis Severity Classification From Clinical Text", *The 3rd Clinical Natural Language Processing Workshop*, EMNLP 2020.

- **Killian, T.**, Ghassemi, M., Joshi, S., "Counterfactual Transfer via Inductive Bias in Clinical Settings", *Inductive Biases, Invariances and Generalization in RL Workshop* ICML 2020

- **Killian, T.**, Subramanian, J., Fatemi, M., Ghassemi, M., "Learning Representations for Prediction of Next Patient State", *1st Annual ACM Conference on Health, Inference and Learning*, April 2020. **Workshop Spotlight**

- Silva, A., **Killian, T.**, Jimenez, I., Son, S.-H., Gombolay, M. "Optimization Methods for Interpretable Differentiable Decision Trees Applied to Reinforcement Learning", *The 23rd International Conference on Artificial Intelligence and Statistics (AISTATS)*, August 2020.

- **Killian, T.**, Goodwin, J., Brown, O. & Son, S-H., "Kernelized Capsule Networks", *1st Workshop on Understanding and Improving Generalization in Deep Learning, ICML*, July 2019.

- Yao, J., **Killian, T.**, Konidaris, G. & Doshi-Velez, F., "Direct Policy Transfer via Hidden Parameter Markov Decision Processes", *The 2nd Lifelong Learning: A Reinforcement Learning Approach Workshop, ICML*, July 2018. **Selected for Oral presentation.**

- Jones, A., **Killian, T.**, Hurley, M., & Allen, R., "Artificial Intelligence and Machine Learning for Decision Support: Recommendations for Investment", **Technical Report**, MIT Lincoln Laboratory, June 2018. *Paper not available for public release*

- **Killian, T.**, Daulton, S., Konidaris, G. & Doshi-Velez, F. , "Robust and Efficient Transfer Learning in Hidden Parameter Markov Decision Processes", *Advances in Neural Information Processing Systems*. December 2017 **Selected for an Oral presentation**

- **Killian, T.**, Konidaris, G. & Doshi-Velez, F., "Robust and Efficient Transfer Learning in Hidden Parameter Markov Decision Processes." In *AAAI* (pp. 4949-4950). February 2017.

- **Killian, T.**, Klaus, R. & Truscott, T.T., "Rebound and jet formation of a fluid-filled sphere", *Physics of Fluids* **24**, 122106 (2012), DOI:10.1063/1.4771985.

PRE-PRINTS

- **Killian, T.**, Ghassemi, M., Joshi, S., "Counterfactually Guided Policy Transfer in Clinical Settings", arXiv preprint arXiv:2006.11654. (2020)

- Rodriguez, I., **Killian, T.**, Son, H-S. & Gombolay, M., "Interpretable Reinforcement Learning via Differentiable Decision Trees", arXiv preprint arXiv:1903.09338. (2019).

- Goodwin, J., Brown, O., **Killian T.**, & Son, H-S., "Learning Robust Representations in Active Sensing", arXiv preprint arXiv:1811.10714. (2018).

- **Killian. T.**, Konidaris, G. & Doshi-Velez F., "Transfer Learning Across Patient Variations with Hidden Parameter Markov Decision Processes." arXiv preprint arXiv:1612.00475. (2016).

EXPERIENCE

**Graduate Research Assistant**                                    **August 2019 - present**
*Department of Computer Science, University of Toronto & Vector Institute*
*Institute of Medical Engineering and Science, Massachusetts Institute of Technology*

- Developing robust representations of patient health, incorporating measures of uncertainty
- Investigating approaches to identify and overcome detrimental treatment decisions in high-risk clinical environments
- Pursuing research to enable robust knowledge transfer between healthcare institutions by combining causal inference and reinforcement learning
- Supervising junior students for research projects focused on Reinforcement Learning

**Research Intern**                                               **June 2021 - December 2021**
*Apple Inc., Health AI*

- Explored utility of self-supervised learning for representation of user health via measured physiological signals
- Established state-of-the-art learning architectures for broader use within the Health AI team
- Served as in-house technical expert on sequential decision making approaches

**Student Researcher / Research Intern**                          **May 2020 - December 2020**
*Google Research, Brain team*

- Investigated the utility of embedding measurements of uncertainty in a Reinforcement Learning agent's state representation
- Executed large scale computational experiments on distributed servers

**Teaching Assistant**                                            **August 2019 - May 2020**
*Department of Computer Science, University of Toronto*
- Part of teaching staff for:
    - CSC311 Introduction to Machine Learning
    - CSC2541 Machine Learning for Healthcare
- Developed and administered assignments and exams
- Worked with and instructed students, answering questions about course material
- Coordinated projects with clinical collaborators, organized and advised student groups

**Associate Technical Staff**                                     **June 2017 - July 2019**
*Air, Missile and Maritime Defense Technology, MIT Lincoln Laboratory*
- Led effort to identify and develop areas for Laboratory investment in Artificial Intelligence
- Developed ML algorithms for efficient and accurate performance in low-data regimes
- Fused multiple information sources to reduce false-alarms in aviation passenger screening

**Assistant Technical Staff**                                     **May 2013 - May 2017**
*Air, Missile and Maritime Defense Technology, MIT Lincoln Laboratory*
- Evaluated the impact of technological and operational improvements to U.S. missile defenses
- Developed and performed data-driven analyses to identify U.S. DoD capability improvements
- Produced briefing materials to present to key U.S. DoD decision makers

**Undergraduate Research Assistant**                              **June 2010 - May 2013**
*Department of Mechanical Engineering, Brigham Young University*

- Published research on fluid activated passive dampening as primary author
- Trained in methods of applied mathematics partnered with computation in MATLAB
- Furnished analytical and mathematical support to experimental techniques

### Office of Naval Research NREIP Intern — Summer 2011
*Naval Surface Warfare Center, Dahlgren, Virginia*
- Designed and carried out experiment to study optimal nose shape for submerging projectiles
- Presented results to division commanding officers and staff.
- Obtained U.S. Department of Defense security clearance.

### Language Instructor (Swedish) — December 2009 - June 2010
*Missionary Training Center, Church of Jesus Christ of Latter-day Saints*
- Collaborated with other instructors to prepare lessons to satisfy curriculum and individual student needs.
- Counseled with students to overcome individual concerns and problems.
- Instructed and evaluated language fluency and understanding of concepts.

---

Volunteer

### Program Committee/Reviewer

- **ICML**: 2019-Present
- **CHIL**: 2020-Present
- **NeurIPS**: 2019-Present
- **ICLR**: 2020-Present
- **TMLR**: 2022-Present
- **JMLR**: 2021-Present
- **NeurIPS ML4H Workshop**: 2017-Present
- **NeurIPS Offline RL Workshop**: 2020-Present
- **NeurIPS Deep RL Workshop**: 2020-Present
- **AAAI**: 2018

### Mentor — May 2020 - Present
*Black in AI*

### Technical Recruiter, Campus Recruiting — December 2014 - July 2019
*Human Resources, MIT Lincoln Laboratory*
- Organized campus information events to introduce Laboratory mission and aims
- Served as mentor and advocate for candidates seeking employment

### Committee Member; PED Seminar Series — June 2015 - December 2017
*MIT Lincoln Laboratory*
- PED = Processing, Exploitation and Dissemination
- Assisted in the organization and planning of seminar series focused on leveraging modern computation techniques to extract actionable insight
- Hosted leading researchers in Machine Learning and Artificial Intelligence

### President, Student Advisory Committee — January 2011-December 2011
*Department of Mathematics, Brigham Young University*
- Led effort to improve curriculum and increase collaboration between students and faculty.
- Participated in department review to introduce an applied and computational concentration.
- Planned and carried out activities to promote mathematics and educate BYU community.

**Missionary, Sweden Stockholm Mission**                                      **March 2007 - March 2009**
*The Church of Jesus Christ of Latter-day Saints*

- Managed and oversaw the work and safety of 12 other missionaries in remote areas of Sweden.

- Trained 6 newly arrived missionaries in language, culture, and proselyting skills.

- Served full-time as a church representative identifying and meeting the needs of the community.