Taylor W. Killian

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Research Interests

Computational and mathematical strategies for efficient and effective *decision making* in the presence of uncertainty: particularly in the use of *transfer learning* within *causal inference*, *reinforcement learning* and *healthcare*.

Education

Ph.D., Computer Science **Expected June 2023**
University of Toronto, Toronto, ON, Canada

Advisor: Marzyeh Ghassemi

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
- LaTeX, MATLAB
- Java, CUDA, C++
- Fluent in Swedish

Awards

- ICML, Top Reviewer Award, 2019
- 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

Experience

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

Undergraduate Research Assistant **June 2010 - May 2013**
Department of Mechanical Engineering, Brigham Young University
- Published research on fluid activated passive dampening as primary author
- Furnished analytical and mathematical support to experimental techniques

Office of Naval Research NREIP Intern **Summer 2011**
Naval Surface Warfare Center, Dahlgren, Virginia

Language Instructor (Swedish) **December 2009 - June 2010**
Missionary Training Center, Church of Jesus Christ of Latter-day Saints

Volunteer

Program Committee/Reviewer
AAAI 2018, NeurIPS ML4H Workshop 2017-Present, ICML 2019, NeurIPS 2019

Technical Recruiter, Campus Recruiting **December 2014 - July 2019**
Human Resources, MIT Lincoln Laboratory

Committee Member; PED Seminar Series **June 2015 - December 2017**
MIT Lincoln Laboratory

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

Publications

- Silva, A., Gombolay, M., **Killian, T.**, Jimenez, I., Son, S.-H., "Optimization Methods for Interpretable Differentiable Decision Trees Applied to Reinforcement Learning", **2019.** *in submission*
- Subramanian, J., Fatemi, M., **Killian, T.**, Ghassemi, M., "Information Encoding for Offline RL in Healthcare", **2019.** *in submission*
- **Killian, T.**, Goodwin, J., Brown, O. & Son, S-H., "Kernelized Capsule Networks", *1st Workshop on Understanding and Improving Generalization in Deep Learning*, ICML 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*, FAIM 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. 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 (pp. 6245-6250). (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). (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

- 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).

Presentations

- 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*, FAIM 2018.
- **Killian. T.**, Daulton, S., Konidaris, G. & Doshi-Velez, F., "Robust and Efficient Transfer Learning using Hidden Parameter Markov Decision Processes." *NIPS 2017.* Long Beach, CA. December 6, 2017. **Oral presentation in the RL, Algorithms and Applications session**
- **Killian. T.**, Doshi-Velez, F. & Konidaris, G., "Robust and Efficient Transfer Learning using Hidden Parameter Markov Decision Processes." *31st AAAI Conference.* San Francisco, CA. February 7, 2017.
- **Killian. T.**, & Doshi-Velez, F., "Accounting for Patient Variation when Predicting Effective Treatment Policies." *MIT Lincoln Laboratory PED Seminar Series.* Lexington, MA. July 12, 2016.
- **Killian. T.**, Bryson, J., Bird, JC., Huey, J., Truscott, T.T., "Self Healing Soap Films." *65th Annual Meeting of the American Physical Society Division of Fluid Dynamics.* San Diego, CA. November 21-23, 2012.
- **Killian. T.**, Klaus, R. & Truscott, T.T., "Harnessing sloshing as a passive dampener." *64th Annual Meeting of the American Physical Society Division of Fluid Dynamics.* Baltimore, MD. November 20-22, 2011.
- **Killian. T.**, Klaus, R. & Truscott, T.T. , "Sphere rebound suppression from sloshing," *75th Annual Meeting of the American Physical Society.* Dallas, TX. March 2011.

Posters/Videos

- [Poster] **Killian, T.**, Goodwin, J., Brown, O. & Son, S-H., "Kernelized Capsule Networks", *1st Workshop on Understanding and Improving Generalization in Deep Learning*, ICML 2019.
- [Poster] 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*, FAIM 2018.
- [Poster] **Killian. T.**, Daulton, S., Konidaris, G. & Doshi-Velez, F., "Robust and Efficient Transfer Learning using Hidden Parameter Markov Decision Processes." *NIPS 2017.* Long Beach, CA. December 6, 2017.
- [Poster] **Killian. T.**, Konidaris, G. & Doshi-Velez, F., "Robust and Effective Transfer Learning using Hidden Parameter Markov Decision Processes." *31st AAAI Conference.* San Francisco, CA. February 7, 2017
- [Poster] **Killian. T.**, Konidaris, G. & Doshi-Velez, F., "Transfer Learning Across Patient Variations with Hidden Parameter Markov Decision Processes." *NIPS Workshop on Machine Learning for Healthcare.* Barcelona, Spain. December 9, 2016.
- [Poster] **Killian. T.**, & Doshi-Velez, F., "Accounting for Patient Variation in the Development of Optimal Treatment Policies." *2nd Annual Harvard IACS Project Showcase.* Cambridge, MA. May 10, 2016.
- [Poster] **Killian. T.**, Hanus, D., & Doshi-Velez, F., "Inferring missing data & accounting for patient variation to predict effective HIV treaments." *5th Annual New England Machine Learning Day.* Cambridge, MA. May 6, 2016.
- [Video] **Killian. T.**, Huey, J., Bryson, J., & Truscott, T.T., "Self healing soap films," *65th Annual Meeting of the American Physical Society Division of Fluid Dynamics.* San Diego, CA. November 18-20, 2012. **http://arxiv.org/abs/1210.3797**
- [Poster] Jafek, A., Langley, K., **Killian. T.** & Truscott, T.T., "Bouncing in puddles," *64th Annual Meeting of the American Physical Society Division of Fluid Dynamics.* Baltimore, MD. November 20-22, 2011.

- [Poster] Klaus, R., **Killian. T.** & Truscott, T.T., "Sphere rebound suppression from sloshing," *63rd Annual Meeting of the American Physical Society Division of Fluid Dynamics*. Long Beach, CA. Nov 2010.

Projects

- **Weighted k-Centers, Optimal Facility Location** Using 2010 US Census data for the state of Massachusetts, we augmented Metric k-centers and Lloyd's algorithms to optimally place a constrained number of distribution centers. https://github.com/twkillian/am205-project
- **Stochastic Inference of Boston Bike-share Data** With data from the Hubway bike-sharing system from the 2012 season, we performed second order analyses to develop intuition about how to augment or improve the system. https://github.com/am207Hubway
- **Two-Stage Supermodular Minimization for Dictionary Selection** Developed preliminary approaches to solve dictionary selection under a supermodular assumption.
- **Automated Anomaly Detection in Surveillance Video** Attempted to provide real-time processing and identification of anomalous behavior in surveillance video, utilizing contemporary methods of parallel computing. https://github.com/cs205-surveillance
- **Quantitative Evaluation of Player Performance** Evaluated the transfer market of international soccer and the perception of player value. Developed a merit-based scoring metric, used to measure player impact in matches they participated in. This impact score was used to infer what value they would have on the transfer market. https://github.com/cs109-FIFA