ALEX KEARNEY

hi@alexkearney.com | (780)-655-4958

RESEARCH INTERESTS

Constructing knowledge of the world is central to intelligence. My research addresses how artificial intelligence systems can construct knowledge by deciding both what to learn and how to learn, independent of designer instruction.
I predominantly use Reinforcement Learning methods.

EDUCATION

PhD COMPUTER SCIENCE, Advisors: Prof. Rich Sutton & Prof. Patrick Pilarski
University of Alberta, expected graduation 2021 | Elevated from MSc program

BSc ARTIFICIAL INTELLIGENCE AND COMPUTER SCIENCE, First Class with Honors
University of Edinburgh, 2016

EXPERIENCE

MACHINE LEARNING ENGINEERING INTERN, Twitter Inc.
(2020-Present)

RESEARCH ASSISTANT, Reinforcement Learning & Artificial Intelligence Lab
(2017–2020) University of Alberta | Supervisors: Rich Sutton PhD, Patrick Pilarski PhD.

- Empirically demonstrated weaknesses in existing evaluation methods for predictive knowledge architectures in Reinforcement Learning.
- Related evaluation concerns to philosophical theories of knowledge, creating interdisciplinary connections to results.
- Proposed improved evaluation techniques for predictive knowledge architectures, with an emphasis on off-policy, life-long, continual learning problems.

MACHINE LEARNING RESEARCH INTERN, Borealis AI Research Institute
(Summer 2017)

- Improved stability of a step-size adaptation method for Temporal-difference (TD) learning, resulting in tuning free meta-learning based on feature relevance.

RESEARCH ASSISTANT, Reinforcement Learning & Artificial Intelligence Lab
(2016–2017) University of Alberta | Supervisors: Rich Sutton PhD, Patrick Pilarski PhD.

- Generalized step-size adaptation method for use with TD learning; improved performance over ordinary fixed step-size TD learning.
- Demonstrated efficacy of method to perform representation learning by scaling weight updates based on relevance of features.

RESEARCH INTERN, Reinforcement Learning & Artificial Intelligence Lab
(2015) University of Alberta | Supervisors: Patrick Pilarski PhD, Rich Sutton PhD.

- Performed comparison of step-size adaptation methods for TD learning on a variety of synthetic and real-world problems.
- Evaluated robustness of on-policy prediction methods in robot domains, with an emphasis on non-stationary problems.

RESEARCH INTERN, Rehabilitation Robotics Lab
(2013/2014) University of Alberta | Supervisors: Patrick Pilarski PhD, Rich Sutton PhD.

- Developed software for myoelectric control of a bionic third-limb.
- Contributed to a control system that learns predictions of user intent online while controlling a bionic limb.
- Conducted experiments with non-amputee users to evaluate effectiveness of a novel meta-learning algorithm in bionic limb control.

A. Kearney, O. Oxton, "Making Meaning: Semiotics Within Predictive Knowledge Architectures", *4th Mutidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM),* July 7-10, Montreal, Quebec, Canada, 2019. 5 pages*.* (Spotlight Talk)

A. Kearney, P. M. Pilarski, "When is a Prediction Knowledge?", *4th Mutidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM),* July 7-10, Montreal, Quebec, Canada, 2019. 5 pages*.*

J. Günther, **A. Kearney**, P. M. Pilarski, "General Value Freebies", *4th Mutidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM),* July 7-10, Montreal, Quebec, Canada, 2019. 5 pages*.*

Johannes Günther, **Alex Kearney**, Nadia Ady, Michael T. Dawson, Patrick M. Pilarski, "Meta-learning for predictive knowledge architectures: A case study using TIDBD on a sensor-rich robotic arm," *Proc. of 18th International Conference on Autonomous Agents and Multiagent Systems* (AAMAS), May 13-17th, Montreal, Canada, 2019.

A. Kearney, V. Veeriah, J. Travnik, R.S. Sutton, P.M. Pilarski, "Every Step You Take: Vectorized Adaptive Step-Sizes for Temporal-Difference Learning," *3rd Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM)*, July 7-10th, Ann Arbor, Michigan, USA, 2017, 5 pages.

A. J. Koop, **A. Kearney**, M. Bowling, P.M. Pilarski, "Dealing With Changing Contexts In Myoelectric Control," *Proc. Of Mec'14: Myoelectric Controls Symposium*, August 18-22, Fredericton, New Brunswick, 2014, Pp. 117-120.

A.L. Edwards, **A. Kearney**, M.R. Dawson, R.S. Sutton, and P.M. Pilarski, "Temporal-Difference Learning to Assist Human Decision Making during the Control of an Artificial Limb," *1st Multidisciplinary Conference on Reinforcement Learning and Decision Making* (RLDM), Oct. 25–27, Princeton, New Jersey, USA, 2013. 5 pages.

L. Cuthbertson, **A. Kearney**, R. Dawson, A. Zawaduk, E. Cuthbertson, A. Gordon-Tighe, K. W. Mathewson**,** *"Women, politics and Twitter: Using machine learning to change the discourse",* *4th AI for Social Good workshop, Dec 14th, Vancouver, Canada, 2019.*

A. Kearney, A. Koop, C. Sherstan, J. Günther, R.S. Sutton, P.M. Pilarski, M.E. Taylor, "Evaluating Predictive Knowledge," *AAAI Fall Symposium on Reasoning and Learning In Real-World Systems For Long-Term Autonomy*, October 18-20th, Arlington, VA, U.S.A, 2018.

J. Günther, **A. Kearney**, M.R. Dawson, C. Sherstan, P.M. Pilarski, "Predictions, Surprise, and Predictions of Surprise in General Value Function Architectures," *AAAI Fall Symposium on Reasoning and Learning In Real-World Systems For Long-Term Autonomy*, October 18-20th, Arlington, VA, U.S.A, 2018.

A. Kearney "Prediction and Perception in Reinforcement Learning", 2nd Workshop on (Dis)Embodied Perception of the Self and Other, co-located with 4th Avant Conference, Porto, Portugal, 2019. (Oral Presentation)

A. Kearney, O. Oxton "Making Meaning: Semiotics Within Predictive Knowledge Architectures", 11th Barbados Workshop on Reinforcement Learning, Bellairs Research Institute, Holetown, Barbados, 2019. (Oral Presentation)

A. Kearney, R.S. Sutton, P.M. Pilarski, "An Enactive Approach to Perception in Reinforcement Learning", *CAPNet/CPS CAN-ACN Satellite Symposium,* co-located with Canadian Association for Neuroscience Conference, Vancouver, British Colombia, Canada, 2018. (Oral

Presentation and Abstract)

A. Kearney, A. Koop, M. Bowling, P.M. Pilarski, "Partition Tree Learning for Improved Control of Myoelectric Prosthetics," *8th Annual Workshop for Women in Machine Learning*, Co-located with NIPS, Lake Tahoe, Nevada, Dec. 05, 2013. (Oral Presentation & Poster)

TECHNICAL REPORTS & NON-REFEREED CONTRIBUTIONS

A. Kearney, A. Koop, "What's a Good Prediction? Issues in Evaluating General Value Functions Through Error," arXiv: 2001.08823, 8 pages, (v1 from Jan 2020). *In Preparation*

J. Günther, N. M. Ady, **A. Kearney**, M. R. Dawson, & P. M. Pilarski. "Examining the Use of Temporal-Difference Incremental Delta-Bar-Delta for Real-World Predictive Knowledge Architectures," *arXiv:1908.05751*, 15 pages, (v1 from Aug 2019). *Under Review.*

A. Kearney, V. Veeriah, J. B. Travnik, R. S. Sutton, P. M. Pilarski, "Learning Feature Relevance Through Step Size Adaptation in Temporal-Difference Learning," arXiv: 1903.03252 [cs.LG] (arXiv): 38 pages, 2018 (v1 from March, 2019). *In Preparation.*

A. Kearney, V. Veeriah, J. B. Travnik, R. S. Sutton, P. M. Pilarski, "TIDBD: Adapting Temporal-difference Step-sizes Through Stochastic Meta-descent,"arXiv:1804.03334 [cs.LG] (arXiv): 9 pages, 2018 (v1 from May, 2017).

HONOURS & AWARDS

(2019) Alberta Innovates Graduate Science Scholarship| **Alberta Innovates | $26 000**
(2019) Borealis AI Fellowship | **Borealis AI | $10 000**
(2018) NSERC Postgraduate Scholarships-Doctoral | **NSERC | $63 000**
(2018/19) President's Doctoral Prize of Distinction | **University of Alberta | $30 000**
(2017) Science Graduate Scholarship | **University of Alberta | $ 2 000**
(2017) Walter H. Johns Graduate Fellowship | **University of Alberta | $5 800**
(2017) Canada Graduate Scholarships – Master's Program | **NSERC | $17 500**
(2014) Google Anita Borg Memorial Scholarship – EMEA | **Google | €10 000**

TRAVEL AWARDS & SCHOOLS

(2018) CIFAR | Neuroscience of Consciousness Winter School
(2018) CIFAR | Deep Learning & Reinforcement Learning Summer School
(2018) University of Indiana | Este's Young Stars Travel Award: Deep, Fast, And Shallow Learning in Humans and Machines

ACADEMIC SERVICE

- (2020) Reviewer for Cambridge Press (One book)
- (2019) Organizer for 11th Barbados Workshop on Reinforcement Learning
- (2019) Reviewer for 4th Reinforcement Learning and Decision Making Conference
- (2019) Reviewer for International Conference on Machine Learning (ICML)
- (2019) Graduate Representative for Computing Science Department Chair Review
- (2017) Reviewer for 3rd Reinforcement Learning and Decision Making Conference

LEADERSHIP

President: Edinburgh University Hoppers
(2014-2016) Edinburgh University Women in Technology Club
- Cultivated a community for women in computer science at the U of E.
- Fundraised and organized activities to support women in CS including, hackathons, workshops, technical talks, conferences, and coding competitions.

Vice President: Edinburgh University SocieTEA
(2015-2016) Edinburgh University Tea Society
- Organized, developed, and ran events for people who like tea.

Hackathon Coordinator, University of Edinburgh
(2014) | University of Edinburgh

- Coordinated a week-long hackathon at U of E for over 80 students.
- Gathered sponsors to finance the event; recruited gov't and industry volunteers.