

Matthew Schlegel

Affiliation: University of Alberta • E-Mail: mkschleg@gmail.com • Website: mkschleg.github.io

Education

University of Alberta – Edmonton, Alberta, CA PhD in Computing Science	Present
Indiana University – Bloomington, IN Master of Science in Computer Science	May 2017
Indiana University – Bloomington, IN Bachelor of Science in Physics with Distinction Minors: Computer Science, Math, Music	May 2015

Recent Publications and Projects

Conferences

- Importance Resampling for Off-Policy Prediction. **Matthew Schlegel**, Wesley Chung, Jian Qiang, Daniel Graves, Martha White. NeurIPS. 2019.
- Meta-descent for online, continual prediction. Andrew Jacobsen, **Matthew Schlegel**, Cameron Linke, Martha White, Adam White. AAAI. 2019.
- Context-dependent upper-confidence bounds for directed exploration. Raksha Kumaraswamy, **Matthew Schlegel**, Adam White, Martha White. Accepted at Neural Information Processing System Conference (NeurIPS). 2018.
- Adapting kernel representations online using submodular maximization. **Matthew Schlegel**, Yangchen Pan, Jiecao Chen, Martha White. International Conference on Machine Learning (ICML). 2017.

Preprint

- General Value Function Networks. **Matthew Schlegel**, Andrew Jacobsen, Andrew Patterson, Muhammad Zaheer, Adam White, Martha White. (In Preparation) arXiv preprint arXiv:1807.06763. 2019.

Workshop

- A Baseline of Discovery for General Value Function Networks under Partial Observability. **Matthew Schlegel**, Adam White, Martha White. Reinforcement Learning under Partial Observability Workshop at NeurIPS. 2018.
- Stable predictive representations with general value functions for continual learning. **Matthew Schlegel**, Adam White, Martha White. Continual Learning and Deep Networks workshop at NIPS. 2017.

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Research Experience

University of Alberta – Research Assistant

January 2019 – Current

Huawei – Research Intern

May 2018 – September 2018

University of Alberta – Research Assistant

August 2017 – May 2018

Indiana University – Research Assistant

May 2016 – July 2017

Teaching Experience

CMPUT 466/551: Machine Learning

Fall 2018, Fall 2019

University of Alberta - Teaching Assistant

CSCI B659: Reinforcement Learning

Spring 2017

Indiana University - Teaching Assistant

CSCI C335: Computer Structures

Spring 2017

Indiana University - Teaching Assistant

BIO L111: Foundations of Biology

Fall 2014

Indiana University - Teaching Assistant

Leadership and Public Speaking

Reinforcement Learning NeurIPS Social

2019

- On the organizing committee for the first reinforcement learning social hosted at the International Conference for Neural and Information Processing Systems.
- Found sponsorship, planned event, managed relationship with the convention center.

Making Minds Reading Group

July 2018 - present

- Organizing and planning the University of Alberta's "Making Minds Reading Group" (MMRG).

Startup Edmonton - Talk

November 14, 2018

- Presented to a non-technical audience on the formulation and use of General Value Functions focusing on work done in the University of Alberta's RLAI and BLINC labs.

Tea Time Talk

August 14, 2018

- Presented work produced in collaboration with Huawei (posted on AmiiThinks youtube channel).

Deep Learning Reinforcement Learning Summer School

Summer 2018

- Presented a poster on the General Value Function Networks. See recent publications for more information.

Indiana University – Diversity and Inclusion Workshop Leader

September 2015 – May 2017

- Create and present workshops, and other events to influence an inclusive environment within the School of Informatics and Computing as a part of the group Promoting Inclusion in Technology (PIT).

Institute for International Business – Program Assistant

Summer 2014 and 2015

- Worked as chaperone/counselor for the Institute's flagship Global Social entrepreneurship Institute. This 5-week immersive business, sponsored by the US State Department, targeted European University Students.

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Reviewing Experience

Conferences

AAAI (2019, 2020)

ICLR (2020)

ICML (2019)

NeurIPS (2019)

Workshops

Biological and Artificial Reinforcement Learning, NeurIPS Workshop (2019)

Optimization Foundations in Reinforcement Learning, NeurIPS Workshop (2019)

Awards

Grants

IVADO PhD Excellence Scholarship (\$100k)	2019-2023
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Other Awards

Runner up for Early PhD Achievement Award	2018
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University of Alberta Doctoral Recruitment Award	
2017-2018	

Dean's List (9 Semesters)	2010-2015
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Founders Scholar (4 Semesters)	2011, 2012
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John Philip Sousa Band Award	2010
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Research Interests

Predictions as cognition

I am keenly interested in the relationship of prior work in predictive cognition in the brain and current research in reinforcement learning, specifically the use and learning of general value functions (GVFs) as predictive units. While there are many types of predictions (and subsequent definitions and nuances) the most interesting is in how predictions effect behavior---defined as anticipation (Bubic, 2010). There are several issues with using GVFs trained online to effect behavior that informs much of my research: stability, off-policy policy evaluation, predictions as representation, and others.

Off-policy Policy Evaluation

To learn many predictions online, it is beneficial to learn about behaviors which are not currently being followed, this is where off-policy policy evaluation comes in. The main contribution of this line of work has been the importance resampling algorithm, which manages to empirically reduce variance in many scenarios without interjecting significant bias or computation requirements, like VTrace or Weighted Importance Sampling respectively. I also have interests in understanding how RMSProp/AMSGrad type learning rate adaptation

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algorithms interact with off-policy learning, and in extending importance resampling to the case of many value functions with a shared representation.

Discovery in Predictive Representations

Representations built from predictions (and really all methods using predictions to effect behavior) all face a common hurdle, the discovery problem. This is the creation and learning of useful predictions in an online process. My current work focuses on defining the base aspects of the problem, and describing a general framework to do discovery. This leads in two directions. The first is describing an ontology, or an ordering, of general value function question specification to be able to generate a diverse set of questions. The second is in credit assignment or the usefulness of a prediction in driving behavior.

Other Interests

My academic background is quite diverse, and I enjoy reading and thinking on a large number of topics including Music, Physics, Biology, and Cognitive Science. I have been a part several Wind Ensembles (playing my primary instrument the clarinet), and spend many evenings playing acoustic guitar. I have an intense love of espresso and coffee, which I share (not so regularly) in my blog: coffeesideai.com.

Technical Skills

- Proficient in several languages including Julia, Python, C/C++, R, Bash scripting, and others; with experience using various build environments including make, and cmake.
- Hands on experience with several machine learning, linear algebra, and miscellaneous libraries including Flux, Tensorflow, Eigen, SDL, and GNU Scientific Library.
- Demonstrated capabilities in writing and communication through published works, and several teaching and leadership experiences.