John D. Martin

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EDUCATION

University of Alberta **2021 – Present**
Postdoctoral Fellow in the Department of Computing Science

Stevens Institute of Technology **2015 – 2021**
Ph.D. in Mechanical Engineering

University of Maryland **2009 – 2012**
Dual B.S. in Physics and Aerospace Engineering

RESEARCH EXPERIENCE

Reinforcement Learning and AI Lab - University of Alberta. **2021 – Present**
Postdoctoral Fellow – Advisor: Michael Bowling

I supervise a group of three graduate students, researching ways to improve the generality of reinforcement learning. One of my projects studies how RL systems can learn from uninterpreted observations. My other projects aim to improve the way learners reason with internally-generated experience, using expressive models that go beyond simply replicating observations. Additionally, my supervisory responsibilities involve reviewing dissertations and participating in thesis defenses.

Robust Field Autonomy Laboratory - Stevens Institute of Tech. **2015 – 2021**
Graduate Research Assistant – Advisor: Brendan Englot

I studied the application of reinforcement learning to mobile robotics. I focused particularly on how to improve the generality of decision making systems by incorporating representations of aleatoric and/or epistemic uncertainty. Much of this work involved a combination of ideas from artificial intelligence, optimization, and probabilistic modeling.

DeepMind - Edmonton **June 2020 – Nov. 2020**
Research Scientist Intern – Host: Joseph Modayil

I studied continual prediction when a reinforcement learning system is given uninterpreted observations and makes updates incrementally online.

Google Brain - Montréal **May 2019 – Feb. 2020**
Research Scientist Intern / Student Researcher – Host: Marc G. Bellemare

I studied continual reinforcement learning for control in two projects. The first project studies efficient exploration with prior knowledge of a novel invariance in the transition structure. The other project studies how to detect catastrophic interference in deep neural networks.

Alfred Gessow Rotorcraft Center - University of Maryland **2011 – 2012**
Undergraduate Research Assistant

I developed algorithms to automatically control a miniature tilt-wing air vehicle. This involved dynamic modeling, feedback control, and embedded processor software design.

Autonomous Vehicle Laboratory - University of Maryland **2010 – 2011**
Undergraduate Research Assistant

I developed algorithms to control novel robotic platforms, including an insect-inspired crawling robot, and a radiation-guided quad-rotor.

Robotics@Maryland - University of Maryland **2009 – 2011**
Project Leader

I co-lead a team of approximately 20–30 undergraduates designing and fabricating an autonomous underwater robot from scratch.

PROFESSIONAL EXPERIENCE

Piasecki Aircraft Corporation **2017 – 2019**
Part-time Analytical Consultant

I provided technical direction for new autonomy research initiatives. I wrote multiple proposals for several SBIR/STTR, Army, and DARPA programs. One of my proposals resulted in full Phase II SBIR funding.

Sikorsky Aircraft **2012 – 2015**
Robotics and Flight Controls Engineer

I worked with a small group of engineers and researchers that took two experimental helicopters to first flight. I was a lead contributor on the X-76 motion planning effort, which involved writing and testing flight-critical software with full-scale flight tests. I contributed designs for two flight-critical subsystems on the S-97: the main rotor servos, and the triply-redundant flight control voting logic. Below are some further details.

- Developed, integrated, and flight-tested motion planning algorithms on a full-scale S-76.
- Implemented a *simplex linear program solver* to optimize speed during flight.
- Developed, integrated, and tested flight control algorithms on the X-76 OPV and S-97.
- Developed a simulation interface to emulate the entire S-97 avionics system.
- Automatically translated MATLAB to C-code for a real-time operating system.
- Participated in peer reviews to qualify flight-critical software.
- Reviewed and generated avionic-systems wiring schematics.

TEACHING EXPERIENCE

Nepal Applied Mathematics and Informatics Institute **December 2021**
Program Committee.
I co-organized an introductory lecture series on reinforcement learning consisting of four ninety-minute lectures, two of which I gave. In addition, I helped to organize the lecture series on introductory machine learning topics.

Stevens Institute of Technology, Advanced Robotics (ME-654) Spring 2020, 2021
Guest Lecture: Seeking Certainty in An Uncertain World
I gave a guest lecture centered on uncertainty-sensitive decision making in RL.

Stevens Institute of Technology, Advanced Robotics (ME-654) **Spring 2017**
Guest Lecture: Reinforcement Learning Basics
I co-taught a lecture with other instructors, introducing students to the basics of RL.

Stevens Institute of Technology, Senior Design (ME-423) **Fall 2014**
Guest Lecture: Sikorsky R&D: Motion Planning for Autonomous Rotorcraft
I gave an industry guest lecture on motion planning algorithms for autonomous helicopters.

REFEREED PUBLICATIONS

Stochastically Dominant Distributional Reinforcement Learning,
John D. Martin, Michal Lyskawinski, Xiaohu Li, Brendan Englot,
37th International Conference on Machine Learning (ICML), (2020).

Variational Filtering with Copula Models for SLAM,
John D. Martin*, Kevin Doherty*, Caralyn Cyr, Brendan Englot, John Leonard,
International Conference on Intelligent Robots and Systems (IROS), (2020).

Autonomous Exploration Under Uncertainty via Deep Reinforcement Learning on Graphs,
Fanfei Chen, **John D. Martin**, Yewei Huang, Jinkun Wang, Brendan Englot
International Conference on Intelligent Robots and Systems (IROS), (2020).

Fusing Concurrent Orthogonal Wide-aperture Sonar Images for Dense Underwater 3D Reconstruction,
John McConnell, **John D. Martin**, Brendan Englot
International Conference on Intelligent Robots and Systems (IROS), (2020).

Sparse Gaussian Process Temporal Difference Learning for Marine Robot Navigation,
John D. Martin, Jinkun Wang, Brendan Englot,
2nd Annual Conference on Robot Learning (CoRL), (2018).

Extending Model-based Policy Gradients for Robots in Heteroscedastic Environments,
John D. Martin, Brendan Englot,
1st Annual Conference on Robot Learning (CoRL), (2017).

WORKING PAPERS

Adapting the Function Approximation Architecture in Online Reinforcement Learning,
John D. Martin*, Joesph Modayil*
ArXiv 2106.09776 (2021)

On Catastrophic Interference in Atari 2600 Games,
William Fedus*, Dibya. Ghosh*, **John D. Martin**, Marc G. Bellemare, Yoshua Bengio, Hugo Larochelle
ArXiv 2002.12499 (2020)

WORKSHOP PUBLICATIONS

MEMENTO: Further Progress Through Forgetting,
William Fedus*, Dibya. Ghosh*, **John D. Martin**, Marc G. Bellemare, Yoshua Bengio, Hugo Larochelle
NeurIPS Workshop on Biological and Artificial RL (2019). (Best Poster Award)

Stochastically Dominant Distributional Reinforcement Learning,
John D. Martin, Michal Lyskawinski, Xiaohu Li, Brendan Englot,
NeurIPS Workshop on Safety and Robust Decision Making (2019).

POSTERS

Stochastically Dominant Distributional Reinforcement Learning,
John D. Martin, Michal Lyskawinski, Xiaohu Li, Brendan Englot,
New York Academy of Sciences, Machine Learning Symposium, (2020)

Distributed Gaussian Process Temporal Differences for Actor-critic Learning,
John D. Martin, Zheng Xing, Zhiyuan Yao, Ionut Florescu, Brendan Englot,
New York Academy of Sciences, Machine Learning Symposium, (2018)

INVITED TALKS

Google Brain, Sparsity Reading Group (Virtual), **August 2021**
Adapting the Function Approximation Architecture in Online Reinforcement Learning.

University of California Berkeley RAIL (Virtual), **November 2020**
Uncertainty, Perception, and Their Lessons for Creating General-purpose Robots.

Massachusetts Institute of Technology (MIT) CSAIL, **November 2019**
From Tasks to Timescales: A path to generalization in reinforcement learning.

Deepmind, Edmonton **October 2019**
From Tasks to Timescales: A path to generalization in reinforcement learning.

Google Robotics, New York **August 2019**
Exploiting Transition Invariance for Multi-stage Reinforcement Learning Tasks.

AWARDS

Robert Crooks Stanley Fellow **Jul. 2019, Jul. 2020**
Provides one year of research funding. Two-time recipient.

Department of Homeland Security Doctoral Fellow **Sep. 2015**
Provided four years of academic and research funding.

AHS Howard Hughes Award **Feb. 2015**

Accepted on behalf of the Sikorsky Autonomous Research Aircraft team, for achieving completely autonomous flight with an S-76 helicopter, including takeoff, path planning, navigation to an objective, and landing zone selection.

ACADEMIC SERVICE

Organizer: NAAMII Winter AI School, ICML Reinforcement Learning Social, 2020

Reviewer: ICLR, NeurIPS, ICML, CoRL, WAFR, RAL, ICRA, IROS

Mentor: NeurIPS New in ML Workshop 2020