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

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

I studied questions related to reinforcement learning and robotics. Particularly, I focused on how the generality of robotic decision making systems can improve by considering different aspects of 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 unstructured 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 researched how to control an RC-sized tilt-wing air vehicle, specifically focusing on dynamic modeling, system identification, feedback control, and embedded processor software design.

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

I researched how 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

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*
Submitted to 38th International Conference on Machine Learning (ICML), (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

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

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

Mentor: NeurIPS New in ML Workshop 2020

COMPUTER SKILLS

Languages and Tools

- *Currently Proficient:* PYTHON, JAX, PANDAS, C++, R
- *Was once Proficient:* C, OCAML, YACC, MATLAB, SIMULINK, PDDL, BASH, SED,t FORTRAN, AWK, LISP, LABVIEW, VBSCRIPT, HTML, XML, CSS, PHP