Mark **Edmonds**

Artifical Intelligence · Cognitive Science · Robotics

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Education

University of California, Los Angeles — Los Angeles, CA
Ph.D. in Computer Science, Artifical Intelligence Concentration; Advisor: Prof. Song-Chun Zhu — *Expected Jun 2021*

University of California, Los Angeles — Los Angeles, CA
M.S. in Computer Science; Advisor: Prof. Song-Chun Zhu — *Jun 2017*

University of Dayton — Dayton, OH
B.S. in Computer Engineering; Magna Cum Laude; Advisor: Prof. Tarek Taha — *May 2015*

Research Interests

Causal Learning Causal model induction through simulation and exploration
Explainable AI Explainable representations and explanation generation
Robotics Learning from demonstration and transfer learning

Skills

Programming Python, C/C++, Shell, LaTeX, Matlab, Javascript, HTML5, CSS, Node.JS, Java, CUDA
Topics Machine Learning, Graphical Models, Reinforcement Learning, Bayesian Networks, Statistical Modeling

Research

Causal Transfer Learning — Los Angeles, CA
Graduate Student Researcher; Center for Vision, Cognition, Learning, and Autonomy (VCLA) — *Sep 2017 – Present*

- Examining how causal knowledge can be incorporated into reinforcement learning to enable better knowledge transfer across task and environment domains.
- Matched human causal learning performance by decomposing causal representations into two Bayesian components: a bottom-up associative learning scheme and a top-down structure learning scheme.
- Studied how humans perform in causal transfer tasks and compared performance against state-of-the-art reinforcement learning algorithms.

Fostering Human Trust through Explainable AI (XAI) — Los Angeles, CA
Graduate Student Researcher; Center for Vision, Cognition, Learning, and Autonomy (VCLA) — *Jan 2019 – Present*

- Developing a computational model to generate explanations for robot behavior based on theory-of-mind (ToM) in a communicative learning setting.
- Fostered trust between robots and humans in an imitation learning setting by providing sequential, action-level explanations to human subjects. This work built off of my work on imitation learning using tactile feedback.

Transferrable Representation Learning using Language Supervision — Los Angeles, CA
Graduate Student Researcher; Center for Vision, Cognition, Learning, and Autonomy (VCLA) — *Jun 2019 – Present*

- Developing a photorealistic virtual environment (based on Unreal Engine) that provides semantic language labels for objects and actions occurring in the virtual agent's field of view.
- Examining the role of language in building generalizable, commonsense representations of the environment.

Imitation Learning using Tactile Feedback — Los Angeles, CA
Graduate Student Researcher; Center for Vision, Cognition, Learning, and Autonomy (VCLA) — *Sep 2015 – Sep 2017*

- Transferred visually latent causal changes from a human demonstrator to a robot using a tactile glove, an And-Or graph, and neural networks.
- Utilized a manipulation policy that encodes long-term temporal constraints using an And-Or graph and leverages haptic feedback from human demonstrators to incorporate real-time sensor data.
- Deployed robot localization on a ROS-based Baxter robot combining SLAM (using RGB-D and LIDAR), wheel odometry, and IMU data through Kalman filtering.

Declarative Memory Acceleration — Dayton, OH
Undergraduate Researcher; Air Force Research Lab (AFRL) — *May 2014 – Sep 2015*

- Accelerated the declarative memory module of AFRL's CECEP cognitive architecture (based on ACT-R) by leveraging the parallelization of CUDA, yielding a 100x speedup over the fastest existing implementation.

Experience

Santa Monica College — Santa Monica, CA
Adjunct Professor, Computer Science Department — *Jun 2016 - Present*

- CS 80, Internet Programming, a class focused on HTML, CSS, JavaScript, MySQL, and PHP.
- CS 50, Introduction to C Programming, a class focused on C fundamentals.
- CS 52, Introduction to C++ Programming, a class focused on C++ fundamentals.

International Center for AI and Robot Autonomy — Los Angeles, CA
Robotics Research Engineer Intern — *Jun 2018 - Mar 2020*

- Built virtual environment for embodied AI that couples language and vision to learn transferrable representations of the environment.

UCLA Radio — Los Angeles, CA
Deep End Theory Podcast Host — *Jan 2016 - Jan 2020*

- Hosted a podcast focused on electronic music that garnered tens of thousands of plays and interviewed some of my favorite electronic music producers.

Garmin International — Olathe, KS
Software Engineering Intern, Aviation Department — *May 2013 - Aug 2013*

- Reduced testing time by 40% for the Datalink team by optimizing timing protocols while adhering to safety standards, saving hundreds of vendor-certification testing time hours.

Cristo Rey Kansas City High School — Kansas City, MO
Summer School Teacher — *May 2011 - Aug 2012*

- Taught pre-calculus and chemistry at a high school focused on college placement for underrepresented groups.

Journal Publications

[3] Y. Zhu, T.Gao, L. Feng, S. Huang, **M. Edmonds**, H. Liu, F. Gao, C. Zhang, S. Qi, Y.N. Wu, J. Tenenbaum, S.C. Zhu
"Dark, Beyond Deep: A Paradigm Shift to Cognitive AI with Humanlike Common Sense," *Engineering 2020.*

[2] **M. Edmonds***, F. Gao*, H. Liu*, X. Xie*, S. Qi, B. Rothrock, Y. Zhu, Y.N. Wu, H. Lu, S.C. Zhu
"A tale of two explanations: Enhancing human trust by explaining robot behavior," *Science Robotics 2019.*

[1] **M. Edmonds**, T. Atahary, S. Douglass, T. Taha.
"Hardware Accelerated Semantic Declarative Memory Systems through CUDA and MapReduce," *TPDS 2018.*

(* indicates equal contribution)

Conference Publications

[8] **M. Edmonds**, X. Ma, S. Qi, Y. Zhu, H. Lu, S.C. Zhu — ***Oral Pres.***
"Theory-based Causal Transfer: Integrating Instance-level Induction and Abstract-level Structure Learning," *AAAI 2020.*

[7] **M. Edmonds**, S. Qi, Y. Zhu, J. Kubricht, S.C. Zhu, H. Lu.
"Decomposing Human Causal Learning: Bottom-up Associative Learning and Top-down Schema Reasoning," *CogSci 2019.*

[6] **M. Edmonds***, J. Kubricht*, Colin Summers, Y. Zhu, B. Rothrock, S.C. Zhu, H. Lu. — ***Oral Pres.***
"Human Causal Transfer: Challenges for Deep Reinforcement Learning," *CogSci 2018.*

[5] X. Xie*, H. Liu*, **M. Edmonds**, F. Gao, S. Qi, Y. Zhu, B. Rothrock, S.C. Zhu.
"Unsupervised Learning of Hierarchical Models for Hand-Object Interactions," *ICRA 2018.*

[4] **M. Edmonds***, F. Gao*, X. Xie, H. Liu, S. Qi, Y. Zhu, B. Rothrock, & S.C. Zhu. — ***Oral Pres.***
"Feeling the Force: Integrating Force and Pose for Fluent Discovery through Imitation Learning to Open Medicine Bottles," *IROS 2017.*

[3] H. Liu*, X. Xie*, M. Millar*, **M. Edmonds**, F. Gao, Y. Zhu, V. Santos, B. Rothrock, & S.C. Zhu. — ***Oral Pres.***
"A Glove-based System for Studying Hand-Object Manipulation via Pose and Force Sensing," *IROS 2017.*

[2] **M. Edmonds**, T. Atahary, T. Taha, & S. Douglass.
"High Performance Declarative Memory Systems through MapReduce," *SNPD 2015.*

[1] D. Prince, **M. Edmonds**, A. Sutter, M. Cusumano, W. Lu, & V. Asari.
"Brain Machine Interface using Emotiv EPOC to control Robai Cyton Robotic Arm," *NAECON 2015.*

(* indicates equal contribution)

Honors, Awards & Recognition

2020 **Press: People prefer robots to explain themselves – and a brief summary doesn't cut it**, The Conversation — Online
2019 **Press: A Robot That Explains Its Actions Is a First Step Towards AI We Can (Maybe) Trust**, IEEE Spectrum — Online
2017 **NSF Doctoral Consortium**, IROS 2017 — Vancouver, BC
2015 **The Anthony Horvath and Elmer Steger Award of Excellence**, University of Dayton — Dayton, OH
2014 **Eta Kappa Nu IEEE Honor Society**, Member — Dayton, OH
2014 **Tau Beta Pi Engineering Honor Society**, Member — Dayton, OH
2011 **Eagle Scout**, Boy Scouts of America — Kansas City, KS

Invited Talks

Causal Transfer: Challenges for Causal Learning and Reinforcement Learning — White Mountain, NH
Student speaker at the ONR MURI Meeting — *Sep 2018*

Causal Imitation: The Necessity of Integrating Observations and Interventions — Pittsburgh, PA
Keynote Speaker at the RSS Causal Imitation Workshop — *Jun 2018*

Feeling the Force: Integrating Force and Pose for Imitation Learning — Los Angeles, CA
Student speaker at the ONR MURI Meeting — *Aug 2017*

Conference Presentations

Theory-based Causal Transfer: Integrating Instance-level Induction and Abstract-level Structure Learning — New York, NY
AAAI 2020 — *Feb 2020*

Human Causal Transfer: Challenges for Deep Reinforcement Learning — Madison, WI
CogSci 2018 — *Jul 2018*

Feeling the Force: Integrating Force and Pose for Imitation Learning — Mountain View, CA
CoRL 2017 Lightning Talk — *Nov 2017*

Feeling the Force: Integrating Force and Pose for Imitation Learning — Vancouver, BC
IROS 2017 — *Sep 2017*