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 — *Present*

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
Reinforcement Learning	Transfer learning and domain adaptation
Robotics	Learning from demonstration and transfer learning

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)

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*

- Investigating the form of explanations that foster human trust and the computational models that support such explanations.
- 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.

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.

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
Teaching	Introduction to C, Introduction to C++, Internet Programming

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*