

Education

University of California, Los Angeles

Ph.D. in Computer Science, Artificial Intelligence Concentration; Advisor: Prof. Song-Chun Zhu

Los Angeles, CA

Expected Jun 2021

University of California, Los Angeles

M.S. in Computer Science; Advisor: Prof. Song-Chun Zhu

Los Angeles, CA

Jun 2017

University of Dayton

B.S. in Computer Engineering; Magna Cum Laude; Advisor: Prof. Tarek Taha

Dayton, OH

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

Adjunct Professor, Computer Science Department

Santa Monica, CA

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

Robotics Research Engineer Intern

Los Angeles, CA

Jun 2018 - Mar 2020

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

UCLA Radio

Deep End Theory Podcast Host

Los Angeles, CA

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

Software Engineering Intern, Aviation Department

Olathe, KS

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

Summer School Teacher

Kansas City, MO

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

- [9] C. Zhang, B. Jia, **M. Edmonds**, S.C. Zhu, Y. Zhu
“ACRE: Abstract Causal REasoning Beyond Covariation,” *CVPR* 2021.
- [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	<i>Sep 2018</i>
Causal Imitation: The Necessity of Integrating Observations and Interventions	Pittsburgh, PA
Keynote Speaker at the RSS Causal Imitation Workshop	<i>Jun 2018</i>
Feeling the Force: Integrating Force and Pose for Imitation Learning	Los Angeles, CA
Student speaker at the ONR MURI Meeting	<i>Aug 2017</i>

Conference Presentations

Theory-based Causal Transfer: Integrating Instance-level Induction and Abstract-level Structure Learning	New York, NY
AAAI 2020	<i>Feb 2020</i>
Human Causal Transfer: Challenges for Deep Reinforcement Learning	Madison, WI
CogSci 2018	<i>Jul 2018</i>
Feeling the Force: Integrating Force and Pose for Imitation Learning	Mountain View, CA
CoRL 2017 Lightning Talk	<i>Nov 2017</i>
Feeling the Force: Integrating Force and Pose for Imitation Learning	Vancouver, BC
IROS 2017	<i>Sep 2017</i>