Gregory Patrick Davis

grpdavis@umd.edu http://www.cs.umd.edu/~grpdavis/

RESEARCH INTERESTS

Bio-inspired computation and artificial intelligence

My goal is to develop neurocognitive models that advance the learning capabilities of intelligent machines and provide testable predictions about the neural basis of cognition and development in biological agents. Specific topics of interest include attractor dynamics in recurrent neural networks, multiplicative gating, associative learning, top-down control of working memory, hierarchical planning, causal inference, and neurosymbolic reasoning.

EDUCATION

University of Maryland - College Park Ph.D. in Computer Science Graduate Certificates: Neuroscience and Cognitive Science Computation and Mathematics for Biological Networks

California Polytechnic State University - San Luis Obispo B.S. in Computer Science Minor in Psychology

September 2012 - June 2016 Cumulative GPA: 3.99 Summa Cum Laude

August 2016 - May 2022

Cumulative GPA: 4.0

EXPERIENCE

Weill-Cornell Medical School

Postdoctoral Associate in Physiology and Biophysics

- · Joint postdoc in Aksay Lab (Weill-Cornell Medicine) and Goldman Lab (UC Davis)
- Two-photon microscopy and optogenetics for closed-loop control of hindbrain oculomotor circuits in larval zebrafish
- · Biophysical modeling of attractor dynamics in recurrent neural circuits

University of Maryland, College Park

- Graduate Research Assistant
- · Worked on an ONR-funded research project to develop a neurocognitive imitation learning system
- Designed, implemented, and tested novel methods for:
 - Learning compositional data structures as systems of attractor states in recurrent neural networks
 - Representing and executing high-level symbolic programs in attractor neural networks
 - Efficient hierarchical causal reasoning for imitation learning in programmable neural networks
- · Implemented a neural inverse kinematic model for bimanual arm control and evaluated its performance on a Baxter Research Robot (Rethink Robotics)
- · Developed a neurocomputational model of cognitive-emotional interference in PTSD that makes testable predictions about behavioral performance in clinically-relevant cognitive-motor tasks

1

Graduate Teaching Assistant

- · CMSC 216 Intro to Computer Systems (C, Unix systems programming, MIPS assembly)
- Taught discussion sections, held office hours, proctored and graded course examinations

New York City, NY August 2022 -

College Park, MD

January 2017 - January 2022

August 2016 - December 2016

Institute for Advanced Technology and Public Policy	San Luis Obispo, CA
Student Research Fellow - Diaital Democracy	October 2014 - July 2016

October 2014 - July 2016

- · Worked on a government transparency project that provides a searchable database of transcribed and annotated legislative committee hearings
- · Contributed to speaker identification models, database design, and automated web scraping pipeline

AWARDS AND SCHOLARSHIPS

Student Research Fellow - Digital Democracy

Outstanding Research Assistant Award University of Maryland - College Park	Spring 2022
\cdot Awarded to the top 2% of campus graduate assistants for exemplary achievement in research	
Ann G. Wylie Dissertation Fellowship University of Maryland - College Park	Spring 2022 Amount: \$15000
\cdot Semester-long fellowship available to graduate students who are completing their dissertations	
Computation and Mathematics for Biological Netw University of Maryland - College Park	vorks Fellowship August 2017 Amount: \$34000
\cdot Interdisciplinary data-driven network biology program (NSF-NRT award number 1632976)	
 J.L. Moore Doctoral Fellowship Computer Science Department, Cal Poly - San Luis Obisp Available to Computer Science graduates pursuing a Ph.D 	2016, 2017 Amount: \$10000 (x2) 0. in Computer Science
Undergraduate Academic Excellence Award College of Engineering, Cal Poly - San Luis Obispo	May 2016

• Awards are granted to students with the highest GPA in the college

PUBLICATIONS

Journal Papers

- · Davis GP, Katz GE, Gentili RJ, Reggia JA. NeuroCERIL: Robotic Imitation Learning via Hierarchical Cause-Effect Reasoning in Programmable Attractor Neural Networks. International Journal of Social Robotics. In review.
- · Davis GP, Katz GE, Gentili RJ, Reggia JA. NeuroLISP: High-level Symbolic Programming with Attractor Neural Networks. Neural Networks. 2022 Feb;146:200-219.
- · Katz GE, Akshay ., Davis GP, Gentili RJ, Reggia JA. Tunable Neural Encodings of Symbolic Robotic Manipulation Algorithms. Frontiers in Neurorobotics. 2021 Dec 14;15.
- · Hauge TC, Katz GE, Davis GP, Huang DW, Reggia JA, Gentili RJ. High-level motor planning assessment during performance of complex action sequences in humans and a humanoid robot. International Journal of Social Robotics. 2021 Aug;13(5):981-98.
- · Davis GP, Katz GE, Gentili RJ, Reggia JA. Compositional Memory in Attractor Neural Networks with One-Step Learning. Neural Networks. 2021 June 1;138:78-97.
- · Reggia JA, Katz GE, Davis GP. Artificial Conscious Intelligence. Journal of Artificial Intelligence and Consciousness. 2020 Mar 29;7(01):95-107.
- · Katz GE, Davis GP, Gentili RJ, Reggia JA. A programmable neural virtual machine based on a fast store-erase learning rule. Neural Networks. 2019 Nov 1;119:10-30.
- · Reggia JA, Katz GE, Davis GP. Modeling Working Memory to Identify Computational Correlates of Consciousness. Open Philosophy. 2019 Jan 1;2(1):252-69.

- · Reggia JA, Katz GE, **Davis GP**. Humanoid cognitive robots that learn by imitating: implications for consciousness studies. Frontiers in Robotics and AI. January 26, 2018.
- Hauge TC, Katz GE, Davis GP, Jaquess KJ, Reinhard MJ, Costanzo ME, Reggia JA, Gentili RJ. A Novel Application of Levenshtein Distance for Assessment of High-Level Motor Planning Underlying Performance During Learning of Complex Motor Sequences. Journal of Motor Learning and Development. 2019 Nov 7;1(aop):1-20.

Conference Presentations

- Shaver A, Peri N, Mezebish R, Matthew G, Berson A, Gaskins C, **Davis GP**, Katz GE, Samuel I, Reinhard M, Costanzo M, Reggia JA, Purtilo J, Gentili RJ. Assessment of a Novel Virtual Environment for Examining Human Cognitive-Motor Performance during Execution of Action Sequences. 24th International Conference on Human-Computer Interaction, June 26 July 1, 2022, virtual.
- Reggia JA, Katz GE, Davis GP, Gentili RJ. Avoiding Catastrophic Forgetting with Short-Term Memory During Continual Learning. 23rd International Conference on Artificial Intelligence, July 26-29, 2021, Las Vegas, Nevada, USA.
- Davis GP, Katz GE, Soranzo D, Allen N, Reinhard MJ, Gentili RJ, Costanzo ME, Reggia JA. A Neurocomputational Model of Posttraumatic Stress Disorder. 10th International IEEE/EMBS Conference on Neural Engineering (NER), May 4, 2021 (pp. 107-110), virtual.
- Katz GE, Davis GP, Gentili RJ, Reggia JA. Bidirectional Cause-Effect Reasoning as the Basis of Imitation Learning. 2018 Workshop on Causal Imitation in Robotics, June 30, 2018, Pittsburgh, PA, USA.
- Katz GE, Dullnig D, Davis GP, Gentili RJ, Reggia JA. Autonomous Causally-Driven Explanation of Actions. 4th Annual Conf. on Computational Science & Computational Intelligence, Dec 14-16, 2017, Las Vegas, NV, USA.
- Hauge TC, Katz GE, **Davis GP**, D-W Huang, Reggia JA, Gentili RJ. High-level motor planning assessment during performance of complex actions in humans and humanoid robots: A computational approach. 47th Annual Meeting of the Society for Neuroscience Meeting, November 11-15, 2017, San Diego, CA, USA.

TECHNICAL SKILLS

- · Object-oriented software design and engineering (Python, C++, Java, etc)
- · Parallel and distributed programming (CUDA, MPI, OpenMP, etc)
- \cdot Design and implementation of diverse neural models, including rate-coding and spiking neural networks, associative and gradient-based learning, and recurrent and multi-layer architectures