Keiland W. Cooper

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Education

University of California Irvine

Neuroscience Ph.D. *In progress*

Indiana University Bloomington

Cognitive Science B.S *concentration*: computation, Neuroscience Cert. *Fourth of May, 2019*

Thesis: Cholinergic modulation may explain hippocampal encoding and retrieval mode switching

Research Projects

With Dr. Ehren Newman: Neural Correlates of Learning and Memory *2015 - Present*

- Hippocampal mode switching computational model
  Investigating the interplay of acetylcholine and theta oscilations and their role of allowing the hippocampus to switch between internal and extrenal information processing by using biologically constrained computational models
- Traveling Theta Wave in the Entorhinal Cortex
  Coded signal processing analyses of electrophysiology data recorded from electrodes across the long axis of the MEC to test our hypothesis of a traveling theta oscillation
- CA1 Assembly Flouresence Imaging
  Spearheaded implementing portable fluorescence imaging by building miniature microscopes, configuring analysis software, and conducting survival viral injection and endoscopic implantation surgeries in mice towards the goal of studying long term CA1 assembly dynamics
- Optic Flow and Theta Modulation
  Constructed behavioral training set up which consisted of building an open field maze, projection system, and software, as well as conducted animal behavioral training to test the influence of optic manipulation on hippocampal theta modulation

With Dr. Mike Jones: Computational Cognitive Science, Artificial Intelligence *2018 - Present*

- Overcoming Catastrophic forgetting in connectionist embedding models.
  Investigated catastrophic forgetting in semantic connectionist models by using homophones as a measure of changes in learned word meaning, as well as applying neuroscience inspired consolidation algorithms to alleviate these shortcomings

With Dr. Fredric Schmitt: Philosophy of Mind *2018*

- Can the Machine Think? An evidence based approach .
  Applied neuroscientific findings to argue against the conclusions of the Chinese Room thought experiment

With Dr. Amit Hagar: History and Philosophy of Science; Quantum Computing *2017 - 2018*

- The Natural Computation of the Brain
  Used principals from the natural computation paradigm and complexity theory to add additional insight to findings from modern neuroscience

With Dr. Susanne Ressl: Biochemical Structure of proteins in Synaptic Connectivity *2015*

- Investigating the Structure of Membrane Protein YejM
  Conducted protein crystallography research consisting of growing cell cultures, extracting and purifying targeted proteins, electrophoresis, and crystal identification

Independant *2016 - Present*

- Predicting Hippocampal CA1 activity with machine learning
  Used recurrent neural networks to generate synthetic CA1 oscillatory output time series from CA3 input using openly shared electrophysiology data recorded from both regions
- Evolving neural networks to play games
  Designed genetic algorithms to generate neural network architectures and parameters to play a difficult popular mobile game to superhuman performance

As part of program

- fMRI Data analysis - with Dr. Tom James, Dr. Josh Brown
- Autonomous Robotics - with Dr. Randall Beer
- Human EEG - with Dr. Ben Ramsden
- Brain network science - with Dr. Rick Betzel
- Congressional voting networks - with Dr. Rob Goldstone

Publications

In review

Perez, J. J. H., Cooper, K. W., & Newman, E. L. (2019). Medial entorhinal cortex activates in a traveling wave. BioRxiv, 632109.

Published

Cooper, K. W. (2018). Can the Machine Understand: An Evidence Based Approach to the Chinese Room. IU Journal of Undergraduate Research, 4(1), 82-85.

Abstracts/Presentations

Hernández J, Cooper K.W., Newman E.L. (2018) Is theta a traveling wave in the medial entorhinal cortex?. Program No. 330.10. Society for Neuroscience, 2018

Cooper K.W, Dachapally P.R, Jones M.N (2018) Consequences of Catastrophic Forgetting on Semantic Representations Learned by Deep Neural Embedding Models Midwest CogSci

Cooper K.W., Hernández J, Newman E.L. (2018) Is theta in the Medial Entorhinal Cortex a Traveling Wave? Society for Neuroscience, Greater Indiana Chapter.

Cooper K. W. (2018) 3D Brain Model Extraction and Virtual Applications. (Panelist) Media School Graduate Association Conference.

Cooper K.W. (2018) FlapAI: Genetically Evolved Neural Networks. Midwest Undergraduate Cognitive Science Conference

Cooper K. W. (2017) Bridging the Gap: Natural Computation and Neural Systems. Indiana University Undergraduate Research Conference.

Cooper K. W., Osborn Z. (2016) Downstream Hippocampal Activity Prediction with Neural Networks. Midwest Undergraduate Cognitive Science Conference.

Awards

Funded

2018	National Science Foundation GRFP *Honorable Mention*
2019	Indiana University Cognitive Science Outstanding Research Award
2018	Ewing Prize
2018	Indiana University Cognitive Science Outstanding Contribution Award
2017, 2018	Indiana University Cognitive Science Research Award

Networks

Professional Societies

Indiana Academy of Science
Psi Chi
Sigma Xi
Sigma Alpha Pi; *NSLS*

Other

ContinualAI.org, co-founder
Carboncopies, volunteer researcher
Student Organization for Cognitive Science, President
ADAPT Consulting, VP of Project Management

Conference Committee

Midwest Undergraduate Cognitive Science Conference, Bloomington 2018, 2019
Learning: Fast, Deep, and Shallow, Bloomington 2018

Pedagogy & Higher Education

Undergraduate Co-Instructor

Autonomous Robotics (CSCI-B 355) Spring 2019
Programming in the Cognitive & Info Sciences (COGS-Q 260) Spring 2018
Computation in Cognitive Science (COGS-Q 320) Spring 2018

Undergraduate Teaching Assistant

Cognitive Psychology (PSY-P 335), Dr. Franco Pestilli - Fall 2018
Introduction to Neuroscience (PSY-P 346), Dr. Ehren Newman - Fall 2017

Committee Seats

Education Policy Committee
Bloomington Faculty Council

Skills

Laboratory	Stereotaxic Rodent Neurosurgery, Histological Procedures/Sacrificial Perfusions, Signal Analysis, fMRI Analysis with Brain Voyager, Electrophoresis, Centrifucation, Cell Culturing
Computational	Python, MATLAB, HTML5/CSS, Java, R, UNIX/Bash
IT	APACHE/Ubuntu Server Initialization, Computer Assembly, Parallel Programming, SQL

Trainings, Workshops, etc.

Nonlinear Dynamics: Mathematical and Computational Approaches, Santa Fe Institute
Complexity Science Certificate, Santa Fe Institute
Science Communication Workshop, Indiana University
High Performance Computing and Supercomputing Workshop, UITS
Aseptic Surgery: Proper Practice Training, Indiana University
Viral Handling; Animal Handling; Institutional Animal Care Training, Indiana University
FERPA; Data Protection and Privacy; Title IX Trainings, Indiana University
IUNI Network Science Workshop, Indiana University
Neurosurgery Shadowing, Riley Hospital

Major Outreach and Service

Hoosier STARS, (co-founder, director)
Brain Club at the Boys and Girls Club
Quora Writer
IU Science Fest
Kirkwood Observatory Guide
Celebrate Science Indiana

Press

Ann Lewandowski (September 28th, 2018) IU undergraduates practice science outreach at Indiana high schools IDS (Link)

Alexandra Moussa-Tooks (August 14, 2018) The art of dissemination part 3: Care to share? ScIU (Link)

Liz Rosdeitcher (2017) Community Partnerships. (Link)

Erdös Number: 5

Paul Erdös -> Ronald L. Graham -> Feng Zhou -> Michael J. Kahana -> Ehren L. Newman