Ionatan J. Kuperwajs — Curriculum Vitae

Contact Information

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Research Interests

My research interests lie at the intersection of cognitive science and computer science. I primarily use tools from artificial intelligence and reinforcement learning to infer what algorithms people use to plan sequences of actions in complex environments.

Education

Ph.D. Candidate in Neural Science 2018-Present
New York University (New York, NY)
Systems, Cognition, and Computation Track

B.A. in Neuroscience, Computer Science, & Mathematics 2014-2018
Macalester College (St. Paul, MN)
Honors in Mathematics, Magna Cum Laude

Summer Schools

IBRO-Simons Computational Neuroscience Imbizo 2018
Cape Town, South Africa

Research Experience

Graduate Research: Human planning in large state spaces
Center for Neural Science, New York University
Advisor: Wei Ji Ma 2019-Present
Investigating the cognitive processes underlying human sequential decision-making, especially in high-complexity tasks. Current focus is on developing a theoretical framework for optimizing planning depth and training deep neural networks to reproduce human play in a large-scale combinatorial game.

Eigen-distortions of stacked, local gain control
Lab for Computational Vision, New York University
Advisor: Eero P. Simoncelli 2018-2019
Trained an optimized end-to-end image compression model based on the concept of divisive normalization in biological systems. Then identified the eigenvalues corresponding to the model-predicted most and least noticeable image distortions, testing the model's ability to mimic human perceptual sensitivity.

Lightweight, flexible visualization and analysis of FreeSurfer surfaces
Computational Visual Neuroscience Lab, University of Minnesota
Advisor: Kendrick N. Kay 2016-2018
Developed statistical and image processing tools for visualization and analysis of high-resolution fMRI data, utilizing FreeSurfer to analyze preprocessed cortical surfaces and decode fine-scale neural activity.

Bayesian inference of neural activity and connectivity from all-optical interrogation of a neural circuit
Janelia Research Campus, Howard Hughes Medical Institute

Advisor: Srinivas C. Turaga Summer 2017
Worked on a variational autoencoder-based framework for mapping neural connectivity from population activity measurements by calcium imaging combined with cellular resolution optogenetic activity perturbations.

Dynamic network model and attractor states of the C. elegans connectome
LINK-Group, Semmelweis University
Advisor: Péter Csermely Spring 2017
Built a network model to simulate global activity states of the C. elegans nervous system to search for stable attractor states and map those to distinct behavioral patterns.

Neural processing of the optic flow field
Computational Neurogimaging Lab, New York University
Advisor: David J. Heeger Summer 2016
Implemented a novel perceptual model for optic flow based on motion without movement to determine that the human visual system estimates heading direction and angular velocity from the evolution of the optic flow field over time.

Publications

Preprints

- van Opheusden, B., Galbiati, G., **Kuperwajs, I.**, Bnaya, Z., Li, Y., & Ma, W.J. (2021). Revealing the impact of expertise on human planning with a two-player board game. *PsyArXiv*. pdf

Conference articles and abstracts

- **Kuperwajs, I.**, van Opheusden, B., & Ma, W.J. (2019). Prospective planning and retrospective learning in a large-scale combinatorial game. *Cognitive Computational Neuroscience*. pdf

Honors & Awards

National Science Foundation Graduate Research Fellowship 2020-2023
Computational Psychology
Three years of NSF financial support for outstanding graduate students in research-based STEM disciplines.

Trainee Travel Grant 2019
Cognitive Computational Neuroscience (CCN)
National Science Foundation funding for highly-rated submissions.

Henry Mitchell McCracken Fellowship 2018
Graduate School of Arts and Sciences, New York University
Multi-year full funding support for doctoral students.

National Honor Society Member 2018
Epsilon of Minnesota, Phi Beta Kappa
Inducted students have a GPA in the upper 12 percent of their graduating class, a commitment to liberal studies, and knowledge of mathematics and a foreign language.

Outstanding Graduate Award 2018
Neuroscience Department, Macalester College
Awarded by faculty to the graduating senior with the highest achievement and promise in the field.

Undergraduate Travel Grant 2018
Computational and Systems Neuroscience (Cosyne)
Coverage of travel and meeting attendance costs for undergraduate students with a strong interest in neuroscience.

Dean's List 2014-2018
Macalester College
Awarded to full-time students with a semester GPA of at least 3.75.

Undergraduate Scholars Program 2017
Janelia Research Campus, Howard Hughes Medical Institute
10-week summer program aimed at well-prepared, independent, and committed undergraduate students with significant research experience.

Men's Soccer Academic All-Conference Team 2015-2017
Minnesota Intercollegiate Athletic Conference
Awarded to student-athletes with a minimum career GPA of 3.5 who meet sport-specific athletic requirements.

National Science Foundation Undergraduate Research Program 2016
Center for Neural Science, New York University
10-week summer program for undergraduates with a strong interest in neuroscience and a research-centered career.

DeWitt Wallace Distinguished Scholar 2014
Macalester College
4-year merit scholarship ($64,000) awarded to academically excellent applicants.

Teaching Experience

Teaching Assistant, New York University
- Mathematical Tools for Neural and Cognitive Science (NEURL-GA 2201) F 19

Teaching Assistant, Macalester College
- Algorithm Design and Analysis (COMP 221) F 17, S 18
- Brain, Mind, and Behavior (PSYC 180) F 16
- Core Concepts in Computer Science (COMP 123) S 16, F 16

Talks

- Model-based and model-free decision-making in a complex planning task
  CNS Lab Talks February 2020
  Center for Neural Science, New York University
- Prospective and retrospective mechanisms in complex sequential decision-making
  First Year Talk December 2019
  Center for Neural Science, New York University
- Human planning in large state spaces
  Concepts and Categories Seminar Series November 2019
  Department of Psychology, New York University
- Combinatorial planning
  Artificial and Biological Computation Lab Meeting June 2019
  Center for Neural Science, New York University
- Visualization and analysis of high-resolution fMRI
  Honors Thesis Defense May 2018
  Department of Mathematics, Macalester College

- Bayesian inference of neural circuit properties from calcium imaging data
  J-Theory Meeting August 2017
  Janelia Research Campus, Howard Hughes Medical Institute
- A dynamic network model for the C. elegans connectome
  Link-Group Meeting May 2017
  Department of Medical Chemistry, Semmelweis University
- Neural processing of the optic flow field
  SURP Symposium July 2016
  Center for Neural Science, New York University

Poster Presentations

- Prospective planning and retrospective learning in a large-scale combinatorial game
  Workshop on Big Data in Cognitive Science December 2019
  Princeton, New Jersey
- Prospective planning and retrospective learning in a large-scale combinatorial game
  Cognitive Computational Neuroscience September 2019
  Berlin, Germany

Technical Skills

Programming: Comfortable in Python and MATLAB. Familiar with R, Java, C, C++, HTML/CSS, and bash.
Coursework: Graduate-level courses in mathematical tools for neuroscience, machine learning, Bayesian and cognitive modeling, and cellular and systems neuroscience.
Methodologies: Behavioral modeling, reinforcement learning, statistical inference, deep learning.
Lab: Experience with human psychophysics and fMRI.
Other Skills: Experience with object-oriented programming, parallel programming, computer vision, network science.
Languages: Fully proficient in English, Spanish, and Hebrew.

Service & Activities

- **Scientist Action and Advocacy Network (ScAAN)** 2018-Present
  President of a pro-bono science group. Work typically consists of evidence-based reports and data analysis/visualization for partner non-profit organizations.
- **Commencement Speaker Selection Committee** 2018
  One of four student representatives nominated to select the Macalester College commencement speaker.
- **Macalester Software Development Organization (MacHack)** 2015-2018
  Hosted events and gatherings for students interested in programming.
- **Macalester College Varsity Men's Soccer Team** 2014-2018
  Member of the nationally-ranked men's soccer team, won conference title and made an NCAA tournament appearance in 2015.