

Guy Davidson

guy.davidson@nyu.edu | +1 415-510-9167 | <https://github.com/guydav> | <https://guydavidson.me>

Researcher at the interface of cognitive science and artificial intelligence. I research problems in which people outperform state of the art artificial approaches and attempt to identify the cognitive mechanisms that underlie the human advantage. I combine theoretical and experimental cognitive science work to understand and model these mechanisms and then apply such cognitive insights to deep reinforcement learning problems. By integrating ideas from the study of human intelligence with rigorous computational research, I aim to help develop machine common sense and narrow the gap between machine and human. I hope that applying ideas from human cognition allows me to contribute toward machine intelligence that better understands humans, and equally enables us to better understand the inferences such models make, improving the interpretability of model behavior.

EDUCATION

NYU CENTER FOR DATA SCIENCE

PhD student

New York, NY
2019–Present

- Advised by Professors Brenden Lake and Todd Gureckis.
- Studying how humans represent tasks and goals through game creation experiments, to develop discriminative and generative models of task representations and inverse reinforcement learning models using a rich ‘task prior.’
- Also excited about reasoning with object-based representations and neural networks models of infant cognition.

BRAINS, MINDS, AND MACHINES SUMMER COURSE

Hosted by the MIT and Harvard Center for Brains, Minds, and Machines

Woods Hole, MA
08/2021

MACHINE LEARNING SUMMER SCHOOL

Hosted by University College London and Imperial College London

London, England
07/2019

MINERVA UNIVERSITY

BSc in Computational Sciences

San Francisco, CA
2015–2019

- Graduated summa cum laude with a concentration in Machine Learning. **GPA: 3.98/4.0**
- Coursework including Bayesian Statistics, Machine Learning, Cognitive Neuroscience, Quantum Mechanics.
- **Capstone project:** investigated the scaling behavior of different meta-learning algorithms: how quickly new tasks are learned as a function of previous training, using a novel benchmark paradigm inspired by visual question answering. Collaborated with **Professor Mike Mozer** at Google Research/CU Boulder. Project presented at CVPR 2020.

PUBLICATIONS AND PRESENTATIONS

PREPRINTS

Davidson, G., Gureckis, Todd M., & Lake, B. M. (2021). Creativity, Compositionality, and Common Sense in Human Goal Generation. <https://psyarxiv.com/byzs5>.

PUBLICATIONS

Davidson, G., Lake, B. M. (2021). Examining Infant Relation Categorization Through Deep Neural Networks. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society, CogSci 2021*. <https://escholarship.org/uc/item/8sm6b1b4>.

Bennett, D., Davidson, G., & Niv, Y. (2021). A model of mood as integrated advantage. *Psychological Review*. <https://doi.org/10.1037/rev0000294>

Davidson, G., Lake, B. M. (2020). Investigating Simple Object Representations in Model-Free Deep Reinforcement Learning. *Proceedings of the 42nd Annual Meeting of the Cognitive Science Society, CogSci 2020*.

<https://cogsci.mindmodeling.org/2020/papers/0466/0466.pdf>.

Davidson, G., Lake, B. M. (2020). Systematically Comparing Neural Network Architectures in Relation Learning. *Object-Oriented Learning (OOL): Perception, Representation, and Reasoning Workshop at ICML 2020*.

https://oolworkshop.github.io/program/ool_20.html.

Davidson, G., Mozer, M. C. (2020). Sequential mastery of multiple visual tasks: Networks naturally learn to learn and forget to forget. *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*.

https://openaccess.thecvf.com/content_CVPR_2020/papers/Davidson_Sequential_Mastery_of_Multiple_Visual_Tasks_Networks_Naturally_Learn_to_CVPR_2020_paper.pdf.

Davidson, G., Radulescu, A., & Niv, Y. (2019). Contrasting the effects of prospective attention and retrospective decay in representation learning. *The 4th Multidisciplinary Conference on Reinforcement Learning and Decision Making*.

Bennett, D., **Davidson, G.**, & Niv, Y. (2019). Momentum and mood in policy-gradient reinforcement learning. *The 4th Multidisciplinary Conference on Reinforcement Learning and Decision Making*.

UNREVIEWED CONFERENCE PRESENTATIONS

Davidson, G., Radulescu, A., & Niv, Y. (2018). Passive forgetting or selective attention? Comparing two models of learning in multidimensional environments. *Cognitive Computational Neuroscience Meeting (Late-Breaking Research)*.

TEACHING

DS-GA 1016: COMPUTATIONAL COGNITIVE SCIENCE

Section leader, grader

NYU
01/2021-05/2021, 01/2022-ongoing

Served as a section leader and grader for graduate-level course focused on computational approaches to modeling cognition.

DS-UA 112: INTRODUCTION TO DATA SCIENCE

Section leader

NYU
09/2019-12/2019

Served as a section leader for new undergraduate course introducing students to NYU's newly approved Data Science major.

RESEARCH & PROFESSIONAL EXPERIENCE

PRINCETON NEUROSCIENCE INSTITUTE

Research Intern

Princeton, NJ
05/2018-08/2018

Interned with **Professor Yael Niv's** lab, to investigate human reinforcement learning (RL) in multidimensional environments:

- Modeled data from previous experiments, making discoveries regarding the dissociable roles of attention and decay in human RL, and the efficacy of eye-tracking and fMRI-based attention measures. Project presented at RLDM 2019.
- Implemented a reinforcement learning experiment in a customizable web platform, enabling data collection using Amazon Mechanical Turk and building a framework used by several current lab members to develop new experiments.
- Developed a simulation environment for bandit problems to motivate work framing mood as a momentum variable.

AIDOC MEDICAL

Research Engineer

Tel Aviv, Israel
05/2017-11/2017

- Implemented research-supporting tools in Azure cloud environment to facilitate and expedite deep learning experimentation, reducing idea-to-experiment turnaround 10x from 1-2 hours to 5-10 minutes.
- Explored distributed model training frameworks, performed experiments and analyses leading to opt for tool development.

AMAZON PRIME AIR

Software Development Engineer Intern

Seattle, WA
05/2016-08/2016

- Implemented binary image loading solution for proprietary hardware and software platform using C and assembly.
- Contributed to serialization library used in multiple projects across the Prime Air development group.

MINERVA PROJECT

Software Development Engineer Intern

San Francisco, CA
01/2016-05/2016

- Designed and delivered overhaul of invoicing system, transitioning from a fixed to a line-itemized implementation, to allow for improved flexibility, history tracking, and increased robustness, in a Python/Django/MySQL web-stack.

SIMILARWEB

Software Engineer

Tel Aviv, Israel
06/2015-09/2015

- Integrated products with external partners, debugged and solved multiple production issues, in Node.JS, iOS, and Python.

ISRAEL DEFENSE FORCES INTELLIGENCE BRANCH

Team leader, training instructor, software engineer

Israel
08/2008-10/2014

- Team leader: grew team of four software developers to ten, responsible for developing tools to enhance analysis capabilities and solve production issues. Reduced turnaround time more than 2x, contributed to Israel Defense Prize-winning project.
- Instructor: managed two other instructors, training ten pupils in software engineering and computer networking.
- Software engineer: built in-house data ingestion pipelines and analysis tools. Developed primarily in Python and Java and cultivated debugging and fault analysis expertise.

SKILLS

PROGRAMMING LANGUAGES

- Python (PyTorch, TensorFlow, Keras, Numpy, Sklearn)
- Javascript • Matlab • Java
- Shell • C • C++ • R • HTML/CSS

INTERESTS

- Native in **English** and **Hebrew**
- Proficient in **Spanish**
- Avid Ultimate Frisbee player (Played on Israeli national team)