Matthias Minderer

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Summary

I am a researcher interested in representation learning in neural systems. During my PhD, I studied how visual and motor information is encoded in the brain. Since then, I have moved to artificial systems, focusing on how to impart abstract structure and inductive biases to the representations learned by deep neural networks. Currently, I work on adversarial methods for learning semantically meaningful visual representations without supervision.

Education

2012–2018	PhD in Neuroscience	Harvard University
2010–2012	MSc in Neuroscience	ETH Zürich
2007–2010	BA in Natural Sciences	University of Cambridge

Research experience

2018–present AI Residency   Google Brain
- Developed a model that learns unsupervised object-centric representations from video.
- Designed adversarial methods to improve self-supervised representation learning.
- Implemented semantic segmentation algorithms for medical images.

2012–2018 PhD research   Dr. Christopher Harvey, Harvard University
- Recorded and analyzed neural activity to study sensorimotor representations in mouse cortex.
- Designed deep neural network models of neural encoding and decoding.
- Developed software tools to collect, analyze and visualize neuroscience data (GitHub).

2011–2012 MSc research   ETH Zürich & Max Planck Institute for Biological Cybernetics
- Studied representations in rat motor cortex using two-photon calcium imaging.

Publications

Minderer M, Tschannen M, Bachem O, Houlsby N. Adversarial shortcut removal for self-supervised representation learning.   In preparation.

Minderer M, Sun C, Villegas R, Cole F, Murphy K, Lee H. Unsupervised Learning of Object Structure and Dynamics from Videos.   NeurIPS (2019). arXiv

Minderer M, Brown KD, Harvey CD. The Spatial Structure of Neural Encoding in Mouse Posterior Cortex during Navigation.   Neuron (2019). PDF

Spaen Q, Asín-Achá R, Chettih SN, **Minderer M**, Harvey CD, Hochbaum DS. HNCcorr: A Novel Combinatorial Approach for Cell Identification in Calcium Imaging Movies.   eNeuro (2019). PDF

Minderer M, Brown K, Harvey CD. Unsupervised mapping of visual-motor representations in mouse cortex during navigation.   BigNeuro workshop, NIPS (2017). PDF

Driscoll LN, Pettit NL, **Minderer M**, Chettih SN, Harvey CD. Dynamic Reorganization of Neuronal Activity Patterns in Parietal Cortex.   Cell (2017). PDF

Minderer M, Harvey CD, Donato F, Moser EI. Neuroscience: Virtual reality explored.   Nature (2016). PDF

Minderer M, Liu W, Sumanovski LT, Kügler S, Helmchen F, Margolis DJ. Chronic imaging of cortical sensory map dynamics using a genetically encoded calcium indicator.   J Phys (2011). PDF

Technical experience

Developed novel deep learning architectures for video prediction, visual representation learning.

Developed wide and deep models of scientific video and timeseries data (CNNs, VAEs, large linear models in Python, TensorFlow/Keras, Matlab).

Designed terabyte-scale image processing pipelines using distributed computing (LSF-managed cluster at Harvard Medical School).

Set up relational databases (MySQL) for data processing pipelines.

Developed virtual reality systems for behavioral experiments (microcontrollers, custom circuits, basic knowledge of C/C++ and OpenGL).

Designed and built custom microscopes and other optical systems (AutoDesk Inventor, Zemax).

Awards

2016	NVIDIA Hardware Grant
2014	Boehringer Ingelheim Fonds PhD Fellowship (PhD years 3 and 4)
2012	Herchel Smith Graduate Fellowship, Harvard University (PhD years 1 and 2)
2009	Homerton College Foundation Scholarship, University of Cambridge

Service

2018–present	Reviewer for ICLR, ICML Workshop on Understanding and Improving Generalization in Deep Learning.
2015	Co-founded a computational methods discussion group at Harvard Medical School. Monthly meetings, 80 members as of 2018.
2014	Teaching fellow for Harvard 306qc: Quantitative Methods for Biologists. Provided introduction to MATLAB programming and statistics for incoming graduate students.
2013	Lecturer for *Science In The News*, a student-run science outreach group.
	Mentor for high-school students in the *Health Professions Recruitment & Exposure Program* at Harvard Medical School.

Relevant coursework

2017	CIFAR Reinforcement Learning Summer School	Montreal Institute for Learning Algorithms
2016	Algorithms: Design and Analysis, Part 1	online; Stanford via Coursera (certificate)
	Convolutional Neural Networks for Visual Recognition	online; Stanford
2015	Advanced Machine Learning	Harvard CS281; Prof. Finale Doshi-Velez
2014	Machine Learning	online; Stanford via Coursera
2013	Computational Neuroscience	Harvard MCB 131; Prof. Haim Sompolinsky
2012	Computational Cognitive Science	MIT 9.660; Prof. Josh Tenenbaum
2007–2010	Undergraduate courses in calculus, linear algebra, probability, statistics	University of Cambridge