

Brenden Lake
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Positions:

New York University

Assistant Professor of Psychology and Data Science
Department of Psychology and Center for Data Science (joint)
Department of Computer Science and Center for Neural Science (affiliate)
September 2017-present

Facebook AI Research

Research Scientist
Oct. 2018-present
Visiting Researcher
July 2017-Sept. 2018

Education:

New York University

Postdoctoral Researcher, Moore-Sloan Data Science Fellow
Center for Data Science
July 2014-August 2017

Massachusetts Institute of Technology

Ph.D. in Cognitive Science, September 2014

- Thesis: Towards more human-like concept learning in machines: Compositionality, causality, and learning-to-learn
- Advisor: Joshua B. Tenenbaum

Stanford University

M.S., Symbolic Systems, June 2009

- Thesis: Unsupervised and semi-supervised perceptual category learning
- Track in Computational and statistical approaches to learning and inference
- Advisor: James L. McClelland

B.S., Symbolic Systems, June 2009

- Concentration in Cognitive Science
- With University Distinction

Publications
(Competitively
refereed):

- Feinman, R. and Lake, B. M. (submitted). SK-reg: A smooth kernel regularizer for convolutional neural networks.
- Rothe, A., Lake, B. M., and Gureckis, T. M. (submitted). Asking goal-oriented questions and learning from answers.
- Lake, B. M., Salakhutdinov, R., and Tenenbaum, J. B. (submitted). The Omniglot Challenge: A 3-Year Progress Report.
- Lake, B. M., Linzen, T., and Baroni, M. (submitted). Human few-shot learning of compositional instructions. *Preprint available on arXiv:1901.04587*.
- Lewis, M., Cristiano, V., Lake, B. M., Kwan, T., and Frank, M. C. (submitted). The role of developmental change and linguistic experience in the mutual exclusivity effect. *Preprint available on PsyArXiv:wsx3a*.
- Lake, B. M. and Piantadosi, S. T. (submitted). People infer recursive visual concepts from just a few examples.
- Loula, J., Baroni, M., and Lake, B. M. (2018). Rearranging the familiar: Testing compositional generalization in recurrent networks. *Proceedings of the 2018 EMNLP Workshop BlackboxNLP: Analyzing and Interpreting Neural Networks for NLP*.
- Rothe, A., Lake, B. M., and Gureckis, T. M. (2018). Do people ask good questions? *Computational Brain & Behavior*, 1(1), 69-89.
- Lake, B. M. and Baroni, M. (2018). Generalization without systematicity: On the compositional skills of sequence-to-sequence recurrent networks. *International Conference on Machine Learning (ICML)*.

- Feinman, R. and Lake, B. M. (2018). Learning inductive biases with simple neural networks. *Proceedings of the 38th Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Lawrence, N., and Tenenbaum, J. B. (2018). The emergence of organizing structure in conceptual representation. *Cognitive Science*, 42(S3), 809-832.
- Lake, B. M., Ullman, T. D., Tenenbaum, J. B., Gershman, S. J. (2017). Building machines that learn and think like people. *Behavioral and Brain Sciences*, 40, E253. (Target Article)
- Rothe, A., Lake, B. M., and Gureckis, T. (2017). Question Asking as Program Generation. *Advances in Neural Information Processing Systems (NIPS)* 30.
- Rothe, A., Lake, B. M., and Gureckis, T. (2016). Asking and evaluating natural language questions. *Proceedings of the 38th Annual Conference of the Cognitive Science Society*.
- Cohen, A. and Lake, B. M. (2016). Searching large hypothesis spaces by asking questions. *Proceedings of the 38th Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Salakhutdinov, R., Tenenbaum, J. B. (2015). Human-level concept learning through probabilistic program induction. *Science*, 350(6266), 1332-1338. (Featured as cover article)
- Monfort, M., Ziebart, B., Lake, B. M., Tenenbaum, J. B. (2015). Softstar: Heuristic-Guided Probabilistic Inference. *Advances in Neural Information Processing Systems (NIPS)* 28.
- Lake, B. M., Zaremba, W., and Gureckis, T. (2015). Deep neural networks predict category typicality ratings for images. *Proceedings of the 37th Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Lee, C.-y., Tenenbaum, J. B. (2014). One-shot learning of generative speech concepts. In *Proceedings of the 36th Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Salakhutdinov, R., Tenenbaum, J. B. (2013). One-shot learning by inverting a compositional causal process. *Advances in Neural Information Processing Systems (NIPS)* 26.
- Lake, B. M., Salakhutdinov, R., Tenenbaum, J. B. (2012). Concept learning as motor program induction: A large-scale empirical study. In *Proceedings of the 34th Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Salakhutdinov, R., Gross, J., and Tenenbaum, J. B. (2011). One shot learning of simple visual concepts. In *Proceedings of the 33rd Annual Conference of the Cognitive Science Society*.
- Lake, B. M. and McClelland, J. L. (2011). Estimating the strength of unlabeled information during semi-supervised learning. In *Proceedings of the 33rd Annual Conference of the Cognitive Science Society*.
- Lake, B. M. and Tenenbaum, J. B. (2010). Discovering Structure by Learning Sparse Graphs. In *Proceedings of the 32nd Annual Conference of the Cognitive Science Society*.
- Lake, B. M., Vallabha, G. K., and McClelland, J. L. (2009). Modeling unsupervised perceptual category learning. *IEEE Transactions on Autonomous Mental Development*, 1(1), 35-43.
- Lake, B. M., Vallabha, G. K., and McClelland, J. L. (2008). Modeling unsupervised perceptual category learning. In *Proceedings of the 7th International Conference on Development and Learning (ICDL)*.
- Lake, B. M. and Cottrell, G.W. (2005). Age of acquisition in facial identification: A connectionist approach. In *Proceedings of the 27th Annual Conference of the Cognitive Science Society*.

Other articles:

- Lake, B. M. (2017). Finding solace in defeat by artificial intelligence. *MIT Technology Review*, April 28, 2017.

Research contracts, grants, and gifts:

- Industry grant, \$585,791, “Automatic concept learning from first person video and audio streams,” 2018-2020, as PI.
- Huawei, \$243,000, “Human-like question asking and learning for machine intelligence,” 2018-2019, as PI.
- NSF I-Corps for Learning Grant, \$50,000, “Learning-to-learn with touchscreen technology,” 2014-2015, as PI.
- NVIDIA Hardware Grant, “Understanding the Psychology of Deep Neural Networks,” 2015.

Honors and Awards:

- Top 35 Innovators Under 35 (TR35), *MIT Technology Review*, 2018.
- Top 10 World Changing Ideas, *Scientific American*, 2016.
- Data Innovator, Center for Data Innovation, 2015.
- Robert J. Glushko Prize for Outstanding Doctoral Dissertation in Cognitive Science, 2015.
- National Science Foundation (NSF) Graduate Research Fellowship, 2011-2014.
- Angus MacDonald Award for Excellence in Teaching Undergraduate Students, 2010.

- Singleton Presidential Fellowship, Massachusetts Institute of Technology, 2009-2010.
 - Elected to Phi Beta Kappa, 2009.
 - Best paper award, *International Conference on Development and Learning (ICDL)*, 2008.
- Media:
- Research featured in the *New York Times*, *Washington Post*, *Los Angeles Times*, *Seattle Times*, *Christian Science Monitor*, *Toronto Star*, *Reuters*, *Popular Mechanics*, *Fortune*, *CBS News*, *NBC News*, *MIT Technology Review*, *Business Insider*, *IEEE Spectrum*, *Motherboard*, *La Recherche*, *Popular Science*, and many other outlets. Also featured on CBS Radio, BBC Radio, and the *Science Magazine* podcast.
 - Media impact score, “Human-level concept learning” ranked 16 of 31,000 papers ever published in *Science* (Altmetric.com; on 1/19/2016). It is the highest scoring scientific output from NYU (3/2015 – 2/2016).
- Teaching:
- Instructor, Advancing AI through cognitive science, PSYCH-GA 3405.001 / DS-GA 3001.014, NYU, Spring 2019.
 - Instructor, Computational cognitive modeling, PSYCH-GA 3405.002 / DS-GA 3001.006, NYU, Spring 2019.
 - Instructor, Advancing AI through cognitive science, PSYCH-GA 3405.001 / DS-GA 3001.014, NYU, Spring 2018.
 - Instructor, Computational cognitive modeling, PSYCH-GA 3405.002 / DS-GA 3001.006, NYU, Spring 2018.
 - Course advisor, Practical Training for Data Science, DS-GA 1009, NYU, Fall 2016.
 - Instructor, Practical Training for Data Science, DS-GA 1009, NYU, Fall 2015.
- Service:
- Search committee, Center for Data Science and Center for Neural Science, 2018-2019.
 - Search committee, Center for Data Science and Computer Science Department, 2017-2018.
 - Co-Organizer, NIPS Workshop on Cognitively Informed Artificial Intelligence, Dec. 2017.
 - Mentor, Artificial Intelligence NexusLab Incubator, New York City, 2016-2018.
 - Organizer, Data Science Lunch Seminar Series, Fall 2015.
 - Organizer, NYU Concepts and Categories (ConCats) seminars, Fall 2014-Spring 2015.
 - Reviewer for *Proceedings of the National Academy of Sciences (PNAS)*, *Nature Communications*, *Nature Machine Intelligence*, *Nature Human Behavior*, *Behavioral and Brain Sciences*, *Cognition*, *Journal of Experimental Psychology: General*, *Cognitive Science*, *Psychonomic Bulletin & Review*, *Infant Behavior & Development*, *Current Directions in Psychological Science*, *Memory & Cognition*, *Vision Research*, *Current Opinion in Behavioral Sciences*, *Big Data*, *Frontiers in Psychology*, Annual Conference of the Cognitive Science Society (*CogSci*), Advances in Neural Information Processing Systems (*NeurIPS*), and International Conference on Artificial Intelligence and Statistics (*AISTATS*), and the National Science Foundation (NSF).
- Invited talks:
- Invited Speaker, “Intelligent Computing and Communications Technologies Workshop,” New Brunswick, NJ, Nov. 2018.
 - Invited Speaker, “Artificial Intelligence and the Barrier of Meaning,” Santa Fe Institute, Oct. 2018.
 - Invited Speaker, “Parallel Distributed Processing and the Emergence of an Understanding of Mind,” Princeton University, Sept. 2018.
 - Invited Speaker, EmTech MIT, MIT Technology Review, Sept. 2018.
 - Invited Speaker, “Brain Visions: geometry, art, and symbolism,” Le Plan-de-la-Tour, France, Sept. 2018.
 - Invited Speaker, Track on the “Future of AI”, Joint Multi-Conference on Human-Level Artificial Intelligence (HLAI), Aug. 2018.
 - Invited Speaker, International Conference on Machine Learning (ICML), Workshop on “Neural Abstract Machines & Program Induction,” July 2018.
 - Facebook Artificial Intelligence Research (FAIR), New York, June 2018.
 - Invited Speaker, Workshop on “Deep, fast and shallow learning in humans and machines,” Indiana University, Bloomington, May 2018.
 - Invited Speaker, EmTech Digital, MIT Technology Review, March 2018.
 - Princeton University, PDP Group seminar, Feb. 2018.
 - Thomas J. Watson Research Center, Yorktown Heights, NY, Oct. 2017.

- Invited Speaker, Facebook Faculty Summit, New York City, Oct. 2017.
- Keynote Speaker, NYU Computational Neuroscience Symposium, June 2017.
- New York University, Cognition and Perception Seminar, Mar. 2017.
- University of Toronto, Department of Computer Science Lecture, Mar. 2017
- UC Berkeley, Department of Psychology / Cognitive Science Colloquium, Feb. 2017.
- University of Washington, Computer Science and Engineering Colloquium, Feb. 2017.
- Stanford University, Department of Psychology Colloquium, Feb. 2017.
- Invited Speaker, New York Artificial Intelligence Meetup, Jan. 2017.
- Invited Speaker, Neural Information Processing Systems (NIPS), Workshop on “Machine Intelligence,” Dec. 2016.
- Stanford University, EE Computer Systems Colloquium, Oct. 2016.
- Qualcomm Research, Santa Clara, CA, Sept. 2016.
- Invited Speaker, International Joint Conference on Artificial Intelligence (IJCAI), Workshop on “Interactive Machine Learning: Connecting Humans and Machines,” July 2016.
- Invited Speaker, International Conference on Machine Learning (ICML), Workshop on “Data-Efficient Machine Learning,” June 2016.
- Invited Speaker, International Conference on Machine Learning (ICML), Workshop on “Deep Learning,” June 2016.
- Google DeepMind, London, May 2016.
- Facebook Artificial Intelligence Research (FAIR), New York, April 2016.
- New York University (NYU), Computational Intelligence, Learning, Vision, and Robotics (CILVR), April 2016.
- Rutgers University-Newark, Seminar on “This is Data Science,” Institute for Data Science, Mar. 2016.
- Invited Speaker, NYC Machine Learning Meetup, Mar. 2016.
- Moore-Sloan Data Science Summit, Cle Elum, WA, Oct. 2015.
- Symposium for Glushko Dissertation Prize, Annual Conference of the Cognitive Science Society, July 2015.
- Invited Speaker, CodeNeuro, New York City, April 2015.
- New York University (NYU), 4th Data Science Showcase, Oct. 2014.
- Invited Speaker, Eastern Psychological Association, Symposium on “Computational Constructivism,” Mar. 2014.
- New York University (NYU), Computational Intelligence, Learning, Vision, and Robotics (CILVR), Feb. 2014.
- Bay Area Cognitive Science Group, Dec. 2013.
- New York University (NYU), Seminar on Concepts and Categories (ConCats), Sept. 2013.
- MIT Spoken Language Systems Group, April 2013.