

Rajeev V. Rikhye, Ph.D.

COMPUTATIONAL NEUROSCIENCE · MACHINE LEARNING · ARTIFICIAL INTELLIGENCE

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Summary

I am a MIT-trained Computational Vision and Machine Learning researcher. My academic research was centered on understanding the neural basis of visual perception and decision-making through a unique combination of experiments and computational modeling. I am now translating these insights into biologically-inspired machine learning algorithms, with the hope of one day developing intelligent agents that see, act and, in turn, can solve real-world problems.

More broadly my research interests are: **1.** embedded artificial intelligence, **2.** speech and visual processing technologies and **3.** brain-inspired machine learning models.

Work Experience

Google, Inc.

Mountain View, CA

RESEARCHER AND MACHINE LEARNING ENGINEER

October 2020 - Present

- ML Researcher on the On-Device Speech Team at Google Research. I research and develop novel machine learning models for automatic speech recognition (ASR) and natural language processing (NLP).
- My primary focus is deep-learning based embedded speech technologies for end-to-end ASR, acoustic modeling and language modeling.

Vicarious AI

Union City, CA

RESEARCHER

October 2018 - October 2020

- Developing novel computer vision algorithms for object detection, semantic segmentation and pose estimation with applications to robotics.
- Spearheading independent research efforts in Computational Neuroscience. Developed a novel generative model for sequential data, with applications to navigation, planning and language processing.
- Leading efforts to extract key performance measures from in-house A/B tests and customer robot deployments. The goal is to develop data-driven decisions for optimizing computer vision models.

Education

Massachusetts Institute of Technology

Cambridge, MA

DOCTOR OF PHILOSOPHY (PH. D.) IN NEUROSCIENCE

August 2012 - July 2016

- **GPA: 5.0/5.0.** Advanced course-work in computer vision, machine learning, inference and statistics
- Thesis: The mechanisms of reliable coding in mouse visual cortex. Advisor: Prof. Mriganka Sur
- Supported by the HHMI International Student Predoctoral Fellowship

Imperial College London

London, UK

MASTER OF ENGINEERING (M. ENG.) IN BIOMEDICAL ENGINEERING WITH ELECTRICAL ENGINEERING

October 2006 - October 2010

- **First Class Honors.** Top 1% of graduating class
- Thesis: Modeling synaptic calcium dynamics. Advisor: Dr. Weifeng Xu
- Visiting scholar at MIT from Aug 2009 – Aug 2010 GPA: 4.9/5.0

Postdoctoral Research Experience

Massachusetts Institute of Technology

Cambridge, MA

POSTDOCTORAL RESEARCH FELLOW

July 2017 - October 2018

- Led two independent research projects aimed at understanding the role of cortico-thalamic neural circuits in rule-guided behaviors.
- Built multiple data analysis pipelines and computational tools to parse complex and high-dimensional neural data.

Howard Hughes Medical Institute / Janelia Research Campus

Ashburn, VA

RESEARCH SPECIALIST

July 2016 - July 2017

- Engineered an image analysis pipeline in JavaScript to rapidly detect and segment neurons in calcium and voltage imaging data-sets.
- Developed an end-to-end data analysis pipeline to screen for novel genetically-encoded voltage indicators.

Skills

Programming	Python (fluent), Matlab (fluent), C++, JavaScript, HTML, \LaTeX
Machine Learning	OpenCV, TensorFlow, PyTorch, Pandas, Scikit Learn, CUDA
Robotics	Ros, MuJoCo
Tools	Jira, Git, Grafana, Docker
Languages	English (Native), Hindi (Spoken), Malay

Honors & Fellowships

- 2014 **International Student Research Fellowship**, Howard Hughes Medical Institute
- 2012 **Henry E. Singleton Fellowship**, Dept. Of Brain and Cognitive Sciences, MIT
- 2010 **Associate**, City and Guilds of London Institute
- 2009 **Tensor Society Mathematics for Engineers Award**, Imperial College London
- 2006 **Academic Excellence Award**, Singapore Indian Development Association

Publications

JOURNAL ARTICLES

Learning cognitive maps as structured graphs for vicarious evaluation

Rajeev V. Rikhye, Nishad Gothoskar, J. Swaroop Guntupalli, Antoine Dedieu, Miguel Lázaro-Gredilla, Dileep George
Nature Communications (2020)

Prefrontal computation as active inference

Thomas Parr, Rajeev V Rikhye, Michael M Halassa, Karl J Friston
Cerebral Cortex (2019)

Thalamic regulation of switching between cortical representations enables cognitive flexibility

Rajeev V Rikhye, Aditya Gilra, Michael M Halassa
Nature Neuroscience 21.12 (2018)

Toward an integrative theory of thalamic function

Rajeev V Rikhye, Ralf D Wimmer, Michael M Halassa
Annual Review of Neuroscience 41 (2018)

Reliable sensory processing in mouse visual cortex through inhibitory interactions between Somatostatin and Parvalbumin interneurons

Rajeev V Rikhye, Ming Hu, Murat Yildirim, Mriganka Sur
bioRxiv (2017)

Jointly reduced inhibition and excitation underlies circuit-wide changes in cortical processing in Rett syndrome

Abhishek Banerjee, Rajeev V Rikhye, Vincent Breton-Provencher, Xin Tang, Chenchen Li, Keji Li, Caroline A Runyan, Zhanyan Fu, Rudolf Jaenisch, Mriganka Sur
Proceedings of the National Academy of Sciences 113.46 (2016)

Spatial Correlations in Natural Scenes Modulate Response Reliability in Mouse Visual Cortex

Rajeev V Rikhye, Mriganka Sur
The Journal of Neuroscience 35.43 (2015)

CONFERENCE PROCEEDINGS

Different clones for different contexts: Hippocampal cognitive maps as higher-order graphs of a cloned HMM

Nishad Gothoskar, J Swaroop Guntupalli, Rajeev V Rikhye, Miguel Lázaro-Gredilla, Dileep George
2019 Conference on Cognitive Computational Neuroscience

Memorize-Generalize: An online algorithm for learning higher-order sequential structure with cloned Hidden Markov Models

Rajeev V Rikhye, J Swaroop Guntupalli, Nishad Gothoskar, Miguel Lázaro-Gredilla, Dileep George
2019 Conference on Cognitive Computational Neuroscience

GDspike: an accurate spike estimation algorithm from noisy calcium fluorescence signals

Jilt Sebastian, YS Sreekar, Rajeev V Rikhye, Mriganka Sur, Hema A Murthy
2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)