Aran Nayebi

website: `https://anayebi.github.io/`
Google Scholar Profile

EDUCATION

Doctor of Philosophy, Neuroscience 2016-2022
Stanford University
Cumulative GPA: 4.04/4.0

Master of Science, Computer Science 2015-2017
Stanford University
Concentration: Artificial Intelligence
Cumulative GPA: 4.05/4.0

Bachelor of Science, Mathematics 2011-2015
Stanford University
Cumulative Major GPA: 3.94/4.0
Secondary Major: Symbolic Systems Concentration: Applied Logic

AWARDS

2020 Top 10% Reviewer for Neural Information Processing Systems (NeurIPS)
2017-2020 Stanford Mind, Brain, Computation, and Technology (MBCT) Graduate Trainee
2017 Hertz Foundation Finalist
2015 NSF Graduate Research Fellowship (NSF GRFP)
2014 Barry M. Goldwater Scholarship
2014 Phi Beta Kappa Honors Society
2012 Stanford Undergraduate Advising & Research (UAR) Small Grant Recipient
2011-2015 Launcelot J. Gamble Undergraduate Scholarship

RESEARCH POSITIONS

ICoN Postdoctoral Fellow, McGovern Institute, MIT 2022-
PIs: Guangyu Robert Yang, Mehrdad Jazayeri, and Michael Halassa

NeuroAI Lab, Stanford University 2016-2022
PI: Dr. Daniel L.K. Yamins
Developed techniques from deep learning and large-scale data analysis to "reverse engineer" neural circuits.

Neural Dynamics and Computation Lab, Stanford University 2016-2022
PI: Dr. Surya Ganguli
Developed techniques from deep learning and large-scale data analysis to "reverse engineer" neural circuits.

Baccus Lab, Stanford University 2015-2016
PI: Dr. Stephen A. Baccus
Modeling the retinal response to natural scenes.

Computer Science Department, CURIS Program, Stanford University 2014-2015
PI: Dr. Virginia V. Williams
Developed quantum algorithms for shortest path problems.

Computer Science Department, CURIS Program, Stanford University 2013-2014
PI: Dr. Luca Trevisan

Proved lower bounds for advised quantum computations.

Mathematics Department, Stanford University 2012-2013
PIs: Dr. Solomon Feferman & Dr. Grigori Mints
Research in mathematical logic (Diophantine equations) and the philosophy of computing.

MANUSCRIPTS UNDER REVIEW (*: joint first **: joint senior)

1. **A. Nayebi***, N.C.L. Kong*, C. Zhuang, J.L. Gardner, A.M. Norcia, D.L.K. Yamins. "Mouse visual cortex as a limited resource system that self-learns an ecologically-general representation". *bioRxiv 2021.*
2. N. Maheswaranathan*, L.T. McIntosh*, H. Tanaka, S. Grant, D.B. Kastner, J.B. Melander, **A. Nayebi**, L. Brezovec, J. Wang, S. Ganguli, S.A. Baccus. "The dynamic neural code of the retina for natural scenes". *bioRxiv* 2019.

PUBLICATIONS

1. **A. Nayebi**, J. Sagastuy-Brena, D.M. Bear, K. Kar, J. Kubilius, S. Ganguli, D. Sussillo, J.J. DiCarlo, D.L.K. Yamins. "Recurrent connections in the primate ventral visual stream mediate a tradeoff between task performance and network size during core object recognition". *Neural Computation*, Volume 34 (2022): 1652-1675.
2. **A. Nayebi**, A. Attinger, M.G. Campbell, K. Hardcastle, I.I.C. Low, C.S. Mallory, G.C. Mel, B. Sorscher, A.H. Williams, S. Ganguli, L.M. Giocomo, D.L.K. Yamins. "Explaining heterogeneity in medial entorhinal cortex with task-driven neural networks". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 34 (2021). (Selected for spotlight presentation)
3. J.B. Melander*, **A. Nayebi***, B.C. Jongbloets, D.A. Fortin, M. Qin, S. Ganguli**, T. Mao**, H. Zhong**. "Distinct *in vivo* dynamics of excitatory synapses onto cortical pyramidal neurons and inhibitory interneurons". *Cell Reports*, Volume 37 (2021).
4. C. Zhuang, S. Yan, **A. Nayebi**, M. Schrimpf, M.C. Frank, J.J. DiCarlo, D.L.K. Yamins. "Unsupervised neural network models of the ventral visual stream". *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, Volume 118 (2021).
5. **A. Nayebi***, S. Srivastava*, S. Ganguli, D.L.K. Yamins. "Identifying learning rules from neural network observables". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 33 (2020). (Selected for spotlight presentation)
6. D.M. Bear, C. Fan, D. Mrowca, Y. Li, S. Alter, **A. Nayebi**, J. Schwartz, L. Fei-Fei, J. Wu, J.B. Tenenbaum, D.L.K. Yamins. "Learning physical graph representations from visual scenes". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 33 (2020). (Selected for oral presentation)
7. D. Kunin*, **A. Nayebi***, J. Sagastuy-Brena*, S. Ganguli, J. Bloom, D.L.K. Yamins. "Two routes to scalable credit assignment without weight symmetry". *Proceedings of the 37th International Conference on Machine Learning (ICML)*, PMLR 119 (2020):5511-5521.
8. C. Zhuang, S. Yan, **A. Nayebi**, D.L.K. Yamins. "Self-supervised neural network models of higher visual cortex development". *Conference on Cognitive Computational Neuroscience (CCN)* 2019: 566-569.
9. J. Kubilius*, M. Schrimpf*, K. Kar, R. Rajalingham, H. Hong, N.J. Majaj, E.B. Issa, P. Bashivan, J. Prescott-Roy, K. Schmidt, **A. Nayebi**, D.M.

Bear, D.L.K. Yamins, J.J. DiCarlo. "Brain-like object recognition with high-performing shallow recurrent ANNs". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 32 (2019): 12805-12816. (Selected for oral presentation)

10. H. Tanaka, **A. Nayebi**, N. Maheswaranathan, L.T. McIntosh, S.A. Baccus, S. Ganguli. "From deep learning to mechanistic understanding in neuroscience: the structure of retinal prediction". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 32 (2019): 8537-8547.
11. **A. Nayebi***, D.M. Bear*, J. Kubilius*, K. Kar, S. Ganguli, D. Sussillo, J.J. DiCarlo, D.L.K. Yamins. "Task-driven convolutional recurrent models of the visual system". *Advances in Neural Information Processing Systems (NeurIPS)*, Volume 31 (2018): 5290-5301.
12. P.S. Javangula, K. Modarresi, P. Shenoy, Y. Liu, **A. Nayebi**. "Efficient hybrid algorithms for computing clusters overlap". *Procedia Computer Science*, Volume 108 (2017): 1050-1059.
13. L.T. McIntosh*, N. Maheswaranathan*, **A. Nayebi**, S. Ganguli, S.A. Baccus. "Deep learning models of the retinal response to natural scenes". *Advances in Neural Information Processing Systems (NIPS)*, Volume 29 (2016): 1369-1377.
14. **A. Nayebi** and V.V. Williams. "Quantum algorithms for shortest paths problems in structured instances". 17th Annual Southwest Quantum Information and Technology (SQuInT) Workshop. 2015.
15. **A. Nayebi**, S. Aaronson, A. Belovs, L. Trevisan. "Quantum lower bound for inverting a permutation with advice". *Quantum Information & Computation*, Volume 15 (2015): 901-913.
16. **A. Nayebi**. "Exponential prefixed polynomial equations". *Bulletin of Symbolic Logic*, Volume 20 (2014): 252.
17. **A. Nayebi**. "Practical intractability: a critique of the hypercomputation movement". *Minds and Machines*, Volume 24 (2014): 275-305.
18. **A. Nayebi**. "Fast matrix multiplication techniques based on the Adleman-Lipton model". *International Journal of Computer Engineering Research*, Volume 3 (2012): 10-19. **(Published while in high school)**
19. **A. Nayebi**. "Upper bounds on the solutions to $n = p + m^2$". *Bulletin of the IMS*, Volume 37 (2011): 95-108. **(Published while in high school)**

TALKS

1. *A goal-driven approach to systems neuroscience*. PhD Dissertation Defense Talk. 15 March 2022. Stanford, CA.
2. *Explaining heterogeneity in medial entorhinal cortex with task-driven neural networks*. Neural Information Processing Systems (NeurIPS) 2021 Spotlight Presentation. 9 December 2021. Virtual.
3. *Explaining heterogeneity in medial entorhinal cortex with task-driven neural networks*. Neuromatch 4.0 Flash Talk. 1 December 2021. Virtual.
4. *Explaining heterogeneity in medial entorhinal cortex with task-driven neural networks*. Stanford Computational Neuroscience Journal Club (CNJC). 17 November 2021. Stanford, CA.
5. *A model-based approach towards identifying the brain's learning algorithms*. Stanford Mind, Brain, Computation, and Technology Seminar. 25 January 2021. Virtual.

6. *Identifying learning rules from neural network observables*. Neural Information Processing Systems (NeurIPS) 2020 Spotlight Presentation. 10 December 2020. Virtual.
7. *Identifying learning rules from neural network observables*. Neuromatch 3.0. 29 October 2020. Virtual.
8. *Assessing the role of feedback connections in artificial and biological neural networks*. Stanford Mind, Brain, Computation, and Technology Seminar. 18 May 2020. Virtual.
9. Presented with J. Sagastuy-Brena. *Two routes to scalable credit assignment without weight symmetry*. International Conference on Machine Learning (ICML) 2020. 12-18 July 2020. Virtual.
10. *Task-driven convolutional recurrent neural network models of dynamics in higher visual cortex*. Society for Neuroscience (SfN) 2019. Minisymposium on Artificial Intelligence and Neuroscience. 21 October 2019. Chicago, IL.
11. *Task-driven recurrent models & dissecting neural computations in silico*. Bernstein Conference 2019. Brain against the Machine Workshop. 18 September 2019. Berlin, Germany.
12. Presented with J.B. Melander. *Deep networks and the brain: simile or metaphor?* Stanford Computational Neuroscience Journal Club (CNJC). 17 April 2019. Stanford, CA.
13. *Measuring and modeling the weight dynamics of many synapses onto diverse cell-types in vivo*. Computational and Systems Neuroscience (Cosyne) 2019. Talk T-36. 3 March 2019. Lisbon, Portugal.
14. *Convolutional recurrent neural network models of dynamics in higher visual cortex*. Vision Sciences Society (VSS) Meeting 2018. 21 May 2018. St. Pete Beach, FL.
15. *Convolutional recurrent neural network models of neural dynamics in the ventral visual stream*. Stanford Psychology FriSem. 7 March 2018. Stanford, CA.
16. *Lower bounds for advised quantum computations*. Stanford Mathematical Logic Seminar. 20 May 2014. Stanford, CA.
17. *On the elimination of the bounded universal quantifier for Diophantine predicates*. Stanford Mathematical Logic Seminar. 22 January 2013. Stanford, CA.
18. *Interactive paradigms of computation*. Stanford Mathematical Logic Seminar. 24 April 2012. Stanford, CA.

POSTERS

1. J. Sagastuy-Brena*, I. Thobani*, **A. Nayebi**, R. Cao, D.L.K. Yamins. *Modelling inter-animal variability*. Conference on Cognitive Computational Neuroscience (CCN) 2022. Poster #P-1.35. 25 August 2022. San Francisco, CA.
2. **A. Nayebi**, A. Attinger, M.G. Campbell, K. Hardcastle, I.I.C. Low, C.S. Mallory, G.C. Mel, B. Sorscher, A.H. Williams, S. Ganguli, L.M. Giocomo, D.L.K. Yamins. *Explaining heterogeneity in medial entorhinal cortex with task-driven neural networks*. Neural Information Processing Systems (NeurIPS) 2021. Poster #F0. 9 December 2021. Virtual.
3. **A. Nayebi***, S. Srivastava*, S. Ganguli, D.L.K. Yamins. *Identifying learning rules from neural network observables*. Computational and Systems Neuroscience (Cosyne) 2021. Poster I-116. 24 February 2021. Virtual.

4. **A. Nayebi***, S. Srivastava*, S. Ganguli, D.L.K. Yamins. *Identifying learning rules from neural network observables*. Neural Information Processing Systems (NeurIPS) 2020. Poster #1568. 10 December 2020. Virtual.
5. D.M. Bear, C. Fan, D. Mrowca, Y. Li, S. Alter, **A. Nayebi**, J. Schwartz, L. Fei-Fei, J. Wu, J.B. Tenenbaum, D.L.K. Yamins. *Learning physical graph representations from visual scenes*. Neural Information Processing Systems (NeurIPS) 2020. Poster #131. 7 December 2020. Virtual.
6. D. Kunin*, **A. Nayebi***, J. Sagastuy-Brena*, S. Ganguli, J. Bloom, D.L.K. Yamins. *Two routes to scalable credit assignment without weight symmetry*. International Conference on Machine Learning (ICML) 2020. 14 July 2020. Virtual.
7. H. Tanaka, **A. Nayebi**, N. Maheswaranathan, L.T. McIntosh, S.A. Baccus, S. Ganguli. *From deep learning to mechanistic understanding in neuroscience: revealing computational mechanisms of retinal prediction via model reduction*. Computational and Systems Neuroscience (Cosyne) 2020. Poster III-62. 29 February 2020. Denver, CO.
8. J. Kubilius*, M. Schrimpf*, K. Kar, R. Rajalingham, H. Hong, N.J. Majaj, E.B. Issa, P. Bashivan, J. Prescott-Roy, K. Schmidt, **A. Nayebi**, D.M. Bear, D.L.K. Yamins, J.J. DiCarlo. *Brain-like object recognition with high-performing shallow recurrent ANNs*. Neural Information Processing Systems (NeurIPS) 2019. Poster #190. 12 December 2019. Vancouver, Canada.
9. H. Tanaka, **A. Nayebi**, N. Maheswaranathan, L.T. McIntosh, S.A. Baccus, S. Ganguli. *From deep learning to mechanistic understanding in neuroscience: the structure of retinal prediction*. Neural Information Processing Systems (NeurIPS) 2019. Poster #152. 11 December 2019. Vancouver, Canada.
10. M. Schrimpf, K. Kar, P. Bashivan, **A. Nayebi**, J.J. DiCarlo, J. Kubilius, H. Hong, N.J. Majaj, R. Rajalingham, E.B. Issa, D.M. Bear, J. Prescott-Roy, JK. Schmidt, D.L.K. Yamins. *Using brain-score to evaluate and build neural networks for brain-like object recognition*. Computational and Systems Neuroscience (Cosyne) 2019. Poster III-61. 2 March 2019. Lisbon, Portugal.
11. **A. Nayebi***, D.M. Bear*, J. Kubilius*, K. Kar, S. Ganguli, D. Sussillo, J.J. DiCarlo, D.L.K. Yamins. *Task-driven convolutional recurrent models of the visual system*. Neural Information Processing Systems (NeurIPS) 2018. Poster #20. 4 December 2018. Montreal, Canada.
12. **A. Nayebi***, J. Kubilius*, D.M. Bear, S. Ganguli, J.J. DiCarlo, D.L.K. Yamins. *Convolutional recurrent neural network models of dynamics in higher visual cortex*. Computational and Systems Neuroscience (Cosyne) 2018. Poster III-83. 3 March 2018. Denver, CO.
13. N. Maheswaranathan*, L.T. McIntosh*, D.B. Kastner, L. Brezovec, **A. Nayebi**, S. Ganguli, S.A. Baccus. *Deep models of retinal responses to natural scenes generalize to diverse structured stimuli*. Computational and Systems Neuroscience (Cosyne) 2018. Poster III-8. 3 March 2018. Denver, CO.
14. L.T. McIntosh*, N. Maheswaranathan*, **A. Nayebi**, S. Ganguli, S.A. Baccus. *Deep learning models of the retinal response to natural scenes*. Neural Information Processing Systems (NIPS) 2016. Poster #150. 5 December 2016. Barcelona, Spain.
15. L.T. McIntosh*, N. Maheswaranathan*, **A. Nayebi**, S. Ganguli, S.A. Baccus. *Deep convolutional neural network models of the retinal response to natural scenes*. Computational and Systems Neuroscience (Cosyne) 2016. Poster III-26. 27 February 2016. Salt Lake City, UT.

16. **A. Nayebi** and V.V. Williams. *Quantum algorithms for shortest paths problems in structured instances*. 17th Annual Southwest Quantum Information and Technology (SQuInT) Workshop. 19-21 February 2015. Berkeley, CA.
17. **A. Nayebi**. *Exponential prefixed polynomial equations*. Association for Symbolic Logic (ASL) European Summer Meeting - Logic Colloquium 2013. 22-27 July 2013. Évora, Portugal.

PATENTS

1. K. Modarresi, I. Radu, C. Menguy, J.V. Muthiyil, Y. Liu, S. Qiang, **A. Nayebi**. *Segment extension based on lookalike selection*. Patent #15,700,343. 14 March 2019.
2. K. Modarresi, Y. Liu, P.P. Shenoy, **A. Nayebi**, P.S. Javangula. *User data overlap determination in a digital medium environment*. Patent #15,610,033. 6 December 2018.
3. K. Modarresi, J.M. Diner, E.T. Chin, **A. Nayebi**. *Segment valuation in a digital medium environment*. Patent #15,354,944. 17 May 2018.

INDUSTRY EXPERIENCE

Machine Learning Scientist Intern at Adobe Systems, Inc June 2016-September 2016

Produced 3 patents and 1 publication.

- Analyzed live and historic data to provide insights to the data set
- Researched, prototyped, and implemented new models and algorithms
- Cooperated and collaborated with other teams across Adobe on common project
- Validated and tested models and algorithms

Author of Ranking Model, Total Waterpolo March 2011-September 2011

Hired to create the first automated water polo ranking model in the United States, which ranks teams based on strength of schedule and home team advantage.

SKILLS

Programming Languages: Python, MATLAB, R, Mathematica, C/C++, Bash. *Software Frameworks:* NumPy, TensorFlow, PyTorch, SciPy, Scikit-learn, Pandas, Theano, Git/Github, LaTeX.

SOFTWARE

1. A creator of `ptutils`, a set of utilities for training and validating PyTorch models on GPU and TPU. Initial release: 2022.
2. A primary contributor to `tnn`, a set of utilities for building temporal neural networks with TensorFlow. 84 Github stars & 13 forks as of September 2021. Initial release: 2016.
3. A primary contributor to `tfutils`, a set of utilities for training and validating TensorFlow models on GPU and TPU. 25 Github stars & 9 forks as of September 2021. Initial release: 2016.
4. Co-author of `GRUV`, a package for algorithmic music generation using recurrent neural networks. 793 Github stars & 170 forks as of September 2021. Initial release: 26 July 2015.
5. Author of Poisson loss, `Permute`, `UpSample1D`, and `UpSample2D` layers in the Keras deep learning API. 2015.
6. Author of `keras-extra` package to connect CNN layers with RNN layers in the Keras deep learning API. 155 Github stars & 37 forks as of September 2021. Initial release: 2015.

7. Author of `DMG Automounter for Linux` shell script to mount Mac OS X DMG files in Linux. 19,138 downloads as of September 2021. Initial release: 2008.

BYLINE ARTICLES

1. **A. Nayebi**. *A model-based approach towards identifying the brain's learning algorithms*. The Stanford AI Lab Blog. 9 December 2020.
2. **A. Nayebi**. *Complementary learning systems within the hippocampus: reconciling episodic memory with statistical learning*. Stanford NeuWrite West Blog. 4 February 2018.

REVIEWER

Nature Communications; Neural Computation; Journal of Neuroscience; Conference on Cognitive Computational Neuroscience (CCN) 2019; Neural Information Processing Systems (NeurIPS) 2018, 2019, 2020; International Conference on Learning Representations (ICLR) 2021; Brain-Score Cosyne 2022 Workshop.

TEACHING

- Spring Quarter 2018. Teaching Assistant, Neuroscience Computational Core (NEPR 208). Instructor: S.A. Baccus. Stanford University.
- Autumn Quarter 2017. Teaching Assistant, Large-Scale Neural Network Models for Neuroscience (CS 375). Instructor: D.L.K. Yamins. Stanford University.

UNIVERSITY SERVICE

- 2020. Munger Graduate Residence Community Associate (CA). Stanford University.
- 2018-2019. Mind, Brain, Computation, and Technology (MBCT) Seminar Organizer. Stanford University.
- 2014-2016. Advising Fellow for the Symbolic Systems Program. Stanford University.
- 2014-2015. Murray House Resident Computing Consultant (RCC). Stanford University.