Nishal Pradeepbhai Shah

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Education

- **Stanford University**
  PhD in Electrical engineering (2013-2020)
  Advisor: Prof. E.J. Chichilnisky
  Thesis: Computational Neuroengineering for Artificial Retina
  GPA: 4.0/4.0

- **Indian Institute of Technology, Delhi**
  Masters of Technology in Information and Communications Technology (2008-2013)
  Dissertation: Development of Orientation Selectivity, Orientation Plasticity And Disparity Selectivity in Mouse V1: A Model
  GPA: 9.583/10

- **Indian Institute of Technology, Delhi**
  Bachelor of Technology in Electrical Engineering (2008-2013)
  GPA: 9.548/10

Awards

- **Milton Safenowitz Postdoctoral Fellowship (2020)** by ALS Association
- **Numerical Technical Founders' fellowship (2014)** to pursue graduate studies at Stanford University
- Secured **Rank 1** (out of 101) in Electrical Engineering qualifying exam at Stanford
- Departmental Scholarship from Dept. Of Electrical Engg at Stanford, 2013-2014
- **Silver Medal** for being first in the undergraduate class at IIT Delhi
- Semester Merit Award: **Four times** for being in the top 7% of the undergraduates
- **CBSE scholarship** for securing 1st Rank in State and 45th All India Rank amongst nearly 800,000 students in All India Engineering Entrance Exam
- Secured All India Rank 208 in All India Pre-Medical Test from amongst 150,000 students
- **National Talent Search Exam (NTSE) scholarship**, 2006
- All India Rank 6 in National Science Olympiad, 2005
- **Travel award** for attending Cosyne 2017
- **Finalist** for Qualcomm Innovation Fellowship in 2016 and 2018

Work Experience

- **Stanford University**
  Postdoctoral Researcher (January, 2021 - Ongoing)
  Advisors: Prof Krishna Shenoy, Dr. Jaimie Henderson

- **Howard Hughes Medical Institute / Stanford University**
  Postdoctoral Researcher (August, 2020 - January, 2021)
  Advisors: Prof Krishna Shenoy, Dr. Jaimie Henderson

- **Stanford University**
  Postdoctoral Researcher (June, 2020 - August, 2020)
  Advisor: Prof. EJ Chichilnisky

- **Google Brain**
  Intern (July, 2016 - March, 2018), Student Researcher (March, 2018 - Sept, 2018)
  Advisors: Yoram Singer, Jonathan Shlens
  Developed machine learning methods for large-scale computational models of hierarchical processing in retina and algorithms for closed loop retinal prosthesis.

- **Computational Cognitive Neuroscience Lab**
  University of Colorado, Boulder
  Intern (May, 2012 - July, 2012)
  Advisor : Prof. Randall O'Reilly
  Developed working memory models of decision making in multiple cognitive tasks.

- **Qualcomm MEMS Technologies**
  Summer Intern (May, 2011 - July, 2011)
  Created a System-Level Analysis and Optimization tool for novel MEMS display.

Journal Papers

1. Pumiao Yan, Arash Akhoundi, **Nishal P. Shah**, Pulkit Tandon, Dante G. Muratore, E.J.Chichilnisky, and Boris Murmann. Data Compression versus Signal Fidelity Tradeoff in Wired-OR Analog-to-Digital Compressive Arrays for Neural Recording. IEEE TBioCAS. July, 2023
2. M. Zaidi, G. Aggarwal, **Nishal P. Shah**, O. Karniol-Tambour, G. Goetz, S. Madugula, A. R. Gogliettino, E. G. Wu, A. Kling, N. Brackbill, A. Sher, A. M. Litke, E.J. Chichilnisky. Inferring retinal ganglion cell light response properties from intrinsic electrical features. Journal of Neural Engineering. June 2023
3. S. Madugula, R. Vilkhu, **Nishal P. Shah**, L. Grosberg, A. Kling, A. Gogliettino, H. Nguyen, P. Hottowy, A. Sher, A. Litke, E.J. Chichilnisky. Inference of Electrical Stimulation Sensitivity from Recorded Activity of Primate Retinal Ganglion Cells. Journal of Neuroscience. June 2023
4. S. Madugula, A. R. Gogliettino, M. Zaidi, G. Aggarwal, A. Kling, **Nishal P Shah**, R. Vilkhu, M. Hays, H. Nguyan, V. Fan, E. G. Wu, P. Hottowy, A. Sher, A. M. Litke, R. A. Silva, E.

J. Chichilnisky. Focal Electrical Stimulation of Human Retinal Ganglion Cells for Vision Restoration. Journal of Neural Engineering. December 2022.

5. **Nishal P Shah**, N. Brackbill, R. Samarakoon, C. Rhoades, A. Kling, A. Sher, A. Litke, Y. Singer, J. Shlens, E.J. Chichilnisky. Learning Variability in the Neural Code of the Retina. Neuron, February 2022.
6. P. Tandon, N. Bhaskar, **Nishal P. Shah**, S. Madugula, L.E. Grosberg, V.H. Fan, P. Hottowy, A. Sher, A.M. Litke, E.J. Chichilnisky, S. Mitra. Automatic Identification and Avoidance of Axon Bundle Activation for Epiretinal Prosthesis. IEEE Trasactions on Neural Systems and Rehabilitation Engineering 2021.
7. N. Brackbill, C. Rhoades, A. Kling, **Nishal P. Shah**, A. Sher, A. M. Litke, E.J. Chichilnisky. Reconstruction of natural images from responses of primate retinal ganglion cells. eLife November 2020
8. **Nishal P Shah**, E.J. Chichilnisky. Computational Challenges and Opportunities for a Bidirectional Artificial Retina. Journal of Neural Engineering, October 2020
9. **Nishal P Shah**, N. Brackbill, C. Rhoades, A. Kling, G. Goetz, A. Litke, A. Sher, E. P. Simoncelli, E.J. Chichilnisky. Inference of nonlinear receptive field subunits with spike-triggered clustering. eLife:9:e45743 March, 2020
10. C. Rhoades, **Nishal P Shah**, M. Manookin, N. Brackbill, A. Kling, G. Goetz, A. Sher, A. Litke, E.J. Chichilnisky Unusual Physiological Properties of Smooth Monostratified Ganglion Cell Types in Primate Retina. Neuron, June 2019.
11. B. Bhaumik, **Nishal P. Shah**. Development and Matching of Binocular Orientation Preference in Mouse V1. Frontiers in Systems Neuroscience 8, 2014

Conference Papers

1. **Nishal P. Shah**, M. S. Willsey, N. Hahn, F. Kamdar, D. Avansino, Krishna Shenoy*, Jaimie Henderson*. A brain-computer typing interface using finger movements. IEEE NER, April 2023
2. P. Vasireddy, A. Gogliettino, J. Brown, R. Vilkhu, S. Madugula, A.J. Phillips, S. Mitra, P. Hottowy, A. Sher, A. Litke, **Nishal P. Shah**, E.J. Chichilnisky. Efficient Modeling and Calibration of Multi-Electrode Stimuli for Epiretinal Implants. IEEE NER, April 2023 (Oral presentation)
3. A. Lotlikar, **Nishal P. Shah**, A. Gogliettino, R. Vilkhu, S. Madugula, L. Grosberg, P. Hottowy, A. Sher, A. Litke, E.J. Chichilnisky, Subhasish Mitra. Partitioned Temporal Dithering for Efficient Epiretinal Electrical Stimulation. IEEE NER, April 2023
4. AJ Phillips, **Nishal P Shah**, M. Hays, S. Madugula, J. Brown, P. Hottowy, A. Sher, A. Litke, EJ Chichilnisky Spatially Multiplexed Electrical Stimulation to Reproduce the Neural Code in the Primate Retina. IEEE NER, April 2023
5. Pumiao Yan, **Nishal P. Shah**, Dante G. Muratore, Pulkit Tandon, E.J. Chichilnisky, Boris Murmann. Data Compression versus Signal Fidelity Tradeoff in Wired-OR ADC Arrays for Neural Recording. IEEE Biomedical Circuits and Systems Conference, October 2022
6. **Nishal P. Shah**, S. Madugula, P. Hottowy, A. Sher, A. Litke, L. Paninski, E.J. Chichilnisky. Efficient Characterization of Electrically Evoked Responses for Neural Interfaces. NeurIPS, December 2019

7. **Nishal P. Shah**, S. Madugula, L. Grosberg, G. Mena, P. Tandon, P. Hottowy, A. Sher, A. Litke, S. Mitra, E.J. Chichilnisky Optimization of Electrical Stimulation for a High-Fidelity Artificial Retina. IEEE NER, March 2019 (*Invited for Plenary talk*)
8. **Nishal P. Shah**, S. Madugula, E.J. Chichilnisky, Y. Singer, J. Shlens. Learning a neural response metric for retinal prosthesis. ICLR, April 2018
9. **Nishal P. Shah**, F. Alexandre. Reinforcement learning and dimensionality reduction: A model in computational neuroscience. IJCNN, July 2011

Pre-prints

1. **Nishal P. Shah**, S. Madugula, A.J. Philips, L. Grosberg, A.R. Gogliettino, A. Dusi, P. Tandon, J. Brown, P. Hottowy, W. Dabrwoski, A. Sher, A. M. Litke, S. Mitra, E.J. Chichilnisky. Precise control of neural activity using temporally dithered and spatially multiplexed electrical stimulation. bioRxiv, July 2022
2. A. Kling, A.R. Gogliettino, **Nishal P Shah**, E. G. Wu, N. Brackbill, A. Sher, A. Litke, R. A. Silva, E. J. Chichilnisky. Functional Organization of Midget and Parasol Ganglion Cells in the Human Retina. bioRxiv 2020

Conference Abstracts (peer-reviewed)

1. **Nishal P Shah**, D. Avansino, F. Kamdar, F. Willet, L. Hochberg, J. Henderson, K. Shenoy. Neural representation of hand gestures in human premotor cortex. Computational and Systems Neuroscience (CoSyNe), March, 2022.
2. **Nishal P Shah**, N. Brackbill, R. Samarakoon, C. Rhoades, A. Kling, A. Sher, A. Litke, Y. Singer, J. Shlens, E.J. Chichilnisky. Learning Variability in the Neural Code of the Retina. Computational and Systems Neuroscience (CoSyNe), February 2019
3. **Nishal P Shah**, N. Brackbill, C. Rhoades, A. Tikidji-Hamburyan, G. Goetz, A. Sher, A. Litke, L. Paninski, E.P. Simoncelli, E.J. Chichilnisky. Model-based inference of nonlinear subunits underlying responses of primate retinal ganglion cells. Computational and Systems Neuroscience (CoSyNe), February 2017
4. **Nishal P Shah**, N. Brackbill, C. Rhoades, A. Tikidji-Hamburyan, G. Goetz, A. Litke, A. Sher, V. Gupta, Y. Singer, E.J. Chichilnisky, J. Shlens. Learning nonlinear models for visual computation in populations of retinal ganglion cells. Computational and Systems Neuroscience (CoSyNe), February 2017

Conference Abstracts (not peer-reviewed)

1. M.S. Willsey, **Nishal P. Shah**, N. Hahn, L.R. Hochberg, K.V. Shenoy, J.M. Henderson, "Decoding Finger Movements for People with Paralysis Using Neural Network Decoding Algorithms in Intracortical Brain-computer Interfaces," AANS 2023 Annual Meeting, April 2023, Los Angeles, CA.
2. **Nishal P Shah**, D. Avansino, F. Kamdar, F. Willet, L. Hochberg, J. Henderson, K. Shenoy. Neural representation of hand gestures in human premotor cortex. SfN, November 2022.
3. C. E. Vargas-Irwin, T. Hosman, J. Gusman, T. K. Pun, T. Singer-Clark, A. Kapitonava, **Nishal. P. Shah**, F. Kamdar, L. R. Hochberg. Single hemisphere encoding of 48 right and left hand gestures in human precentral gyrus. SfN, November 2022.

4. M. Zaidi, G. Aggarwal, **Nishal P. Shah**, O. Karniol-Tambour, G. Goetz, S. Madugula, A. R. Gogliettino, E. G. Wu, A. Kling, N. Brackbill, A. Sher, A. M. Litke, E.J. Chichilnisky. Inferring retinal ganglion cell light response properties from intrinsic electrical features.Investigative Opthalmology and Visual Science (ARVO), May 2021
5. **Nishal P Shah**, D. Avansino, F. Willet, L. Hochberg, K. Shenoy, J. Henderson. Neural representation of hand gestures in human premotor cortex. SfN 2021.
6. **Nishal P. Shah**, S. Madugula, L. Grosberg, G. Mena, P. Hottowy, W. Dabrowski, A. Sher, A.M. Litke, S. Mitra, E.J. Chichilnisky. Temporal dithering of epiretinal stimulation to optimize artificial vision. The Eye and the Chip (TEATC), November 2019 (*Oral Presentation*)
7. S. Madugula, L. Grosberg, G. Mena, **Nishal P. Shah**, P. Hottowy, A. Sher, A. M. Litke, L. Paninski, E.J. Chichilnisky. Using electrical images to predict electrical stimulation thresholds for epiretinal stimulation. The Eye and the Chip (TEATC), November 2019 (*Best poster award*)
8. **Nishal P Shah**, S. Madugula, L. Grosberg, G. Mena, K. Ganesan, N. Bhaskhar, P. Hottowy, W.Dabrowski, A. Sher, A.M. Litke, S. Mitra, E.J. Chichilnisky. Greedy dictionary-based stimulation for optimization of epiretinal prosthesis. The Eye and The Chip (TEATC), September 2017
9. **Nishal P Shah**, N. Brackbill, C. Rhoades, A. Tikidji-Hamburyan, G. Goetz, A. Litke, A. Sher, V. Gupta, Y. Singer, E.J. Chichilnisky, J. Shlens. Learning nonlinear models for visual computation in populations of retinal ganglion cells. Computational and Systems Neuroscience (CoSyNe), February 2017

Talks

1. Neural representation of finger movements in human premotor cortex. Nanosymposium on *Advances in Neuroprosthetics for Control of Motor Behavior* at SfN, November 2022.
2. Brain Computer Interfaces for Restoration of Movement After Paralysis. ALS Association Research Conference, Golden State Coast Chapter. January 2022 (Invited)
3. Brain Computer Interfaces for Restoration of Movement After Paralysis. ALS Association Research Week, West Coast Chapter. November 2021 (Invited)
4. Individual variability of neural computations in primate retina. Vision Brunch, Stanford University. May 2020 (*Invited*)
5. Computational neuroengineering for artificial retina. Vision Brunch, Stanford University. February 2020 (*Invited*)
6. Temporal dithering of epiretinal stimulation to optimize artificial vision. The Eye and the Chip (TEATC), November 2019
7. Real Time Optimization Of Visual Coding For Artificial Retina. Computational and Systems Neuroscience (Cosyne) March 2018 (*Invited*)
8. Model-based identification of retinal ganglion cell subunits. Investigative Opthalmology and Visual Science Supplement (ARVO), May 2016

Patents

1. **Nishal P. Shah** and E.J. Chichilnisky; Systems and Methods for Artificial Sight Prosthetics. Application filed on March 23, 2020; PCT/US2020/024298
2. **Nishal P. Shah**, Krishna Shenoy and Jaimie Henderson; Multidimensional Keyboard for Brain-Computer Interfaces. Provisional application filed April 2023.

3. Praful Vasireddy, **Nishal P. Shah**, and E.J. Chichilnisky. Systems and Methods for Calibration of Retinal Prosthetics. Provisional application filed April 2023.

Reviewer

- Neural Information Processing System (NeurIPS) 2020, 2021, 2022, 2023.
- Journal of Neural Engineering.
- International Conference on Machine Learning (ICML) 2021, 2022.
- International Conference on Learning Representations (ICLR) 2023.
- Nature Reviews Bioengineering.
- Transactions of Machine Learning Research (TMLR).