

Education

Ph.D., Computer Science, New York University	2017–2022
◦ Thesis: Better Visual Synthesis via Better Inductive Biases ◦ Thesis committee: Guido Gerig (advisor), Marc Niethammer, Daniel Rueckert, Sotirios Tsaftaris	
M.S., Electrical Engineering, New York University	2015–2017
B.E., Electronics & Telecommunications Engineering, University of Mumbai	2010–2014

Research experience

Instructor, Radiology, Harvard Medical School and Massachusetts General Hospital, MA	2025–
◦ Investigator and faculty member at the Athinoula A. Martinos Center for Biomedical Imaging.	
Postdoctoral Associate, CSAIL, Massachusetts Institute of Technology, MA	2022–2024
◦ PI: Polina Golland ◦ Developed data-efficient representation learning and domain randomization methods to train networks that generalize to new datasets and tasks at test time with no retraining. ◦ Led the development of a large-scale AI-based curation, annotation, and image analysis framework for tens of thousands of fetal and maternal MRI volumes with clinical partners at Harvard Medical School.	
Research Assistant, Computer Science & Engineering, New York University, NY	2016–22
◦ PI: Guido Gerig ◦ Ph.D. research focused on data-efficient and prior-driven deep learning for image analysis via group-equivariant networks, generative adversarial networks, representation learning, and image registration. ◦ M.S. research (2016–17) developed robust non-negative tensor factorizations, nonlinear motion correction, and functional data analysis for multi-spectral microscopy analysis and molecular identification.	
Intern, Deep Learning Team, Hyperfine, NY	Summers 2020 & 2021
◦ Developed methods for self-supervised image enhancement (2020) and joint reconstruction and deformable registration (2021) on low-field 0.064T MRI, where standard MRI methods and deep networks fail. ◦ Research improved machine learning pipelines deployed in clinical settings and led to MICCAI, WACV, and Medical Image Analysis publications, 1 granted US patent, and 2 US patent applications.	
Image Data Science Intern, Merck Research Laboratories, Merck & Co., NJ	Summer 2019
◦ Developed equivariant generative adversarial networks, with parts of methodology published in ICLR. ◦ Methods improved data augmentation for digital pathology and oncology imaging pipelines.	
Graduate Assistant, Soil Mechanics Lab, New York University, NY	Spring 2016
◦ Deployed stereo-vision techniques for tracking quartz particle flow in oil under varying tunnel pressure. ◦ Enabled a civil engineering team to quantify displacements in physical toy models of underground tunnels.	

Awards

Best paper

◦ MIDL 2023 Best Oral Paper Award	2023
◦ ISBI 2021 Best Student Paper Finalist	2021

Outstanding Reviewer

◦ ICLR Notable Reviewer	2025
◦ ICCV Outstanding Reviewer	2023
◦ CVPR Outstanding Reviewer	2022, 2023
◦ ECCV Outstanding Reviewer	2022
◦ MICCAI Outstanding Reviewer (top 1% of reviewers)	2020, 2021

- MICCAI Outstanding Reviewer Honorable Mention 2022, 2023

Academic

- Pearl Brownstein Doctoral Research Award from NYU CSE for “*doctoral research which shows the greatest promise*” (equivalent to best departmental Ph.D. thesis at NYU CSE) 2022
- Deborah Rosenthal, MD Award for “*Outstanding Performance on the Ph.D. Qualifying Exam*” (given to 1–2 qualifying students each year in the NYU CSE department) 2019
- NYU School of Engineering Ph.D. Fellowship 2017
- NYU Electrical and Computer Engineering Graduate Student Scholarship 2015

Funding

Principal Investigator

- MGB Neuroscience Institute Transformative Scholar Award (\$300,000; Solo PI) 2026–28
- MGB Radiology Innovation Award (\$1,000; Solo PI) 2026–27

Co-Investigator on NIH NIBIB R01EB033773 and NIH NIMH UM1 MH134812.

Publications

Journals and Full-length Conference Proceedings

- Nature** Vivek Gopalakrishnan, David-Dimitris Chlorogiannis, Andrew Abumoussa, Anna M. Larson, Nazim Haouchine, Darren B. Orbach, Sarah Frisken, **Neel Dey**[‡], and Polina Golland[‡]
 “Rapid patient-specific neural networks for intraoperative X-ray to volume registration”
Nature (2026),
[‡] **Equal supervision. To appear.**
- arXiv** Sebo Diaz, Polina Golland, Elfar Adalsteinsson, and **Neel Dey**
 “Why Invariance is Not Enough for Biomedical Domain Generalization and How to Fix It”
arXiv preprint arXiv:2604.02564 (2026).
- NeurIPS** Vivek Gopalakrishnan, **Neel Dey**, and Polina Golland
 “PolyPose: Localizing Deformable Anatomy in 3D from Sparse 2D X-ray Images using Polyrigid Transforms”
Advances in Neural Information Processing Systems (2025).
- ICLR** **Neel Dey**, Benjamin Billot, Hallee E. Wong, Clinton J. Wang, Mengwei Ren, P. Ellen Grant, Adrian V. Dalca, and Polina Golland
 “Learning General-purpose Biomedical Volume Representations using Randomized Synthesis”
International Conference on Learning Representations (2025).
- CVPR** S. Mazdak Abulnaga, Andrew Hoopes, **Neel Dey**, Malte Hoffmann, Bruce Fischl, John Guttag, and Adrian V. Dalca
 “MultiMorph: On-demand Atlas Construction”
Computer Vision and Pattern Recognition (2025).
- MedIA** Jingru Fu, Yuqi Zheng, **Neel Dey**, Daniel Ferreira, and Rodrigo Moreno
 “Synthesizing Individualized Aging Brains in Health and Disease with Generative Models and Parallel Transport”
Medical Image Analysis (2025).
- NeurIPS** Axel Elaldi, Guido Gerig, and **Neel Dey**
 “Equivariant spatio-hemispherical networks for diffusion MRI deconvolution”
Advances in Neural Information Processing Systems (2024).
- CVPR** Vivek Gopalakrishnan, **Neel Dey**, and Polina Golland
 “Intraoperative 2D/3D Image Registration via Differentiable X-ray Rendering”
Computer Vision and Pattern Recognition (2024).

- WACV** Neel Dey, S. Mazdak Abulnaga, Benjamin Billot, Esra Abaci Turk, P. Ellen Grant, Adrian V. Dalca, and Polina Golland
 “AnyStar: Domain randomized universal star-convex 3D instance segmentation”
Winter Conference on Applications of Computer Vision (2024).
- arXiv** Andrew Hoopes, Neel Dey, Victor Ion Butoi, John V. Guttag, and Adrian V. Dalca
 “VoxelPrompt: A Vision Agent for End-to-End Medical Image Analysis”
arXiv preprint arXiv:2410.08397 (2024).
- TMI** Benjamin Billot, Neel Dey, Daniel Moyer, Malte Hoffmann, Esra Abaci Turk, Borjan Gagoski, Ellen Grant, and Polina Golland
 “SE(3)-Equivariant and Noise-Invariant 3D Motion Tracking in Medical Images”
Transactions on Medical Imaging (2024), Impact factor: 10.6.
- MIDL** Benjamin Billot, Neel Dey, Esra Abaci Turk, Ellen Grant, and Polina Golland
 “Network conditioning for synergistic learning on partial annotations”
Medical Imaging with Deep Learning (2024),
Oral presentation.
- MIDL** Axel Elaldi, Guido Gerig, and Neel Dey
 “ $E(3) \times SO(3)$ -Equivariant Networks for Spherical Deconvolution in Diffusion MRI”
Medical Imaging with Deep Learning (2023),
Oral presentation. Invited for journal extension (top 6 papers).
- MIDL** Nalini M. Singh, Neel Dey, Malte Hoffmann, Bruce Fischl, Elfar Adalsteinsson, Robert Frost, Adrian V. Dalca, and Polina Golland
 “Data Consistent Deep Rigid MRI Motion Correction”
Medical Imaging with Deep Learning (2023),
Best oral paper. Invited for journal extension (top 6 papers).
- MICCAI** Neerav Karani, Neel Dey, and Polina Golland
 “Boundary-weighted logit consistency improves calibration of segmentation networks”
Medical Image Computing and Computer-Assisted Intervention (2023),
Early accept.
- IPMI** Amin Nejatbakhsh, Neel Dey, Vivek Venkatachalam, Eviatar Yemini, Liam Paninski, and Erdem Varol
 “Learning Probabilistic Piecewise Rigid Atlases of Model Organisms via Generative Deep Networks”
Information Processing in Medical Imaging (2023),
Oral presentation.
- MELBA** S Mazdak Abulnaga, Neel Dey, Sean I Young, Eileen Pan, Katherine I Hobgood, Clinton J Wang, P Ellen Grant, Esra Abaci Turk, and Polina Golland
 “Shape-aware Segmentation of the Placenta in BOLD Fetal MRI Time Series”
The Journal of Machine Learning for Biomedical Imaging PIPPI 2022 Special Issue (2023).
- WACV** Bo Zhou, Neel Dey, Jo Schlemper, S. Sadegh Mohseni Salehi, Chi Liu, James S Duncan, and Michal Sofka
 “DSFormer: A dual-domain self-supervised transformer for accelerated multi-contrast MRI reconstruction”
Winter Conference on Applications of Computer Vision (2023).
- MICCAI** Neel Dey, Jo Schlemper, Seyed Sadegh Mohseni Salehi, Bo Zhou, Guido Gerig, and Michal Sofka
 “ContraReg: Contrastive learning of multi-modality unsupervised deformable image registration”
Medical Image Computing and Computer-Assisted Intervention (2022),
Travel award.
- NeurIPS** Mengwei Ren, Neel Dey, Martin Styner, Kelly Botteron, and Guido Gerig
 “Local spatiotemporal representation learning for longitudinally-consistent neuroimage analysis”
Advances in Neural Information Processing Systems (2022),
Oral presentation.

MedIA Bo Zhou, Jo Schlemper, **Neel Dey**, Seyed Sadegh Mohseni Salehi, Kevin Sheth, Chi Liu, James S Duncan, and Michal Sofka
“Dual-domain self-supervised learning for accelerated non-cartesian mri reconstruction”
Medical Image Analysis (2022), Impact factor: 10.7.

ICLR **Neel Dey**, Antong Chen, and Soheil Ghafurian
“Group Equivariant Generative Adversarial Networks”
International Conference on Learning Representations (2021).

ICCV **Neel Dey**, Mengwei Ren, Adrian V. Dalca, and Guido Gerig
“Generative adversarial registration for improved conditional deformable templates”
International Conference on Computer Vision (2021).

IPMI Axel Elaldi[‡], **Neel Dey**[‡], Heejong Kim, and Guido Gerig
“Equivariant spherical deconvolution: Learning sparse orientation distribution functions from spherical data”
Information Processing in Medical Imaging (2021),
[‡] **Equal contribution.**

TMI Mengwei Ren[‡], **Neel Dey**[‡], James Fishbaugh, and Guido Gerig
“Segmentation-renormalized deep feature modulation for unpaired image harmonization”
IEEE Transactions on Medical Imaging (2021), Impact factor: 10.6.
[‡] **Equal contribution.**

ISBI Shijie Li, **Neel Dey**, Katharina Bermond, Leon Von Der Emde, Christine A. Curcio, Thomas Ach, and Guido Gerig
“Point-supervised segmentation of microscopy images and volumes via objectness regularization”
International Symposium on Biomedical Imaging (2021),
Best student paper finalist (3rd place).

MICCAI Mengwei Ren, Heejong Kim, **Neel Dey**, and Guido Gerig
“Q-space conditioned translation networks for directional synthesis of diffusion weighted images from multi-modal structural MRI”
Medical Image Computing and Computer Assisted Intervention (2021),
Oral presentation.

MedIA **Neel Dey**, Sungmin Hong, Thomas Ach, Yiannis Koutalos, Christine A. Curcio, R. Theodore Smith, and Guido Gerig
“Tensor decomposition of hyperspectral images to study autofluorescence in age-related macular degeneration”
Medical image analysis (2019), Impact factor: 10.7.

MICCAI **Neel Dey**, Jeffrey Messinger, R. Theodore Smith, Christine A. Curcio, and Guido Gerig
“Robust non-negative tensor factorization, diffeomorphic motion correction, and functional statistics to understand fixation in fluorescence microscopy”
Medical Image Computing and Computer-Assisted Intervention (2019),
Early accept.

SPIE **Neel Dey**, Shijie Li, Katharina Bermond, Rainer Heintzmann, Christine A. Curcio, Thomas Ach, and Guido Gerig
“Multi-modal image fusion for multispectral super-resolution in microscopy”
Medical Imaging: Image Processing (2019),
Oral presentation.

Peer Reviewed Workshops

ML4PS Mohammadhossein Momeni, Vivek Gopalakrishnan, **Neel Dey**, Polina Golland, and Sarah Frisken
“Differentiable Voxel-based X-ray Rendering Improves Sparse-View 3D CBCT Reconstruction”
Machine Learning for the Physical Sciences Workshop (2024).

- MedIPS** Zeen Chi, Zhongxiao Cong, Clinton J. Wang, Yingchen Liu, Esra Abaci Turk, Ellen Grant, Mazdak Abulnaga, Polina Golland, and **Neel Dey**
 “Dynamic Neural Fields for Learning Atlases of 4D Fetal MRI Time-series”
Medical Imaging meets NeurIPS workshop (2023).
- AMAI** Satyananda Kashyap, Neerav Karani, Alexander Shang, Niharika D’Souza, **Neel Dey**, Lay Jain, Ray Wang, Hatice Akakin, Qian Li, Wenguang Li, et al.
 “Feature Selection for Malapposition Detection in Intravascular Ultrasound-A Comparative Study”
International Workshop on Applications of Medical AI at MICCAI (2023).
- OMIA** Guillaume Gisbert, **Neel Dey**, Hiroshi Ishikawa, Joel Schuman, James Fishbaugh, and Guido Gerig
 “Self-supervised denoising via diffeomorphic template estimation: application to optical coherence tomography”
Ophthalmic Medical Image Analysis Workshop at MICCAI (2020).

Patents

- USPTO** **Neel Dey**, Jo Schlemper, S. Sadegh Mohseni Salehi, Michal Sofka, and Prantik Kundu
 “Deep Learning Methods for Noise Suppression in Medical Imaging”
US Patent 12,228,629, granted and active (2025).
- USPTO** **Neel Dey**, Jo Schlemper, S. Sadegh Mohseni Salehi, Li Yao, and Michal Sofka
 “Contrastive multimodality image registration”
US Patent Application 18/611,219, pending (2024).
- USPTO** Bo Zhou, Jo Schlemper, **Neel Dey**, and Michal Sofka
 “Dual-domain self-supervised learning for accelerated non-cartesian magnetic resonance imaging reconstruction”
US Patent Application 18/597,629, pending (2024).

Academic Service and Leadership

Organizing Committee

- Boston Medical Imaging Workshop 2023

Area Chair

- WACV: Winter Conference on Applications of Computer Vision 2027
- ECCV: European Conference on Computer Vision 2026
- CVPR: Computer Vision and Pattern Recognition 2026
- MIDL: Medical Imaging with Deep Learning 2025–26
- ML4H: Machine Learning for Health Symposium 2024–25
- CHIL: Conference on Health, Inference and Learning 2024

Technical Reviewer

- NeurIPS: Neural Information Processing Systems 2023, ’25, ’27
- ICLR: International Conference on Learning Representations 2024–25
- CVPR: Computer Vision and Pattern Recognition 2022–24
- ICCV: International Conference on Computer Vision 2023, ’25
- WACV: Winter Conference on Applications of Computer Vision 2023
- MICCAI: Medical Image Computing and Computer Assisted Interventions 2020–23
- MIDL: Medical Imaging with Deep Learning 2022–23
- MedIA: Medical Image Analysis 2023, 2025
- ECCV: European Conference on Computer Vision 2022
- TPAMI: Transactions on Pattern Analysis and Machine Intelligence 2020, 2022
- MELBA: The Journal of Machine Learning for Biomedical Imaging 2022
- MedNeurIPS: Medical Imaging meets NeurIPS 2022–23
- TMI: Transactions on Medical Imaging 2020

- ISBI: International Symposium on Biomedical Imaging 2018–20
- Neuroinformatics 2017

Miscellaneous

- Graduate Student Mentor for NYU ECE helping MS students navigate research opportunities 2017

Press

- AI-ready Healthcare podcast interview (link) 2023
- MIT News (link), featuring our MIDL 2023 paper on MRI motion correction 2023
- NYU “The Future Of” podcast (link), discussing my early Ph.D. research 2019
- NYU press release (link) featuring my MS research career 2017

Invited talks

Representations Learnt from Synthetic Volumes Enable Training-free Medical Image Analysis

- MEC-Lab, TU Darmstadt, Germany 2025
- NYU Tandon CS-GY (Graduate *Computer Vision* course) 2024, 25
- PICS Colloquium, Penn Institute for Computational Sciences, University of Pennsylvania 2024
- Siemens Healthineers, Princeton, NJ 2024
- Sabuncu Lab, Cornell Tech and Weill Cornell Medicine 2024
- Laboratory for Computational Neuroimaging, Martinos Center, MGH & Harvard Medical School 2024
- Visual Computing Seminar, MIT 2024
- Laboratory for Ex vivo Modeling of Neuroanatomy, Martinos Center, MGH & Harvard Medical School 2024
- Clinical and Applied Machine Learning group, CSAIL, MIT 2024

Multi-scale Dense Representation Learning

- Jonasson Seminar, Division of Biomedical Imaging, KTH Royal Institute of Technology, Sweden 2024
- Deep Learning Seminar, Biomedical Engineering & Radiology, Yale University 2023
- Surgical Planning Laboratory, Brigham and Women’s Hospital & Harvard Medical School 2022
- Lab for Computational Neuroimaging, Martinos Center, MGH & Harvard Medical School 2022
- Biomedical Image Analysis Seminar, CSAIL, MIT 2022

Generative Deep Learning for Atlas Construction and Deformable Registration

- Boston University (Graduate *Analyzing Medical Imaging with AI Techniques* Course) 2023
- Machine Learning Team, National Institute of Mental Health 2022
- Sabuncu Lab, Cornell Tech and Weill Cornell Medicine 2022
- NYU Radiology, Grossman School of Medicine 2022
- VoxelTalk seminar series, MIT, MGH, & Harvard Medical School 2021

Tensor factorization of multispectral images to study Age-related Macular Degeneration

- ARVO’18 Special Interest Group: ”Next-gen Autofluorescence Imaging: let’s get ready!” 2018
- NYU Tandon CS-GY 6923 (Graduate *Machine Learning* course) 2017

Student Mentorship

[Informally co-mentored Ph.D. students not listed]

Harvard Medical School / Massachusetts General Hospital

2026–

- *Guy Davies, Visiting PhD student from UCL (research secondment):* 2026
- Learning general-purpose slice-to-volume alignment networks.

Massachusetts Institute of Technology

Sept 2022–2024

co-supervised with Polina Golland

- *Zeen Chi, Zhongxiao Cong, MIT Undergraduate Research Opportunities Program (UROP):* 2023
- Learning biomedical atlases with neural fields.
- Published (as senior author) at the MedNeurIPS 2023 workshop.
- *Lay Jain, MEng thesis:* 2022-23
- Unsupervised learning for medical image time-series (co-supervised w/ Neerav Karani).

- *Haimoshri Das, MEng thesis:* 2022-23
Joint registration and segmentation of placental image time-series.
- *Runqian (Ray) Wang, MIT Undergraduate Research Opportunities Program (UROP):* 2022-23
Intravascular ultrasound time-series classification in collaboration with IBM Research and Boston Scientific.
Published at the MICCAI AMAI 2023 workshop.

New York University 2017–22
co-supervised with Guido Gerig

- *Russell Wustenberg, MS thesis:* 2021–22
Polyrigid kinematic modeling of carpal bone dynamics from low-resolution dynamic MRI.
- *Shijie Li, predoctoral research:* 2018–20
Click-supervised semantic segmentation in 2D digital pathology and 3D fluorescence microscopy.
Published at ISBI 2021 and won 3rd place for best student paper.
- *Guillaume Gisbert, 1-year BS/MS internship:* 2019–20
Structured noise removal in dynamic OCT images using deformable templates and deep unsupervised denoising.
Published at the MICCAI OMIA 2020 workshop.
- *Michelle La, MS thesis:* 2019–20
Joint representations of fluorescence lifetime images and multi-spectral fluorescence microscopy of retinal tissue.
- *Shishir Lakshminarayan, MS capstone project:* 2017
A user interface for joint registration and tensor factorization of multi-spectral fluorescence microscopy images.