

## Education

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<b>Ph.D., Computer Science, New York University</b>	2017–2022
<ul style="list-style-type: none"> <li>◦ Thesis: Better Visual Synthesis via Better Inductive Biases</li> <li>◦ Thesis committee: Guido Gerig (advisor), Marc Niethammer, Daniel Rueckert, Sotirios Tsaftaris</li> </ul>	
<b>M.S., Electrical Engineering, New York University</b>	2015–2017
<b>B.E., Electronics &amp; Telecommunications Engineering, University of Mumbai</b>	2010–2014

## Research experience

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<b>Postdoctoral Associate, CSAIL, Massachusetts Institute of Technology, MA</b>	2022–2024
<ul style="list-style-type: none"> <li>◦ <b>PI: Polina Golland</b></li> <li>◦ 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.</li> <li>◦ 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.</li> </ul>	
<b>Research Assistant, Computer Science &amp; Engineering, New York University, NY</b>	2016–22
<ul style="list-style-type: none"> <li>◦ <b>PI: Guido Gerig</b></li> <li>◦ 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.</li> <li>◦ 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.</li> </ul>	
<b>Intern, Deep Learning Team, Hyperfine, NY</b>	Summers 2020 & 2021
<ul style="list-style-type: none"> <li>◦ 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.</li> <li>◦ 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.</li> </ul>	
<b>Image Data Science Intern, Merck Research Laboratories, Merck &amp; Co., NJ</b>	Summer 2019
<ul style="list-style-type: none"> <li>◦ Developed equivariant generative adversarial networks, with parts of methodology published in ICLR.</li> <li>◦ Methods improved data augmentation for digital pathology and oncology imaging pipelines.</li> </ul>	
<b>Graduate Assistant, Soil Mechanics Lab, New York University, NY</b>	Spring 2016
<ul style="list-style-type: none"> <li>◦ Deployed stereo-vision techniques for tracking quartz particle flow in oil under varying tunnel pressure.</li> <li>◦ Enabled a civil engineering team to quantify displacements in physical toy models of underground tunnels.</li> </ul>	

## Awards

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<b>Best paper</b>	
◦ MIDL 2023 Best Oral Paper Award	2023
◦ ISBI 2021 Best Student Paper Finalist	2021
<b>Outstanding Reviewer</b>	
◦ 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

## Publications

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### Journals and Full-length Conference Proceedings

[Inter-disciplinary context: ICLR, CVPR, ICCV, and NeurIPS are flagship venues for machine learning and vision, and MICCAI, IPMI, MIDL, MedIA, and TMI are the premier conferences and journals for biomedical imaging.]

**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),  
**Accepted, to appear.**

**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),  
**Accepted, to appear.**

**arXiv** Vivek Gopalakrishnan, Neel Dey, David-Dimitris Chlorogiannis, Andrew Abumoussa, Anna M Larson, Darren B Orbach, Sarah Frisken, and Polina Golland  
 “Rapid patient-specific neural networks for intraoperative X-ray to volume registration”  
*arXiv preprint arXiv:2503.16309* (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).

**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 out of 181 submissions).**

**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 out of 181 submissions).**

**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: 10.9.

**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<sup>‡</sup>, **Neel Dey**<sup>‡</sup>, Heejong Kim, and Guido Gerig

“Equivariant spherical deconvolution: Learning sparse orientation distribution functions from spherical data”

*Information Processing in Medical Imaging* (2021),

<sup>‡</sup> **Equal contribution.**

**TMI** Mengwei Ren<sup>‡</sup>, **Neel Dey**<sup>‡</sup>, James Fishbaugh, and Guido Gerig

“Segmentation-renormalized deep feature modulation for unpaired image harmonization”

*IEEE Transactions on Medical Imaging* (2021), Impact factor: 10.6.

<sup>‡</sup> **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: 10.9.
- 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 recon-

struction”  
US Patent Application 18/597,629, pending (2024).

## Academic Service and Leadership

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### Organizing Committee

- Boston Medical Imaging Workshop 2023

### Area Chair

- MIDL: Medical Imaging with Deep Learning 2025
- ML4H: Machine Learning for Health Symposium 2024
- CHIL: Conference on Health, Inference and Learning 2024

### Technical Reviewer

- ICLR: International Conference on Learning Representations 2024–25
- CVPR: Computer Vision and Pattern Recognition 2022–24
- NeurIPS: Neural Information Processing Systems 2023, 2025
- ICCV: International Conference on Computer Vision 2023, 2025
- 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

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- 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

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

- MEC-Lab, TU Darmstadt, Germany 2025
- 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
- NYU Tandon CS-GY (Graduate *Computer Vision* course) 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

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### Massachusetts Institute of Technology

Sept 2022–now

*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.