

Neel Dey

Postdoctoral Associate, Computer Science and Artificial Intelligence Lab,
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Interests: Representation Learning, Generative Models, Geometric Deep Learning, Synthetic Data

Education

Ph.D., Computer Science, New York University 2017–2022

- Thesis: Better Visual Synthesis via Better Inductive Biases (Advisor: [Guido Gerig](#))

M.S., Electrical Engineering, New York University 2015–2017

B.E., Electronics & Telecommunications Engineering, University of Mumbai 2010–2014

Experience

Postdoctoral Associate at CSAIL, Massachusetts Institute of Technology, MA Sept 2022–now

- Developing data-efficient representation learning and domain randomized generative model methods to train networks that generalize to new datasets and tasks at test time with no retraining.
- Leading 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 at New York University Computer Science and Engineering, NY 2016–22

- Developed generative data-efficient deep learning methods for computer vision via group-equivariant networks, generative adversarial networks, representation learning, and image registration (Ph.D. research).
- Developed multi-spectral microscopy analysis and molecular identification pipelines using robust non-negative tensor factorizations, nonlinear motion correction, and functional data analysis (M.S. research).

Deep Learning Intern at Hyperfine, Inc., NY Summers 2020 & 2021

- Developed and deployed 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, leading to MICCAI, WACV, and Medical Image Analysis publications and several US patent applications.
- Accelerated internal software libraries and tooling by migrating them to use graph execution and train deep networks 2-5× faster.

Image Data Science Intern at Merck Research Laboratories, Merck & Co., NJ Summer 2019

- Developed equivariant generative adversarial networks, with parts of methodology published in ICLR.
- Methods improved data augmentation pipelines for digital pathology and oncology imaging workflows.

Selected full-length papers

[**ICCV**] “Generative adversarial registration for improved conditional deformable templates”

International Conference on Computer Vision (2021).

Neel Dey, Mengwei Ren, Adrian V. Dalca, and Guido Gerig

[**ICLR**] “Group equivariant generative adversarial networks”

International Conference on Learning Representations (2021).

Neel Dey, Antong Chen, and Soheil Ghafurian

[**NeurIPS**] “Local spatiotemporal representation learning for longitudinally-consistent neuroimage analysis”

Advances in Neural Information Processing Systems (2022). [**Oral presentation.**]

Mengwei Ren, Neel Dey, Martin Styner, Kelly Botteron, and Guido Gerig

[**CVPR**] “Intraoperative 2D/3D Image Registration via Differentiable X-ray Rendering”

Computer Vision and Pattern Recognition (2024).

Vivek Gopalakrishnan, Neel Dey, and Polina Golland

[Preprint] “General Biomedical Image Representation Learning from Synthetic Volumes”

Under review (2024), [Preprint available [here](#)].

Neel Dey, Benjamin Billot, Clinton Wang, Hallee Wong, Mengwei Ren, Ellen Grant, Adrian Dalca, Polina Golland

[WACV] “AnyStar: Domain randomized universal star-convex 3D instance segmentation”

Winter Conference on Applications of Computer Vision (2024).

Neel Dey, Mazdak Abulnaga, Benjamin Billot, Esra Abaci Turk, P. Ellen Grant, Adrian Dalca, and Polina Golland

[MICCAI] “ContraReg: Contrastive learning of multi-modality unsupervised deformable image registration”

Medical Image Computing and Computer-Assisted Intervention (2022). [Travel award.]

Neel Dey, Jo Schlemper, Seyed Sadegh Mohseni Salehi, Bo Zhou, Guido Gerig, and Michal Sofka

[MIDL] “ $E(3) \times SO(3)$ -Equivariant Networks for Spherical Deconvolution in Diffusion MRI”

Medical Imaging with Deep Learning (2023). [Oral presentation.]

Axel Elaldi, Guido Gerig, and Neel Dey

[IPMI] “Equivariant spherical deconvolution: Learning sparse orientation distribution functions from spherical data”
Information Processing in Medical Imaging (2021).

Axel Elaldi[‡], Neel Dey[‡], Heejong Kim, and Guido Gerig ([‡] Equal contribution).

[MIDL] “Data consistent deep rigid MRI motion correction”

Medical Imaging with Deep Learning (2023). [Oral Presentation, Best oral paper.]

Nalini M. Singh, Neel Dey, Malte Hoffmann, Bruce Fischl, Elfar Adalsteinsson, Robert Frost, Adrian Dalca, and Polina Golland.

[Patents] Through Ph.D. internships with Hyperfine:

◦ “Deep learning methods for noise suppression in medical imaging.” Neel Dey, et al. Pending.

◦ “Contrastive multimodality image registration” Neel Dey, et al. Pending.

Awards

Best paper: MIDL 2023 (best oral paper), ISBI 2021 (best student paper finalist)

Outstanding reviewer: CVPR (’22–’23), ICCV (’23), ECCV (’22), MICCAI (’20–’21; honorable mention: ’22–’23)

Assorted:

- 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
- MICCAI 2022 Student Travel Award 2022
- Deborah Rosenthal, MD Award for “*Outstanding Performance on the Ph.D. Qualifying Exam*” 2019
- NYU School of Engineering Ph.D. Fellowship 2017
- NYU Electrical and Computer Engineering Graduate Student Scholarship 2015

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

Technical skills

Languages Python, shell scripting, MATLAB

Deep learning frameworks PyTorch, Tensorflow 2

Workflows Git, SLURM, OpenStack, Kubernetes+AWS

Imaging frameworks ITK, ANTs, MONAI, FreeSurfer, 3D Slicer, ITK-SNAP, ImageJ

Service

Reviewer ICLR (’24), NeurIPS (’23), CVPR (’22–’24), ICCV (’23), ECCV(’22), MICCAI (’20–’23), and more

Misc. Area Chair for CHIL (’24); Co-organizer for Boston Medical Imaging Workshop (’23)

Mentorship Co-supervised 10 students at MIT and NYU, leading to 7 published papers and theses