Anirban Ray

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PhD Student — Generative Models for Microscopy Image Restoration

Summary

PhD student in Computer Science at Technische Universität Dresden and Human Technopole (Milan), supervised by Dr. Florian Jug. Research focuses on generative modeling for microscopy inverse problems, with emphasis on conditional flow matching, restoration under unknown forward operators, and calibrated uncertainty estimation.

Education

PhD in Computer Science — Technische Universität Dresden & Human Technopole (Milan) 2022 – 2026 (expected)
Generative models for microscopy restoration, dehazing, and super-resolution.

Master of Engineering in Computer Science — Nagoya Institute of Technology, Japan 2016 – 2018
Thesis on modeling feature evolution in convolutional neural networks.

Bachelor of Technology in Computer Science and Engineering — Vel Tech R&D Institute of Science and Technology, India 2011 – 2015

Research Experience

ResMatching: Noise-Resilient Computational Super-Resolution — Human Technopole & TU Dresden 2024 – Present
Guided conditional flow matching framework for fluorescence microscopy super-resolution, enabling posterior sampling and pixel-wise uncertainty estimation.

HazeMatching: Microscopy Dehazing with Conditional Flow Matching — Human Technopole & TU Dresden 2023 – 2025
Dehazing widefield microscopy using observation-guided conditional flows, balancing fidelity and realism with calibrated uncertainty.

RESOLFT Time-Lapse Imaging with Deep Learning — Human Technopole (collaboration) 2022 – 2025
Deep learning–based restoration of low-SNR and sub-sampled RESOLFT microscopy data to enable faster and longer live-cell imaging.

Industry Experience

Associate Researcher — Hitachi Ltd., Tokyo, Japan 2018 – 2022
Applied research in computer vision and deep learning for industrial and microscopy image analysis systems.

Engineering Intern (AR Applications) — Sun Corporation, Japan 2016
Development of augmented reality applications for smart-glass platforms.

Engineering Intern (Cloud Services) — Machine Pulse / Mahindra Teqo, India 2014 – 2015
Analysis of database migration strategies for large-scale cloud systems.

Teaching Experience

Teaching Assistant — Deep Learning for Microscopy Image Analysis — Human Technopole, Milan 2022 – 2024
Project mentoring and practical sessions on deep learning for microscopy restoration.

Teaching Assistant — Deep Learning @ MBL — Marine Biological Laboratory, Woods Hole 2023 – 2024
Hands-on mentoring for bioimaging deep learning projects.

Selected Publications and Preprints

ResMatching: Noise-Resilient Computational Super-Resolution via Guided Conditional Flow Matching
arXiv:2510.26601

Dehazing Light Microscopy Images with Guided Conditional Flow Matching
arXiv:2506.22397

RESOLFT Time-Lapse Imaging Empowered by Deep Learning
Research Square Preprint

Patents

- US Patent 12327363 — Neural models for object identification and segmentation.
- US Patent 12211213 — Adaptive feature extraction and object detection.
- EP Patent 3961562A1 — AI-based image processing systems.

Honors and Achievements

- Selected Participant, Optical Microscopy and Imaging in the Biomedical Sciences (MBL, 2023).
- International Computer Vision Summer School (ICVSS), 2017.
- Aichi Monozukuri Scholarship for graduate studies in Japan, 2015.

Skills

- Programming: Python, PyTorch, NumPy, OpenCV, Linux, Bash, Git, SLURM
- Research: generative models, conditional flow matching, diffusion models, inverse problems
- Writing and tools: LaTeX, Markdown

Last updated: December 12, 2025