Anirban Ray

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About Me

Final year PhD student specializing in Computational Image Restoration and Generative AI for Microscopy. Research focuses on Flow Matching models and deep learning for biological inverse problems. Passionate about AI4Science.

Education

Technische Universität Dresden & Human Technopole — Dresden, Germany / Milan, Italy
PhD in Computer Science (Advisor: Dr. Florian Jug) — *2022 – 2026 (Expected)*

- Thesis: Generative AI for Microscopy Restoration using Flow-Matching.

Nagoya Institute of Technology — Nagoya, Japan
Master of Engineering in Computer Science — *2016 – 2018*

- Thesis: Modeling the Feature Evolution in CNNs using LSTM.

Vel Tech Rangarajan Dr. Sagunthala R&D Institute — Chennai, India
B.Tech. in Computer Science and Engineering — *2011 – 2015*

Current Research (PhD)

RESOLFT Time-Lapse Imaging via Deep Learning — Human Technopole
Research Project — *2024 – Present*

- Restored low-SNR and sub-sampled acquisitions, enabling 5× longer imaging with 10× lower light dose.
- Achieved 4× speed increase for live-cell imaging while preserving 60 nm resolution.

ResMatching: Noise-Resilient Super-Resolution — Human Technopole
Research Project — *2024 – 2025*

- Developed a Guided Conditional Flow Matching framework for fluorescence microscopy.
- Unified denoising, super-resolution, and uncertainty estimation within a single generative model.

HazeMatching: CFM for Microscopy Dehazing — Human Technopole
Research Project — *2023 – 2024*

- Created a generative framework to restore images degraded by scattering and haze.
- Modeled mappings between widefield and confocal modalities for clearer biological visualization.

Professional Experience

Hitachi Ltd., Center for Technology Innovation — Tokyo, Japan
Associate Researcher — *2018 – 2022*

- **Bacterial Analysis:** Developed neural architectures for precise segmentation and counting of bacterial cells in SEM images.
- **Industrial AI:** Bridged industrial automation with quantitative biological imaging.

Sun Corporation — Konan, Japan
Engineering Intern (AR Applications) — *Sept 2016*

- Built AR apps for AceReal smart glasses using Unity and Vuforia frameworks.

Publications & Patents

- **ResMatching:** Noise-Resilient Computational Super-Resolution via Guided Conditional Flow Matching. *IEEE ISBI*, 2026.
- **HazeMatching:** Conditional Flow Matching for Microscopy Dehazing. *arXiv:25xx.xxxx*, 2025.
- **RESOLFT** time lapse imaging empowered by deep learning. *Preprint*, 2024/25.
- **Patent US 12327363:** Neural models for identifying and segmenting objects of interest from images.
- **Patent US 12211213:** Adaptive feature extraction and object detection for microscopy imaging.
- **Patent EP 3961562A1:** AI image-processing systems for industrial and microscopy applications.
- **Bacterial Classification:** Joint modeling of morphological and internal features. *CISS*, 2022.
- **Bacterial Segmentation:** Quantitative analysis in SEM images using Deep Learning. *CISS*, 2021.

Teaching & Professional Service

- **Teaching Assistant:** DL4MIA (Milan, 2022–2024) and DL@MBL (Woods Hole, USA, 2023–2024). Mentored projects resulting in NeurIPS 2024 publications.
- **Invited Talk:** "Introduction to Diffusion Models for Microscopy" (EMBO-DL4MIA, May 2024).
- **Reviewer:** Served as an official reviewer for the AI4Life Open Call (2024).

Selected Achievements

- **3rd Place:** Microscopy imaging competition at OMIBS Course, Marine Biological Laboratory, USA (2023).
- **Aichi Monozukuri Scholarship:** Full Master's funding, awarded to top 10 students in Asia (2015).
- **Selected Participant:** ICVSS (Italy, 2017) and IISc Undergraduate Summer School (Bangalore, 2013).

Skills

Computing	Python, PyTorch, OpenCV, NumPy, SLURM, Git, Bash, Linux, LaTeX, Unity.
Languages	Bengali (Native), English (Fluent), Hindi (Fluent), Japanese (Conversational), Italian (Elem.).