Aditya Jabade

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Education

Columbia University - 4.0/4 New York, NY | Aug 2024 - Dec 2025
M.S. Applied Mathematics: Numerical Analysis and Methods for PDEs, Computational Mathematics, Applied Linear Algebra, Optimization Methods, Deep Learning in Biomedical Imaging, Digital Signal/Image Processing

Birla Institute of Technology & Science Pilani - 8.84/10 Goa, IN | Aug 2018 - May 2022
B.E. Electronics & Instrumentation Engineering; Minor in Physics

Technical Skills

Languages: Python (PyTorch, SciPy, OpenCV, Scikit, NumPy, Pandas), C++ (OOP), MATLAB/Simulink
Technologies and Tools: UNIX/Linux, Git, Docker, MLFlow

Work Experience

Ultrasound and Elasticity Imaging Laboratory | Research Intern New York, NY | June - Aug 2025

- Collaborated with two researchers to develop a **MATLAB**-based **data-acquisition sequence** on **Verasonics Vantage NXT** for real-time cardiac imaging. Implemented **custom control logic** to coordinate live B-mode localization, high-frame-rate acquisition, and focused-mode segmentation.
- Refined TX/RX sequencing based on literature for strain estimation, contributed to **CUDA**-based focused B-mode segmentation, and **validated** complete pipeline on phantom and human cardiac data—achieving **~22 fps** real-time localization and stable acquisition performance.

Oneirix Labs | Associate Engineer Pune, IN | Jun 2022 - Jun 2024

- Constructed a **modular** image processing framework to detect, segment blood cells from microscopic images using **YOLO**, **OpenCV**. Built a **NumPy**-vectorized ellipse-fitting algorithm using **least-squares** and **RANSAC**, achieving **2×** faster, outlier-resilient cell geometry extraction than Hough Transform method.
- Re-formulated a medical device's **regression** module from L_2 to **L_∞ minimization**, implementing a **SciPy**-based **minimax solver** to reduce maximum residuals and improve system performance. Built a scalable **data processing** pipeline with **Pandas**, **NumPy** to extract, analyze operational data from **100+** device logs informing **2** design improvements for next-generation devices.
- **Led** a team in evaluating **5 image-registration** algorithms (MediaPipe landmark-based transform, SimpleElastix, optical flow, etc.) using **qualitative**, **quantitative** overlay metrics; selected and implemented **optical-flow** model in **OpenCV**/**scikit-image**, achieving **96%** alignment accuracy for cosmetic product assessment. Managed Agile sprints in **Azure DevOps** to accelerate PoC delivery.

Academic Projects

Physics-Informed Neural Network (PINN) for Poisson Equation [Medium]/[GitHub]

- Formulated a Physics-Informed Neural Network (**PINN**) in **PyTorch** to solve the **Poisson** equation, embedding physical laws directly into loss function via **PDE** and dirichlet boundary-condition residuals.
- Achieved physics loss **<10^{-2}** and boundary-condition loss **<10^{-6}**, accurately constructing the analytical solution with **<0.5%** mean relative error, as validated through loss-curve and surface-error analysis.

Image Denoising using PDE Modeling and Numerical Analysis [GitHub]

- Modeled denoising of Gaussian-noisy images by implementing four **finite difference** schemes (Forward/Backward Euler, Crank-Nicolson, Method of Lines) in **Python** to solve the **2D heat equation**.
- **Benchmarked** schemes across PSNR, SSIM, and stability, identifying optimal method-Forward Euler that boosted image quality by **8.7dB** (PSNR) and **84%** (SSIM) while running **5.4x** faster.

Brain Tumor Segmentation Using U-Net Architectures [GitHub]

- Engineered and benchmarked U-Net variants in **PyTorch**: Vanilla, U-Net++, Attention, Swin on BraTS 2020 dataset for brain tumor segmentation.
- **Optimized** PyTorch preprocessing pipeline (normalization, augmentation, resizing), improving model generalization and segmentation accuracy, achieving **97%** accuracy and Dice **0.893** on top model.