

Lafith Mattara

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EDUCATION

National Institute of Technology Rourkela

Odisha, India

Bachelor of Technology in Biomedical Engineering

2021

- Graduated with First class & CGPA 7.5/10.
- **Relevant Courses:** Biomedical signal processing, Medical imaging & image processing, Statistics for Bioengineers, Rehabilitation engineering & Robotics, Artificial intelligence & machine learning.
- Led simulator development for Autonomous Underwater Vehicle development team - Tiburon.
- Contributed original creative work to the college magazine, showcasing writing skills and creativity.

RESEARCH EXPERIENCE

R&D Engineer

Feb 2024 – Now

Image-Guided Robotics, Healthcare Technology Innovation Centre, IIT Madras

Tamil Nadu, India

- Leading the development of image analysis module for a Robotic Antenatal Ultrasound System, integrating advanced AI models for standard plane detection, segmentation, and biometry extraction.
- Designing and optimizing the motion planning algorithms for a Spine Surgery Robot, tailored for minimally invasive thoracolumbar surgery.
- Applying Foundation models and spatio-temporal models to enhance fetal ultrasound analysis.
- Coordinating a 4-member interdisciplinary team to build a comprehensive data pipeline, covering data acquisition, model training, and deployment for real-time clinical use.

Visiting Research Scientist

Dec 2022 – Dec 2023

Cancer Biology Lab, University of Alabama at Birmingham (UAB)

Alabama, USA

- Developed convolutional and graph neural networks to analyze whole slide images from breast cancer patients, improving diagnostic insights through automated image interpretation.
- Investigated the association between neighborhood deprivation, tumor microenvironment, and race, presented preliminary findings at the ATTIS 2023 Symposium.
- Coordinated collaborations between the Biomedical Imaging Informatics Lab at Georgia State University and the Cancer Biology Lab at UAB, facilitating joint research efforts and data sharing.
- Provided a protocol leveraging UAB's supercomputing resources to efficiently store, extract, and preprocess large-scale whole slide image datasets, significantly improving data accessibility and processing speed.
- Mentored three undergraduate students at the Biomedical Imaging Informatics Lab, guiding them in whole slide image analysis techniques and supporting their research skill development.

Undergraduate Research Internship

Dec 2020 – Feb 2021

Center for Computational Imaging, IIT Palakkad

Kerala, India

- Created an FD-based denoising algorithm with wavelet transform to enhance ultrasound image quality, improving sharpness, noise reduction, and contrast.
- Validated the algorithm across ultrasound images, achieving marked diagnostic improvements.
- Utilized imaging methods like blind deconvolution and fractal dimension analysis, demonstrating technical proficiency in computational imaging.

Undergraduate Research Project

Dec 2018 – Nov 2019

Software Tissue Biomechanics Lab, NIT Rourkela

Odisha, India

- Conducted uniaxial tensile experiments on goat skin specimens at varying strain rates to analyze biomechanical properties.
- Performed nonlinear regression analysis to determine the best-fitting hyperelastic model, achieving a coefficient of determination (R^2) between 0.97–0.99 using the Ogden model.
- Contributed to findings that demonstrated nonlinear, anisotropic stress-strain behavior and collagen fiber alignment during deformation, with potential applications in tissue engineering.
- Results presented at Asian-Pacific Conference on Biomechanics 2019 Conference.

FORTHCOMING PUBLICATIONS

Mattara, L., Bhargava, M., Saini, G., Seth, G., Kong, J., & Aneja, R. A deep learning-based analysis of the association between neighborhood deprivation and the tumor microenvironment in Black and White women with breast cancer. (*under-preparation*)

CONFERENCES

XVIII Clinical Ultrasonography in Practice (CUSP) conference Sep 2024
Chennai Trade Centre *Tamil Nadu, India*

- Presented a prototype of a Robotic Antenatal Ultrasound System, showcasing capabilities for automatic scanning and real-time detection of 20+2 standard fetal planes, advancing precision in prenatal imaging.

Research Retreat, O'Neal Comprehensive Cancer Center, Oct 2023
O'Neal Comprehensive Cancer Center, University of Alabama at Birmingham

- Presented a poster titled- A deep learning-based analysis of the association between neighborhood deprivation and the breast tumor microenvironment in Black and White women.

Annual Translational and Transformative Informatics Symposium April 2023
University of Alabama at Birmingham

- Presented a poster titled- A Machine learning model to evaluate the association between the tumor microenvironment and neighborhood deprivation in Black and White women with Triple Negative Breast Cancer.

Asian-Pacific Conference on Biomechanics Nov 2019
Taipei, Taiwan

- Project titled 'Investigation of the Biomechanical Properties of Goat Skin,' presented by Dr. Anju R. Babu.

PROFESSIONAL EXPERIENCE

Project Engineer Nov 2021 – Oct 2022
Endoscopy Design and Development group, Healthcare Technology Innovation Centre, IIT Madras *Tamil Nadu, India*

- Led the design and development of a VR application for visualizing feed from a stereo-endoscope using a VR headset.
- Developed the core software stack, including video and image capture from the camera interface, processing using Microsoft Media Foundation API, post-processing with OpenCV and CUDA, and rendering in a 3D environment.
- Implemented deep learning models for polyp detection, deploying on edge devices using NVIDIA Tao and NVIDIA DeepStream.
- Utilized frameworks and tools such as Unreal Engine, Unity, PyTorch, OpenCV, Python, and C++ to build and optimize the system.
- Demonstrated strong dedication, rapid learning, and adaptability throughout the project, contributing significantly to the success of the software development.

Project Intern Jun 2021 – July 2021
Center for Computational Imaging, IIT Palakkad *Kerala, India*

- Tackled the challenge of contrast limitations in industrial CT by implementing MUSICA (Multi-Scale Image Contrast Amplification) techniques. This approach sharpened internal features within scanned materials, making subtle structural variations immediately clear for inspection and analysis.
- Collaborated closely with Visiconsult, Germany to ensure the enhancements met industry standards, enabling immediate application to nondestructive testing processes.

PROJECTS

Real-Time Self-Prompting SAM Model for Standard Plane Detection and Anatomical Segmentation in Fetal Ultrasound March 2024 – Aug 2024
Image-Guided Robotics, Healthcare Technology Innovation Centre, IIT Madras *Tamil Nadu, India*

- Modified the SAM (Segment Anything Model) foundation model to be self-prompting and capable of running in real-time, enhancing its responsiveness for practical applications.
- Integrated the modified SAM model into a Robotic Antenatal Ultrasound System for standard plane detection and anatomical structure segmentation in fetal ultrasound scans.
- Achieved 96% specificity in detecting 20+2 standard planes, demonstrating the model's high accuracy and potential for real-time clinical use.

Multi-Stage Deep Learning Model for Whole Slide Image Annotation

May 2023 – Oct 2023

Cancer Biology Lab, University of Alabama at Birmingham

Alabama, USA

- Developed a multi-stage deep learning architecture for classifying patches of a Whole Slide Image (WSI) obtained from breast cancer patients, capable of classifying into one of 24 histology classes.
- Capable of integrating contextual information from higher magnification levels based on the class type to enhance classification accuracy for certain histology classes.
- Utilized distributed training for efficient training and scaling, achieving an F1 score of 0.95 and demonstrating the model's robustness in handling complex histological data.

AUV Simulator

Apr 2018 – Dec 2020

Team Tiburon, NIT Rourkela

Odisha, India

- Developed a 3D simulator for testing software stacks of an Autonomous Underwater Vehicle (AUV).
- Built using Unity3D (C#) for the simulation environment, with obstacle modeling in Blender.
- Integrated the simulator with ROS through ROSBridgeLib, enabling real-time communication with a control algorithm.
- Transmitted camera images to the control algorithm every frame, optimizing communication by encoding images for efficient data transfer.

AWARDS

Winner, 6th National Competition on Student Autonomous Underwater Vehicle (SAVe)

2019

National Institute of Ocean Technology (NIOT), in association with IEEE-OES, Marine Technology Society (MTS), and Ocean Society of India (OSI)

- Led the development of a 3D Autonomous Underwater Vehicle (AUV) simulator as part of Team Tiburon, representing National Institute of Technology (NIT) Rourkela.
- The team won 1st place at the 6th National SAvE Competition, held at IIT Madras, competing against top engineering institutes across India.
- The win earned the team the opportunity to participate in the international ROBOSUB Competition in San Diego, USA.

TECHNICAL SKILLS

Languages: Python, C/C++, Rust, C#, R

Frameworks: PyTorch, Tensorflow, OpenCV, ROS

Libraries: Scikit-learn, Kornia, Pandas, NumPy, Matplotlib

Other: Unreal Engine 5, Unity, Blender

OPEN SOURCE CONTRIBUTIONS

Laplacian Pyramid Transform for Tensor Images

Kornia Library

(PR 1816)

- Developed and implemented a Laplacian Pyramid transform for tensor images within Kornia, a differentiable computer vision library for PyTorch.
- Enhanced Kornia's functionality by adding a scalable, multi-resolution image representation technique, useful for applications in image analysis, feature detection, and deep learning.

3D Model of Marked Bin for Robotics Testing

Gazebo Model Repository

(PR 53)

- Developed and contributed a 3D model of a marked bin to facilitate testing of autonomous robots' object-dropping capabilities in simulation environments.
- Model accepted into the official Gazebo model repository, providing an open-source tool for robotics researchers and developers.