LAKSHMI NARAYANAN M

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SUMMARY

An applied researcher focused on building computational technologies for healthcare and surgical applications. My work spans image-guided surgical navigation, anatomical modelling, patient-specific implant design, and medical device automation, bridging clinical imaging and engineering.

RESEARCH EXPERIENCE

INDIAN INSTITUTE OF TECHNOLOGY - DELHI **Scientific Staff**

Project: ***Automated Orthopaedic Recon Plate Bending Machine*** May 2026 - Present

- Developing an end-to-end automation pipeline for patient-specific orthopaedic reconstruction plate bending, transforming CT imaging data and anatomical geometry into machine-executable manufacturing instructions.
- Designing computational methods for anatomical reconstruction and patient-specific plate design, including extraction of bone geometry and surface contours, geometric feature analysis, curvature and angle estimation, and generation of patient-specific bending parameters.
- Developing the digital-to-physical manufacturing workflow that converts patient-specific bending parameters into OPB commands and G-code, enabling automated integration with a CNC-based orthopaedic reconstruction plate-bending machine for multi-axis bending and twisting.

Technical guidance by ***Dr. Sunil Jha*** *(Associate Dean - R&D, IIT Delhi)*

TATA MEMORIAL CENTRE (ACTREC) - MUMBAI **Applied Researcher**

Project: ***Medical Image Analysis for Neuro and Vertebral Navigation*** Feb 2025 - Mar 2026

- Built an end-to-end spine navigation pipeline from CT data, enabling anatomically consistent spinal canal centerline reconstruction for surgical planning.
- Designed a vertebra-centric coordinate system for reliable lumbar (L1–L5) localization across patients with anatomical variability.
- Developed pelvic landmark (ASIS, PSIS, and SUMMIT) detection to anchor vertebral-level estimation and support navigation alignment.
- Developed a post-operative DES point re-localization workflow, mapping intraoperative stimulation sites back onto pre-operative MRI.

Clinical & Technical guidance by ***Dr. Aliasgar V Moiyadi*** *(Chief of Neurosurgery, Tata Memorial Hospital)*
Dr. T. A. Dwarakanath *(Former Head, Robotics Section, DRHR, BARC)*

INDIAN COUNCIL OF MEDICAL RESEARCH (NCDIR) - BANGALORE **R&D Internship**

Project: ***Automated Cancer Registry Data Quality and Duplicate Detection*** Jul 2024 - Sep 2024

- Developed a GUI-based data quality control tool for national cancer registry datasets, enabling interactive validation, record-level review, and identification of data inconsistencies.
- Integrated a fuzzy scoring–based duplicate detection framework to identify non-exact duplicate patient records arising from variations and inconsistencies in demographic and clinical attributes.
- Applied the data quality and deduplication workflow to large-scale registry datasets across multiple HBCRs and PBCRs, improving data consistency and reliability for downstream analysis.

Technical guidance by ***Dr. Saravanan V*** *(Scientist - D, ICMR, NCDIR)*

EDUCATION

MSc in Computer Science (Specialization in Machine Intelligence) Sep 2023 - Jun 2025
Kerala University of Digital Sciences, Innovation & Technology (Formerly IIITM-K, Thiruvananthapuram) *CGPA: 7.03*

Bachelor of Computer Applications Jun 2019 – Apr 2022
Bishop Heber College (Bharathidasan University, Tiruchirappalli) *(Department Rank - 1) CGPA: 9.25*

HONORS & AWARDS

IEEE YESIST'12 (International Innovation Contest)
Top Finalist | Tunisia, North Africa | September 2024

Outstanding Student Award - Bishop Heber College
Recognized for Top Departmental Achievement

Best Outgoing Project Award - Bishop Heber College
For the highest evaluated final year project

AI Arena 2.0 - Mercer | Mettl (National Level Hackathon)
Winner | Remote, India | January 2024

Geeks for Geeks (National Level 48 Hrs. Hackathon)
Secured a Top Eight Position | Andhra Pradesh, India | February 2024

Kumaraguru Yugam (National Level Paper Presentation)
First Place | Tamil Nadu, India | February 2024

SJC's Innovation 2022 (National Level Hackathon)
First Place | Tamil Nadu, India | April 2022

KEY PROJECTS

User-Defined Pattern Authentication (UDPA) | Personal Initiative Project 2022-24

- Engineered a user-defined pattern based authentication system integrating computer vision and augmented reality, emphasizing originality and user-controlled security.
- Designed the authentication workflow with privacy preserving principles in mind, enabling future extension toward zero-knowledge proof based verification without exposing user secrets.
- The work received recognition at national and international innovation forums, reflecting its novelty and potential impact in secure authentication systems.

Tech Stack: Python, Computer Vision, Augmented Reality

Instant-NGP Based Neural Rendering of MRI Data for Surgical Visualization Oct 2024 – Jan 2025

- Developed an experimental neural-rendering workflow using NVIDIA Instant-NGP to reconstruct interactive 3D volumetric representations from 2D MRI slices for anatomical and surgical visualization.
- Adapted the Instant-NGP workflow to MRI data and explored near real-time rendering for interactive 3D inspection, enabling visualization of anatomical structures from different viewpoints.
- Evaluated reconstruction quality using PSNR and SSIM, achieving approximately 26 dB and 0.90 respectively, to assess anatomical fidelity and visual realism.

Tech Stack: NVIDIA Instant-NGP, CUDA, MRI Preprocessing

SKILLS

Computer Vision & Medical Imaging
CT & MRI Processing | Image Registration & Coordinate Transforms | 2D/3D Computer Vision | Anatomical Landmark Detection | 3D Reconstruction & Visualization | Image Segmentation |

Machine Learning & Deep Learning
Supervised & Unsupervised Learning | Feature Engineering | CNNs | U-Net based Segmentation | Model Training & Validation | Performance Evaluation |

Frameworks & Libraries
PyTorch | TensorFlow | Keras | OpenCV | SciPy | Scikit-learn | Scikit-image | Trimesh | Matplotlib | NumPy | Pandas |

Programming & Automation
Python | C | Git | G-code | CNC/PLC Integration | Modbus | HTML/CSS |