Ajay Gunalan Ph.D.

ajay.gunalan@pm.me ajaygunalan.com +1 443 409 6591

It's Not Possible. No, It's Necessary.

Love to work on the cutting edge of technology and develop the next generation of autonomous agents and robots.

Education

University of Genoa & Italian Institute of Technology — Genoa, Italy
Ph.D. in Bioengineering and Robotics — Nov 2020 - Mar 2024

B.S.A. Crescent Institute of Science and Technology — Chennai, India
B.Tech. in Mechanical Engineering | CGPA: 8.45/10 — Aug 2013 - May 2017

G.R.T Mahalakshmi Vidyalaya — Chennai, India
12th Grade | 88.0% — Mar 2013

A.V.Meiyappan Matriculation — Chennai, India
10th Grade | 87.4% — Mar 2011

Skills

Programming Languages	C, C++, Python, MATLAB, LaTeX
Libraries & Frameworks	OpenCV, PyTorch, CUDA, ROS, ROS2, MoveIt, git, Make
Embedded Systems	Arduino, STM32F4, Embedded Linux

Experience

Johns Hopkins University — Baltimore, USA
Postdoc — Nov 2024 – Present

(1) Re-implemented visual servoing of UR5e robot under photoacoustic imaging guidance; (2) Designed an ultrasound probe holder for UR5e; (3) Documented ethical and surgical protocols for a clinical study; (4) Implemented task-space admittance control on the **robotic arm** (UR5e) using ROS2 in C++; (5) Developed a calibration algorithm in C++ for the force-torque sensor to compensate for gravity and bias. (code)

Italian Institute of Technology — Genoa, Italy
Ph.D. Student — Nov 2020 - Apr 2024

My Ph.D. thesis focused on **surgical laser robot** for vocal-cord surgery (thesis): (1) Enhanced laser-based optical imaging efficiency using compressive sensing for; (2) Developed ROS-based visual servoing for laser microsurgery using segment anything model tracking; (3) Implemented laser spot tracking via optical flow and Kalman filtering with OpenCV (video); (4) Integrated OCT imaging for precise depth control in laser surgery

Italian Institute of Technology — Genoa, Italy
C++ Software Engineer — Oct 2019 - Oct 2020

Interfaced multiple real-sense, zed & other sensors with Nvidia jetson to stream audio, video & pointcloud simultaneously in virtual reality (VR) for **tele-operated robots** by multi-threading. (blog)

Indian Institute of Science — Bangalore, India
Software Engineer — Feb 2018 - Jun 2019

(1) Motion planning simulation of a robotic arm in Gazebo using ROS and MoveIt; (2) CAN bus communication between two linux system; (3) Software development for servo motor control and trajectory tracking for **quadruped robot**; (4) Improved the communication rate between low-level drivers and control algorithms by shared-memory (IPC); (5) Control the robot like in a video game using non-blocking communication (blog, pub.)

Asimov Robotics Pvt. Ltd. — Kochi, India
Software Engineer Internship — Jul 2017 - Dec 2017

(1) Gravity compensation for a banking **humanoid robot**; (2) Position and velocity control of DC motor; (3) TCP/IP communication between ROS and non-ROS module; (4) Sensors like IMU, etc. integration using I2C & SPI. (blog)

Selected Awards

- Finalist, **Top 10 out of 11,000+** applicants, in IICDC 2016 by Texas Instruments Inc. & Indian Institute of Management, Bangalore for our **medical device**, "Smart Intravenous Dripper". (blog)

Publications

1. *S. Li,* ***A. Gunalan*** *et al. "Auto-CALM: Autonomous Computer-Assisted Laser Microsurgery," to IEEE Transactions on Medical Robotics and Bionics. [doi, video]*

2. ***A. Gunalan*** *et al. "Compressive Image Scanning Microscope," In: International Symposium on Computational Sensing, Luxembourg, 2023.* [link]

3. ***A. Gunalan****, L. S. Mattos, "Towards OCT-Guided Endoscopic Laser Surgery—A Review," Diagnostics, 2023.* [link]

4. *S. Li, M.A. Azam,* ***A. Gunalan****, et al. "One-Step Enhancer: Deblurring and Denoising of OCT Images", Applied Sciences, 2022.* [link]

5. *D. Dholakiya, S. Bhattacharya,* ***A. Gunalan****, et al. "Design, Development and Experimental Realization of a Quadrupedal Research Platform: Stoch". In:IEEE International Conference on Control Automation and Robotics (ICCAR), 2019.* [link]

Miscellaneous

- Took seminars on simulation of a robotic arm in Gazebo using ROS and **MoveIt** for students of Dr. Shishir Kolathaya and Prof. Ashitav Goshal at IISc, Bangalore [link].
- Internship (July 2016) at TIDC INDIA, Ambattur, India, where I learnt various process and methodologies involved in desgin and fabrication of cam chain used in two-wheelers.
- Internship (June 2016) at J.K. Fenner(India) Ltd, Sriperumbudur, India, where I learnt various process and methodologies involved in desgin and fabrication of rubber seal's used in bearings.
- Inplant Training (June 2015) at Ashok Leyland, Ennore, India, where I had a practical exposure to various manufacturing methods and assemble line production system.

Referees

1. Muyinatu Bell — Baltimore, USA
   Johns Hopkins University — Email: mledijubell@jhu.edu

2. Leonardo De Mattos — Genova, Italy
   Italian Institute of Technology — Email: leonardo.demattos@iit.it

3. Nikhil Deshpande — Nottingham, UK
   University of Nottingham — Email: nikhil.deshpande@nottingham.ac.uk

4. Yonas Tefera — Italian Institute of Technology
   Italian Institute of Technology — Email: yonas.tefera@iit.it