Gokul B. Nair

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Website | Github | Linkedin

EDUCATION

Queensland University of Technology | Brisbane, Australia Apr 2023 onwards
PhD Candidate
I am affiliated with the QUT Centre for Robotics (QCR), Perception and Localisation group, under the guidance of Dr. Tobias Fischer and Prof. Michael Milford. My focus is on Visual Place Recognition within the realm of mobile robotics, specifically through a project titled "Fast and Robust Event-Driven Visual Place Recognition".

International Institute of Information Technology | Hyderabad, India Aug 2015 - Sep 2020
B.Tech. (Honors) + M.S. by Research in Computer Science Engineering CGPA: 8.05/10 | *MS Thesis*
During my MS research, performed under the supervision of Dr. K. Madhava Krishna, I focused on monocular multi-body SLAM for autonomous driving scenarios. The main contribution of my work was the formulation of a pose-graph optimization approach that integrates trajectory estimates into a static metric map. By incorporating dynamic visual cues from wireframe reconstructions and 3D detection, as well as static cues as features from the environment, we achieved improved estimates of vehicle trajectories. Our method effectively addressed the challenge of relative-scale estimation encountered in monocular approaches. *Presentation*

RESEARCH/WORK EXPERIENCE

Robotics Software Engineer | Clutterbot Technologies | Bengaluru, India Nov 2022 - Mar 2023
Technologies: Monocular SLAM, ROS, C++, Python

- *Long-term Localisation*: I enhanced the existing simultaneous localisation and mapping (SLAM) pipeline for real-world scalability and contributed to the development of a recovery pipeline from delocalization.

Engineer-Mobile Robotics | Addverb Technologies | Noida, India Oct 2020 - Sep 2022
Technologies: Robot Perception, Deep Learning, Image Processing, ROS, C++, Python

- *Bin-Picking Project*: I improved the existing stack by integrating a deep learning module for diverse handling of stock-keeping units (SKU). I developed a communication module between the perception software and collaborative robots(cobot) like Universal Robots UR5 and Omron TechMan TM14. I implemented cobot behaviors in Omron VPL and UR G-Code for pick-and-place operations. I also designed real-time region-of-interest detection and object-orientation-estimation modules for intelligent object packing.
- *Autonomous Mobile Robot (AMR)*: I played a key role in developing, testing, and deploying AMRs, collaborating with cross-functional teams for quality assurance and seamless integration with clients' industrial setups. Additionally, I optimized the state machine for a fleet management system (FMS), enabling efficient task execution during on-site operations of the AMR fleet.
- I also assessed the feasibility and performance of various visual and depth sensors for practical robotic solutions

Robotics Research Intern (Remote) | DreamVu Inc. | Hyderabad, India Jun 2020 - Aug 2020
Technologies: Omnidirectional Vision, ROS, Open3D, PCL, C++, Python

- I utilized indigenously designed PAL cameras to leverage monocular omnidirectional visual data for standard robot mapping and localization. I employed depth-estimation techniques to acquire 3D scene understanding from the aforementioned data.

Research Assistant | Robotics Research Centre (RRC), IIIT-H | Hyderabad, India May 2017 - Sep 2020
Technologies: Robot Vision, Deep Learning, Optimization Methods, C++, Python, Matlab, PyTorch, Ceres-Solver, g2o

- I focused on developing monocular SLAM pipelines tailored for autonomous driving scenarios. I experimented with deep learning models and Gaussian approaches to obtain accurate predictions of non-holonomic vehicle trajectories. Moreover, I explored the utilization of non-linear least squares optimization techniques to estimate 3D pose of vehicles in metric scale. *GitHub*

Teaching Assistant | IIIT-H | Hyderabad, India Aug 2016 - May 2020

- I facilitated tutorial sessions, evaluated assignments and examinations and provided comprehensive logistical support for various courses, including Introduction to Robotics, Algorithms Analysis and Design, and Digital Logic and Processor.

Android App Developer | Omitra, T-Hub | Hyderabad, India Aug 2016 - Nov 2016
Technologies: Android Studio, Java

- I developed and integrated a full-stack REST API-based module into their existing Android app, enhancing its functionality.

Software Development Intern | Cyient | Hyderabad, India Jun 2016 - Aug 2016
Technologies: VectorCAST, Bash Scripting

- *Whitebox Software Testing*: I generated equivalence class table reports for quality testing and developed a Bash toolbox to automate their generation from source code.

PUBLICATIONS

Enhancing Visual Place Recognition via Fast and Slow Adaptive Biasing in Event Cameras
Gokul B. Nair, Michael Milford, Tobias Fischer
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024
Webpage | *arXiv* | *Video* | *GitHub* | *Dataset*

BirdSLAM: Monocular Multibody SLAM in Bird's-Eye View
Swapnil Daga, *Gokul B. Nair*, Rahul Sajnani, Anirudha Ramesh, Junaid Ahmed Ansari, K. Madhava Krishna
International Conference on Computer Vision Theory and Applications (VISAPP) 2021
arXiv | *Video*

Multi-object Monocular SLAM for Dynamic Environments
Gokul B. Nair, Swapnil Daga, Rahul Sajnani, Anirudha Ramesh, Junaid Ahmed Ansari, J. Krishna Murthy, K. Madhava Krishna
IEEE Intelligent Vehicles Symposium(IV) 2020
DOI | *arXiv* | *Video*

RELEVANT PROJECTS

Formulations of Forward Kinematics *Presentation*
Technologies: Forward Kinematics, Matlab

- I conducted a comparative study of forward kinematics in dual-quaternion and Euclidean space on the simulation of a 3R planar robotic manipulator, evaluating computational efficiency.

Bowling Alley Simulation *GitHub*
Technologies: Software Engineering, Software Design Patterns, Java, UML

- I created a bowling alley simulation that manages game parties and scoring, while also improving feature delivery through software design pattern integration.

Competitive Bot for Ultimate 9x9 Tic-Tac-Toe *GitHub*
Technologies: Artificial Intelligence, Python

- I developed a competitive bot that employs recursive simulations to determine the best move in each turn. Using heuristics and the minimax algorithm with alpha-beta pruning, the bot achieves efficient decision-making capabilities.

Sentiment Analysis - Sentence Classification *GitHub*
Technologies: Deep Learning, Natural Language Processing, Sentiment Analysis, PyTorch

- I implemented and trained CNN-based deep learning models for sentiment analysis on a diverse dataset of forum posts.

ACHIEVEMENTS, VOLUNTEERING AND POSITIONS OF RESPONSIBILITY

Ambassador, QUT Centre for Robotics, Brisbane, Australia (Aug 2024 onwards).
Reading Group Organizer, Visual Localization Group, QUT Centre for Robotics, Brisbane, Australia (Mar 2024 onwards).
Reviewer, IEEE ICRA (2024), IEEE IROS (2020-2024), IEEE CAI (2023), BMVA BMVC (2020-2024), IEEE MFI (2021-2023).
Technical Book Reviewer, BPB Publications, New Delhi, India, 2022.
(Co-)Coordinator, Alumni Cell (2016-18) and Entrepreneurship Cell (E-Cell) (2016-18), IIIT-Hyderabad, India.
Deans Merit List for academic excellence 2016, IIIT-Hyderabad, India.
Qualified Regional Mathematical Olympiad (RMO) 2013, organised by CUSAT, Kochi, India.
National Talent Search Examination (NTSE) Scholar 2013, organized by NCERT, New Delhi, India.
Attended Student Research Fellowship (RGSRF) Program 2011, organized by RGCB, Thiruvanantapuram, India.

REFERENCES

Tobias Fischer, Senior Lecturer and Chief Investigator, QUT, Brisbane, Australia *tobias.fischer@qut.edu.au*
Michael Milford, Professor and Joint Director, QUT Centre for Robotics, Brisbane, Australia *michael.milford@qut.edu.au*
K. Madhava Krishna, Professor and Head, Robotics Research Centre, IIIT-Hyderabad, India *mkrishna@iiit.ac.in*
J. Krishna Murthy, Postdoctoral Associate, CoCoSci and CSAIL, MIT, Massachusetts, USA *krrish94@gmail.com*
Bharat Gopalakrishnan, Chief Manager-Mobile Robotics, Addverb Technologies, Noida, India *bharathg91@gmail.com*