Saurabh **Gupta**

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Education

Doctoral Student *University of Bonn, Germany*
Institute of Geodesy and Geoinformation | Guide: Prof. Dr. Cyrill Stachniss *Nov. 2023 — Present*

Master of Science in Geodetic Engineering (Major in Mobile Sensing and Robotics) *University of Bonn, Germany*
Institute of Geodesy and Geoinformation | **GPA: 1.1** (German Scale) *Oct. 2020 — Oct. 2023*

Skills

Programming Languages	C++, Python
Frameworks	Robots Operating System (ROS1/2), Gazebo, OpenCV, Open3D, CasADi, Git, Linux

Work Experience

Photogrammetry and Robotics Lab, University of Bonn *Bonn, Germany*
Master Thesis *May 2023 — Oct. 2023*
- Designed and implemented a loop closure module for SLAM using locally consistent maps
- Performed efficient loop closure relative-pose estimation using ORB features on 2D density maps and binary search tree (HBST)
- Resulted in a peer-reviewed publication at IEEE ICRA 2024

Photogrammetry and Robotics Lab, University of Bonn *Bonn, Germany*
Student Research Assistant *Oct 2021 — Oct. 2023*
- Implemented an easy-to-use parser to extract PointCloud2 message data from rosbag files in C++ with no ROS dependencies 🜨
- Developed the ROS1 wrapper for VDBFusion, a TSDF model integration pipeline for 3D dense mapping 🜨
- Developed a software pipeline in C++ for volumetric object-level SLAM based on the *Fusion++* research paper 🜨

Teaching Experience

Institute of Geodesy and Geoinformation, University of Bonn *Bonn, Germany*
Course Tutor | Modern C++ for Computer Vision | Prof. Dr. Cyrill Stachniss, Dr. Tiziano Guadagnino *Oct. 2023 — Feb. 2024*

Institute of Computer Science III, University of Bonn *Bonn, Germany*
Course Tutor | Computer Vision I | Prof. Dr. Juergen Gall *Oct. 2022 — Feb. 2023*

Institute of Geodesy and Geoinformation, University of Bonn *Bonn, Germany*
Course Tutor | Statistics and Adjustment Theory | Prof. Dr. Wolf-Dieter Schuh, Dr. Jan-Martin Brockmann *Oct. 2021 — Feb. 2022*

Projects

Visual Odometry for Agriculture Environments 🜨 *Bonn, Germany*
Institute of Geodesy and Geoinformation, University of Bonn *Oct. 2021 — Apr. 2022*
- Benchmarked classical feature descriptors like SIFT, ORB for orchard-like environments
- Implemented custom descriptor based on RGBD data using macro-features computed via learning based object-detection pipeline
- Developed a Visual Odometry pipeline using learned features and descriptors from the SuperPoint algorithm

Visual Place Recognition using Bag-of-Visual-Words *Bonn, Germany*
Institute of Geodesy and Geoinformation, University of Bonn *Oct. 2021 — Feb. 2022*
- Implemented a visual place recognition pipeline using ORB features and a Bag of Visual Words (BoVW) dictionary generated by k-means clustering
- The pipeline was written in C++ showcasing use of modern C++ programming tools such as the standard template library, containers and algorithms

Game Theoretic Control for Multi-Robot Racing 🜨 *Bonn, Germany*
Institute of Geodesy and Geoinformation, University of Bonn *Apr. 2021 — Aug. 2021*
- Implemented a basic center-line tracking Stanley controller to collect baseline data for system identification
- Used the kinematic system model for the model predictive controller (MPC), where the controller's goal was to maximize progress along track, to stay within track boundaries, and achieve a race-line trajectory
- Demonstrated a game theoretic formulation of the two-player racing scenario using the iterative best response (IBR) algorithm built upon iterative MPC solutions for each car

Publications

Effectively Detecting Loop Closures using Point Cloud Density Maps
S. Gupta, T. Guadagnino, B. Mersch, I. Vizzo, C. Stachniss
IEEE International Conference on Robotics and Automation, 2024