Justin Tomasi

Mobile Robotics, Computer Vision, Machine Learning, State Estimation

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Education

M.A.Sc., Aerospace Engineering - Robotics · University of Toronto *Toronto, Canada*

Institute for Aerospace Studies · Space and Terrestrial Autonomous Robotic Systems (STARS) Lab *2018 - 2020*

- Thesis title: "Learned Adjustment of Camera Gain and Exposure Time for Improved Visual Feature Detection and Matching." Advised by Dr. Jonathan Kelly.
- Ontario Graduate Scholarship valued at $10,000.

B.E.Sc., Electrical Engineering (with Distinction) · Western University *London, Canada*

Department of Electrical and Computer Engineering · Faculty of Engineering *2011 - 2016*

- NSERC undergraduate research award.
- Jean Ann Maynard Scholarship Recipient.
- Bluewater Power 4th Year Capstone Project Award.

Experience

Graduate Researcher · University of Toronto *Toronto, Canada*

Institute for Aerospace Studies · Space and Terrestrial Autonomous Robotic Systems (STARS) Lab *2018 - 2020*

- Thesis focused on improving the robustness of visual perception algorithms for autonomous vehicles.
- Developed a real-time, self-supervised deep learning-based camera parameter regression system.
- Conducted real-world visual odometry driving experiments using vehicles equipped with monocular cameras.
- System resulted in an increased number of sequential inlier feature matches in challenging lighting conditions.
- Increased inlier feature count resulted in robust inter-frame pose estimates in monocular visual odometry applications.
- Made extensive use of modern state estimation, sensor calibration, and visual perception algorithms.
- Collected a novel training dataset for the self-supervised training of a custom convolutional neural network.

Laboratory Teaching Assistant · University of Toronto *Toronto, Canada*

ROB301: Introduction to Robotics · Division of Engineering Science *2019*

- Assisted in the development of state estimation, perception and control laboratory experiments in ROS.
- Gained expertise with sensor calibration, sensor fusion algorithms, and using various probabilistic filtering techniques.

Projects

LIDAR-IMU Calibration for an Autonomous Vehicle · University of Toronto *Toronto, Canada*

Mobile Robotics Graduate Course Project *2019*

- Implemented a modified hand-eye sensor calibration technique for a 3D Velodyne LIDAR-to-IMU calibration.
- Estimated the extrinsic calibration between sensors through determination of time-synchronized sensor trajectories.
- Utilized real-world Velodyne point cloud and IMU data captured using the 'aUToronto' autonomous vehicle.

SLAM using Factor Graphs and GTSAM · University of Toronto *Toronto, Canada*

AER 1513 State Estimation Course Project *2018*

- Solved the SLAM problem for various indoor mobile robot datasets using factor graphs.
- Utilized the Georgia Tech Smoothing and Mapping (GTSAM) library to solve the SLAM problem.

Skills

State Estimation & Sensor Fusion	Kalman filter, EKF, IEKF, UKF, particle filter, linear & nonlinear batch approaches, 3D state estimation, Lie groups, modelling sensor uncertainty, occupancy grid mapping
Deep Learning & Computer Vision	Convolutional neural networks, classification tasks, object detection and tracking, semantic segmentation, network compression techniques, dataset design, feature detection & matching
Visual Navigation	Monocular/stereo visual odometry, filter and batch SLAM, monocular/stereo camera calibration
Programming	C++, Python, ROS, MATLAB, LaTex, Git, Linux
Libraries	PyTorch, OpenCV, C++ Standard Library, NumPy, SciPy, PCL, ORB-SLAM2, Libviso2, GTSAM
Hardware	Monocular/stereo/RGB-D cameras, 2D/3D LIDAR, GPS-IMU, various mobile robot platforms

Professional and Extracurricular Activities

VP Social · Aerospace Students' Association *Toronto, Canada*

University of Toronto Institute for Aerospace Studies *2018-2019*

- The ASA represents graduate students at UTIAS and organizes athletic, social, academic, and professional events.

Engineer in Training · PEO *Toronto, Canada*

Professional Engineers Ontario *2016-Present*

- The PEO is the regulatory body for the engineering profession in Ontario.

Student Volunteer · Canadian National Exhibition UTIAS Demo Booth *Toronto, Canada*

University of Toronto Institute for Aerospace Studies *2019*

- The Centre for Aerial Robotics Research and Education hosted a demonstration booth at the Canadian National Exhibition.

Awards & Honours

2019	**Ontario Graduate Scholarship,** $10,000	*Toronto, Canada*
2016	**Jean Ann Maynard Scholarship,** $1,800	*London, Canada*
2016	**Bluewater Power Distribution 4th Year Project Award,** $400	*London, Canada*
2015	**NSERC Undergraduate Research Award,** $4,500	*London, Canada*

Publications

[1] J. Tomasi, B. Wagstaff, S. L. Waslander, and J. Kelly, "Learned camera gain and exposure control for improved visual feature detection and matching," *submitted to: IEEE Robotics and Automation Letters*, 2021.

[2] J. Tomasi, "Learned adjustment of camera gain and exposure time for improved visual feature detection and matching," Master's thesis, University of Toronto, 2020.

[3] L. Clement, M. Gridseth, J. Tomasi, and J. Kelly, "Learning Matchable Image Transformations for Long-Term Metric Visual Localization," *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 1492–1499, 2020.