

Carlos Jaramillo

SENIOR ENGINEER IN MOBILE ROBOTICS, PERCEPTION, & COMPUTER VISION

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10+ years of experience in Robotics, Perception, & Sensor Fusion; detail-oriented, curious, passionate; well-versed in developing efficient & scalable software in modern C++ and Python; a team-player who enjoys diversity to deliver solutions to real-world problems.

Skills

Languages	Python, C/C++, C# (WPF), Java, MATLAB, Octave, BASH-script, x86-assembly, VHDL, HTML, Javascript, Markdown, LaTeX
Development	Docker/BalenaOS, Eclipse (IDE), VS Code (IDE), Doxygen, Git, CI-CD with Github, Gitlab, BitBucket, Jenkins, Jira, Agile Scrum
Frameworks	WPF (UI), OpenCV, PCL, Eigen, Robotics Operating System (ROS, ROS2), DDS, MOOS-IvP, Caffe, Scikit Learn, Tensorflow, CUDA
Modelling	3D CAD: SolidWorks, Fusion360 Scientific Software: Simulink, Mathematica, Geometry Expressions.
Hardware	NVIDIA TX2/Xavier, Raspberry Pi micro-controllers: Arduino, PIC
Sensors	Stereo cameras, omnidirectional cameras, LiDARs (2.5D and 3D), sonars, RADARs, GPS, IMUs

Engineering Experience

Sea Machines Robotics

Boston, MA

SENIOR AUTONOMY ENGINEER

May 2022 - PRESENT

- Developed software tools, scripts, and drivers for communicating and collecting data from sensors and the programmable logic computer.
- Collaborated, on-boarded, and managed outsourced development of SMR products such as the AI-based computer vision system AI-ris.
- Maintained and developed new features for the WPF-based UI that relied on MySQL and MS T-SQL for Autonomy communication.
- Supported operations during field deployments of SMR systems. Also, managed BalenaCloud fleets, Jenkins pipelines, AWS accounts, and simulators.
- Designed a new architecture in terms of path planning and trajectory control, drastically improving the system's cross-track error, reliable sea-keeping, and future maintainability.
- Evaluated potential sensor-fusion solutions for close-quarters navigation in clutter sea environments involving LiDARs and marine RADARs.
- Demonstrated strong competency with MOOS-IvP - an essential framework of the SM300 system for maritime autonomous navigation, configuration, and mission planning.

Piaggio Fast Forward

Boston, MA

SENIOR ROBOTICS ENGINEER

Nov. 2019 - May 2022

- Enhanced the target following control of the *gita*[™] robots with several types of controllers.
- Improved the target tracking performance with custom state estimation Kalman filters and data association algorithms.
- Created tools for data acquisition, annotation, visualization, as well as target tracking evaluation metrics.
- Implemented probabilistic mapping and trajectory control capabilities by fusing various 3D perception technologies (e.g., vision and RADAR)
- Responsible for project planning and coordination with diverse stakeholders across the organization.

Aurora Flight Sciences, a Boeing Company

Cambridge, MA

PERCEPTION ENGINEER

June 2018 - Nov. 2019

- R&D of sensor systems for detection and avoidance of non-cooperative airborne targets.
- Implemented 3D LiDAR-based solutions for landing zone evaluation for VTOL aircrafts.
- Gained exposure to RADAR and ADS-B technology by developing sensor interfaces to applications.
- Technical lead and mentorship for junior engineers and interns.

Research Experience

Mitsubishi Electric Research Laboratories

Cambridge, MA

RESEARCH SCIENTIST INTERN

Aug. 2016 - July 2017

- Developed algorithms for SLAM (simultaneous localization and mapping) and 3D reconstruction.
- Invented a direct multichannel tracking algorithm for tracking the pose of a monocular camera (visual odometry) using high-dimensional features in a direct image alignment framework.

Computer vision applied towards navigation systems

- Conducted research in 3-D computer vision-centric systems applied towards assistive localization and navigation of visually impaired people and autonomous ground and micro aerial vehicles (MAVs).

Omnidirectional Depth Sensing with Catadioptric Rigs

- Developed various catadioptric rigs in folded configurations using conic mirrors (spherical, hyperbolic) separated by a baseline and a monocular camera inside the bottom mirror. The system approximates a single viewpoint with constraints in the design parameters. A complete globe of depth information can be obtained from the fusion of “omnistereo” (equator) and optical flow (poles).

MetroBotics Project funded by NSF Research Experiences for Undergraduates

Brooklyn, NY

Sep. 2009 - Jan. 2010

- Studied interaction of hybrid groups of virtual agents and robots through the Player/Stage interface.

Computer Research Association (CRA) Research Experience for Undergraduates

Brooklyn, NY

May 2009 - Aug. 2009

- Experimented with different types of small, educational robots: Mindstorms Robotics Invention System, IPRE Scribbler, and Surveyor SRV-1

Projects

Team: City Autonomous Transportation Agent (CATA)

City College, NY

Feb. 2011 - Sep. 2012

- Engineered an autonomous vehicle with a simplified electrical architecture (focusing in safety and usability) and by adopting a new software architecture based on the open-source Robotics Operating System framework, which enforced modularity, maintainability, and reusability.
- Our team participated and qualified for the 19th Annual Intelligent Ground Vehicle Competition (IGVC), June 3-6, 2011.

Team: CityALIEN

City College, NY

Oct. 2009 - June 2010

- Designed the City College's IGVC 2010 rover (CityALIEN), which incorporated a novel omnidirectional stereo vision approach to sensing.
- Our team won the First Place in the Design Category at the 18th Annual Intelligent Ground Vehicle Competition (IGVC), June 4-7, 2010.

Publications

PHD THESIS

Enhancing 3D Visual Odometry with Single-Camera Stereo Omnidirectional Systems

Carlos Jaramillo in *CUNY Academic Works*, 2018, New York

JOURNAL ARTICLES

Visual odometry with a single-camera stereo omnidirectional system

Carlos Jaramillo, Liang Yang, J. Pablo Muñoz, Yuichi Taguchi, Jizhong Xiao

Machine Vision and Applications 30.7 (Oct. 2019) pp. 1145–1155. Springer, 2019

Design and Analysis of a Single-Camera Omnistereo Sensor for Quadrotor Micro Aerial Vehicles (MAVs)

Carlos Jaramillo, Roberto G. Valenti, Ling Guo, Jizhong Xiao

Sensors 16.2 (Jan. 2016) p. 217. Multidisciplinary Digital Publishing Institute, 2016

Generating near-spherical range panoramas by fusing optical flow and stereo from a single-camera folded catadioptric rig

Igor Labutov, Carlos Jaramillo, Jizhong Xiao

Machine Vision and Applications 24.1 (Jan. 2013) pp. 133–144. Springer Berlin / Heidelberg, 2013

CONFERENCE PROCEEDINGS

Direct Multichannel Tracking

Carlos Jaramillo, Yuichi Taguchi, Chen Feng

Proceedings - 2017 International Conference on 3D Vision, 3DV 2017, 2017, Qingdao

GUMS: A Generalized Unified Model for Stereo Omnidirectional Vision (Demonstrated Via a Folded Catadioptric System)

Carlos Jaramillo, Roberto G. Valenti, Jizhong Xiao

IEEE International Conference on Intelligent Robots and Systems, 2016

Autonomous quadrotor flight using onboard RGB-D visual odometry

Roberto G. Valenti, Ivan Dryanovski, Carlos Jaramillo, Daniel Perea Strom, Jizhong Xiao

International Conference on Robotics and Automation (ICRA 2014), 2014

6-DoF pose localization in 3D point-cloud dense maps using a monocular camera

Carlos Jaramillo, Ivan Dryanovski, Roberto G Valenti, Jizhong Xiao

Robotics and Biomimetics (ROBIO), 2013 *IEEE International Conference on*, 2013

A Single-Camera Omni-Stereo Vision System for 3D Perception of Micro Aerial Vehicles (MAVs)

Carlos Jaramillo, Ling Guo, Jizhong Xiao

2013 IEEE 8th Conference on Industrial Electronics and Applications (ICIEA), 2013, Melbourne

Incremental registration of RGB-D images

Ivan Dryanovski, Carlos Jaramillo, Jizhong Xiao

2012 IEEE International Conference on Robotics and Automation, 2012

Fusing Optical Flow and Stereo in a Spherical Depth Panorama Using a Single-Camera Folded Catadioptric Rig

Igor Labutov, Carlos Jaramillo, Jizhong Xiao

International Conference on Robotics and Automation (ICRA), 2011, Shanghai

Education

CUNY The Graduate Center

PH.D. IN COMPUTER SCIENCE

GPA: 3.50 / 4.00 Focus on Robotics and Computer Vision

New York, NY

Sep. 2011 - May 2018

CUNY City College of New York

M.S. IN COMPUTER SCIENCE

GPA: 3.77 / 4.00 Grove School of Engineering Graduate Citation

New York, NY

Jan. 2010 - May 2011

CUNY City College of New York

B.E. IN COMPUTER ENGINEERING

GPA: 3.72 / 4.00 Magna Cum Laude

New York, NY

Sep. 2003 - Dec. 2009

SUNY Westchester Community College

A.S. IN COMPUTER SCIENCE

GPA: 3.94 / 4.00 Computer Science Department Salutatorian

Valhalla, NY

Sep. 2001 - May 2003

Honors & Awards

INTERNATIONAL

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| 2011 | Finalist , Best Computer Vision Paper, International Conference on Robotics and Automation (ICRA) | <i>Shanghai, China</i> |
| 2010 | Best Presentation Award , The 10th Workshop on Omnidirectional Vision, Camera Networks and Non-classical Cameras (OMNIVIS 2010) | <i>Zaragoza, Spain</i> |
| 2010 | First Place , Design Competition of the 18th Intelligent Ground Vehicle Competition (IGVC) | <i>Michigan, U.S.A</i> |
| 2010 | First Place , Junior Scientist Conference at at Vienna University of Technology, Masters Category | <i>Vienna, Austria</i> |

DOMESTIC

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|-----------|--|------------------------|
| 2016 | Scholarship , Great Minds in STEM (GMiS) by Intel | <i>U.S.A</i> |
| 2012-2015 | Fellowship (Pre-Doctoral) , Ford Foundation | <i>U.S.A</i> |
| 2010-2013 | Fellowship (Pre-Doctoral) , NSF Bridge to the Doctorate by NSF/NYC-LSAMP | <i>U.S.A</i> |
| 2011 | Mentoring Award , City College of New York, CUNY | <i>New York, U.S.A</i> |
| 2011 | Honorable Mention , National Science Foundation Graduate Research Fellowship Program | <i>U.S.A</i> |
| 2010-2011 | Scholarship , Google Scholar | <i>U.S.A</i> |
| 2011 | First Place , LSAMP Bridge to the Doctorate Retreat, Research Presentations Master's Category | <i>Florida, U.S.A</i> |
| 2008-2009 | Award , General Motors Engineering Excellence Award through HACU | <i>U.S.A</i> |
| 2008-2009 | Scholarship , DMJM Harris Scholarship by the Grove School of Engineering, CUNY CCNY | <i>New York, U.S.A</i> |
| 2003 | Scholarship , Harold L. Drimmer Scholarship, SUNY WCC | <i>New York, U.S.A</i> |
| 2001-2003 | Honor , Honors Program Graduate and President's List Recognition, SUNY WCC | <i>New York, U.S.A</i> |
| 2000 | Rank , Sub Lieutenant (reserve) of Ecuadorian Air Force (FAE) | <i>Ecuador</i> |
| 2000 | Valedictorian , Colegio Técnico Aeronáutico | <i>Quito, Ecuador</i> |

Teaching Experience

CUNY City College STEM Institute

STEM ROBOTICS, INSTRUCTOR

- Taught a group of selective high school students the fundamentals of mobile robotics using the Raspberry Pi and the Python programming language how to actuate motors and poll sensor data (e.g. ultrasonic, infrared) and various electronic components. Ultimately, participants built robots to compete in an autonomous robot sumo tournament (video link: youtu.be/6138-qjoD3Q)

New York, NY

Summer 2015

CUNY Lehman College

CIS 212: MICROCOMPUTER ARCHITECTURE, ADJUNCT PROFESSOR

- This requirement course provided a broad study of architecture of microcomputer systems with emphasis on CPU functionality, system bus & memory design and performance, secondary storage technologies and management, input/output peripherals, and network technologies.

Bronx, NY

Spring 2014 - Spring 2016

- Taught Python programming constructs such as console I/O, data types, variables, control structures, iteration, data structures, function definitions and calls, parameter passing, functional decomposition, object oriented programming, debugging and documentation techniques.

Columbia Secondary School

New York, NY

PART-TIME TEACHER

Spring 2010

- Taught elective course: Programming in C with Lego NXT Robots.