

# Carlos Jaramillo

SENIOR ENGINEER IN MOBILE ROBOTICS, PERCEPTION, & COMPUTER VISION

Street Address, City, MA, 02021, USA

✉ omnistere@gmail.com | 🏠 www.omnistere.us | 🐧 ubuntuslave | 🌐 carlos-jaramillo-cuny

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

<b>Languages</b>	Python, C/C++, Java, MATLAB, Octave, BASH-script, x86-assembly, VHDL, HTML, Javascript, Markdown, LaTeX
<b>Development</b>	Docker/Balena, Eclipse (IDE), VS Code (IDE), Doxygen, Git, CI-CD with Github, Gitlab, BitBucket, Jenkins, Jira, Agile Scrum
<b>Frameworks</b>	CUDA, OpenCV, PCL, Eigen, Robotics Operating System (ROS, ROS2), DDS, MOOS-IvP, Caffe, Scikit Learn, Tensorflow, CUDA
<b>Modelling</b>	3D CAD: SolidWorks, Fusion360   Scientific Software: Simulink, Mathematica, Geometry Expressions.
<b>Hardware</b>	NVIDIA TX2/Xavier, Raspberry Pi   micro-controllers: Arduino, PIC
<b>Sensors</b>	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 with sensors and the programmable logic computer employed in the SM300 product family and simulators.
- Designed a new architecture in terms of path planning and trajectory control, which drastically improved the cross-track error of the system, reliable seakeeping, and future maintainability.
- Evaluated potential sensor-fusion solutions for close-quarters navigation in clutter sea environments involving LiDARs and marine RADARs.

### 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.

### Research Foundation, City University of New York

New York, NY

RESEARCH ASSISTANT

Jan. 2010 - May 2016

#### 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 "omnistere" (equator) and optical flow (poles).

## MetroBotics Project funded by NSF Research Experiences for Undergraduates

Brooklyn, NY

RESEARCH ASSISTANT

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

RESEARCH ASSISTANT

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

LEADER

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

CONTRIBUTOR

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

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

### DOMESTIC

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

## Teaching Experience

### CUNY City College STEM Institute

STEM ROBOTICS, INSTRUCTOR

New York, NY

Summer 2015

- 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](https://youtu.be/6138-qjoD3Q))

### CUNY Lehman College

CIS 212: MICROCOMPUTER ARCHITECTURE, ADJUNCT PROFESSOR

Bronx, NY

Spring 2014 - Spring 2016

- 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.

CMP 230: PROGRAMMING METHODS I, ADJUNCT PROFESSOR

Fall 2013

- 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

PART-TIME TEACHER

New York, NY

Spring 2010

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