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++, Java, MATLAB, BASH-script, x86-assembly, VHDL, HTML, Javascript, Markdown, LaTeX
Development	Docker, Eclipse (IDE), VS Code (IDE), Doxygen, Git, Continuous Integration via Github or Gitlab, Jenkins, Agile Scrum
Frameworks	CUDA, OpenCV, PCL, Eigen, RTI DDS, Robotics Operating System (ROS), Caffe, Scikit Learn, Tensorflow
Modelling	3D CAD: SolidWorks, Fusion360 | Scientific Software: Mathematica, Geometry Expressions.
Hardware	NVIDIA TX2/Xavior, Raspberry Pi | micro-controllers: Arduino, PIC
Sensors	Stereo cameras, omnidirectional cameras, LiDARs (2.5D and 3D), sonars, RADARs

Engineering Experience

Piaggio Fast Forward — *Boston, MA*

Senior Robotics Engineer — *Nov. 2019 - PRESENT*

- Enhanced the following control, target tracking methods, and implemented probabilistic mapping and trajectory control capabilities.
- Architected target tracking evaluation metrics.
- Responsible for fusing various 3D perception technologies (e.g., vision and RADAR) for tracking targets.
- 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, hyperbolical) 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*

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

New York, NY

Ph.D. in Computer Science

Sep. 2011 - May 2018

GPA: 3.50 / 4.00 Focus on Robotics and Computer Vision

CUNY City College of New York

New York, NY

M.S. in Computer Science

Jan. 2010 - May 2011

GPA: 3.77 / 4.00 Grove School of Engineering Graduate Citation

CUNY City College of New York *New York, NY*

B.E. in Computer Engineering *Sep. 2003 - Dec. 2009*

GPA: 3.72 / 4.00 Magna Cum Laude

SUNY Westchester Community College *Valhalla, NY*

A.S. in Computer Science *Sep. 2001 - May 2003*

GPA: 3.94 / 4.00 Computer Science Department Salutatorian

Honors & Awards

International

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

Domestic

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