

# Luca Carlone

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## EDUCATION

<b>Ph.D. in Mechatronics</b> Institution: Politecnico di Torino, Turin, Italy	1/2009 – 2/2012
<b>M.S. in Automation Engineering, <i>cum laude</i></b> Institution: Politecnico di Milano, Milan, Italy	9/2006 – 9/2008
<b>M.S. in Mechatronics, <i>cum laude</i></b> Institution: Politecnico di Torino, Turin, Italy	9/2006 – 9/2008
<b>B.S. in Mechatronics, <i>cum laude</i></b> Institution: Politecnico di Torino, Turin, Italy	9/2003 – 9/2006

## EMPLOYMENT

<b>Research Scientist</b> Institution: Massachusetts Institute of Technology, Cambridge, USA	6/2016 – present
<b>Postdoctoral Associate</b> Institution: Massachusetts Institute of Technology, Cambridge, USA	8/2015 – 5/2016
<b>Postdoctoral Research Fellow</b> Institution: Georgia Institute of Technology, Atlanta, USA	4/2013 – 7/2015
<b>Research Assistant</b> Institution: Politecnico di Torino, Turin, Italy	3/2012 – 4/2013
<b>Visiting Researcher</b> Institution: University of California Santa Barbara, Santa Barbara, USA	4/2011 – 10/2011
<b>Visiting Researcher</b> Institution: University of Zaragoza, Zaragoza, Spain	6/2010 – 10/2010

## PROFESSIONAL ACTIVITIES

### Organization of International Workshops:

- *Geometry and Beyond - Representations, Physics, and Scene Understanding for Robotics*, in conjunction with “Robotics: Science and Systems” (RSS), ([link to website](#)), 2016.
- *Multi View Geometry in Robotics, MVIGRO*, in conjunction with “Robotics: Science and Systems” (RSS), ([link to website](#)), 2015.
- *The problem of mobile sensors: setting future goals and indicators of progress for SLAM*, in conjunction with “Robotics: Science and Systems” (RSS), ([link to website](#), [link to Google+ Community](#)), 2015.

- *Multi View Geometry in Robotics, MVIGRO*, in conjunction with “Robotics: Science and Systems” (RSS), ([link to website](#)), 2014.

#### Associate Editor and Program Committee Member for International Conferences:

- IEEE International Conference on Robotics and Automation (ICRA), 2016.
- IEEE International Conference on Intelligent Robots and Systems (IROS), 2015-2016.
- 25th International Joint Conference on Artificial Intelligence (IJCAI), 2016.
- IEEE International Conference on Emerging Technologies and Factory Automation (ETFFA), 2015.

#### Member of Technical Committees and Working Groups:

- *Technical Committee on Multi-Robot Systems* of the IEEE Robotics and Automation Society.
- *Map Data Representation Working Group* of the IEEE Robotics and Automation Society.
- *Technical Committee on Agricultural Robotics and Automation* of the IEEE Robotics and Automation Society.

**Reviewer for International Journals:** IEEE Transactions on Robotics (2011-2015), IEEE Robotics and Automation Letters (2015-2016), IEEE Transactions on Automatic Control (2011-2012), IEEE Transactions on Signal Processing (2015), Journal of Aerospace Information Systems (2016), Automatica (2016), Wiley Encyclopedia of EEE (2016), IEEE Transactions on Aerospace and Electronic Systems (2015-2016), IEEE Control Systems Magazine (2015), International Journal of Robotics Research (2013-2015), Applied Mathematics and Computation (Elsevier) Journal (2014), IEEE Transactions on Intelligent Transportation Systems (2013-2014), IEEE Robotics and Automation Magazine (2013-2015), IEEE Transactions on Control Systems Technology (2014), Robotica (2012, 2014), Robotics and Autonomous Systems (2010, 2015).

**Reviewer for International Conferences:** International Conference on Robotics and Automation - ICRA (2013-2016), International Conference on Intelligent Robots and Systems - IROS (2011, 2013-2016), Robotics: Science and Systems - RSS (2016), Conference on Decision and Control - CDC (2011, 2014), American Control Conference - ACC (2011-2013, 2016), IEEE Multi-conference on Systems and Control - MSC (2010), International Conference on 3D Vision - 3DV (2014), International Conference on Computer Vision and Pattern Recognition - CVPR (2013).

## AWARDS AND RECOGNITIONS

- ★ **Best Paper Award** at the 12th International “Workshop on the Algorithmic Foundations of Robotics” (WAFR), 2016.
- ★ Interview featured on **MIT LIDS/ALL Magazine**, “How robust algorithms can change the world”, Volume 12, 2016. ([link](#))
- ★ The paper *Towards 4D Crop Analysis in Precision Agriculture: Estimating Plant Height and Crown Radius over Time via Expectation-Maximization* (in collaboration with J. Dong, G.C. Rains, T. Coolong, and F. Dellaert) featured on the second edition of the Springer Handbook of Robotics, 2016.
- ★ **Best Conference Paper Finalist** at the International Conference “Robotics: Science and Systems” (RSS), 2015.
- ★ **IEEE Best Conference Paper Award** at the 9th Conference on Autonomous Robot Systems and Competitions, 2009.
- ★ **IEEE Best Oral Presentation Award** at the 9th Conference on Autonomous Robot Systems and Competitions, 2009.

## PRINCIPAL INVESTIGATOR IN RESEARCH GRANTS

- ★ **Robust Situational Awareness via Distributed Multi-Robot Mapping and Fast Visual-Inertial Navigation**, Army Research Lab, MAST Collaborative Technology Alliance, W911NF-08-2-0004.  
Total award: \$35 000, Period of performance: 7/1/2016 - 6/30/2017.
- ★ **Sparse Sensing for Autonomous Systems**, MIT Lincoln Laboratory.  
Total award: \$120 000, Period of performance: 10/1/2016 - 9/30/2017.

## INVITED PRESENTATIONS

Massachusetts Institute of Technology (MIT), Cambridge, USA, *Seminar title*: Where did I leave my self-driving car? A Mathematical Perspective on Robot Localization and Mapping, LIDS & Stats Tea Talk, November, 2016.

University of Florida (UF), Gainesville, USA, *Seminar title*: Pushing the Boundaries of Perception: Inherently Robust Solutions for Robot Localization and Mapping, March, 2016.

University of Pennsylvania (UPenn), Philadelphia, USA, *Seminar title*: Unifying Pose Graph Inference across the Fields – Solutions, Guarantees, and Open Problems, April, 2015.

Massachusetts Institute of Technology (MIT), Cambridge, USA, *Seminar title*: Unifying Pose Graph Inference across the Fields – Solutions, Guarantees, and Open Problems, March, 2015.

Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, *Seminar title*: Distributed random convex programming: algorithms and applications, July, 2012.

California Institute of Technology (Caltech), Pasadena, USA, *Seminar title*: Network localization from relative measurements, September, 2011.

EURON/EUROP Annual Meeting, San Sebastian, Spain, *Seminar title*: An Application of Kullback-Leibler Divergence to Active SLAM and Exploration with Particle Filters, March, 2010.

## TEACHING

**Instructor**: *Autonomous Vehicles* (a.k.a. “Duckietown”), Massachusetts Institute of Technology, 2016.

**Instructor**: *RACECAR IAP*, Massachusetts Institute of Technology, 2016.

**Certificate of Accomplishment**: Teaching Workshop for Postdocs (12 sessions), Georgia Tech, 2014.

**Lecturer**: *Automatic Control I*, Politecnico di Torino, 2009-2012.

**Lecturer**: *Fundamentals of Automatic Control*, Politecnico di Torino, 2010-2012.

**Lecturer for Ph.D. course**: *Research topics in computer and control engineering - Introduction to probabilistic robotics*, Politecnico di Torino, 2010, 2012.










**Teacher assistant**: *Calculus I*, Politecnico di Torino, 2005.

**Teacher assistant**: *Fundamentals of Automatic Control*, Politecnico di Torino, 2005.
















## PUBLICATIONS


: link to paper (pdf), : link to slides, : link to website, : link to video : link to code

**Selected Publications**

1. C. Forster, L. Carlone, F. Dellaert, D. Scaramuzza, *On-Manifold Preintegration for Real-Time Visual-Inertial Odometry*, IEEE Trans. on Robotics, 2016, accepted. (arxiv preprint: 1512.02363 , **conference version was best paper finalist at RSS 2015**)
2. L. Carlone, G. Calafiore, C. Tommolillo, F. Dellaert, *Planar Pose Graph Optimization: Duality, Optimal Solutions, and Verification*, IEEE Trans. on Robotics, 32(3):545-565, 2016.   (**extension was best paper at WAFR 2016**)
3. C. Cadena, L. Carlone, H. Carrillo, Y. Latif, D. Scaramuzza, J. Neira, I.D. Reid, J.J. Leonard. *Past, Present, and Future of Simultaneous Localization And Mapping: Towards the Robust-Perception Age*, IEEE Trans. on Robotics, 2016, accepted. (arxiv preprint: 1606.05830 )
4. L. Carlone and S. Karaman, *Attention and Anticipation in Fast Visual-Inertial Navigation*, submitted, 2016. (arxiv preprint: 1610.03344 )
5. F. Ma, L. Carlone, U. Ayaz, and S. Karaman, *Sparse sensing for resource-constrained depth reconstruction*, Int. Conf. on Intelligent Robots and Systems (IROS), 2016.    (supplemental material: )

**Journal papers**


1. C. Forster, L. Carlone, F. Dellaert, D. Scaramuzza, *On-Manifold Preintegration for Real-Time Visual-Inertial Odometry*, IEEE Trans. on Robotics, 2016, accepted. (arxiv preprint: 1512.02363 )
2. L. Carlone, G. Calafiore, C. Tommolillo, F. Dellaert, *Planar Pose Graph Optimization: Duality, Optimal Solutions, and Verification*, IEEE Trans. on Robotics, 32(3):545-565, 2016.  
3. V. Indelman, L. Carlone, F. Dellaert, *Planning in the Continuous Domain: a Generalized Belief Space Approach for Autonomous Navigation in Unknown Environments*, International Journal of Robotics Research, 34(7):849–882, 2015. 
4. L. Carlone and A. Censi, *From Angular Manifolds to the Integer Lattice: Guaranteed Orientation Estimation with Application to Pose Graph Optimization*, IEEE Trans. on Robotics, 30(2):475–492, 2014.  
5. L. Carlone, V. Srivastava, F. Bullo, G. Calafiore, *Distributed random convex programming via constraints consensus*, SIAM Journal on Control and Optimization, 52(1):629–662, 2014.  (arxiv preprint: 1207.6226 )
6. L. Carlone, R. Aragues, J. Castellanos, B. Bona, *A fast and accurate approximation for planar pose graph optimization*, International Journal of Robotics Research, (33)7:965–987, 2014.   
7. L. Carlone, V. Macchia, F. Tibaldi, B. Bona, *Quaternion-based EKF-SLAM from relative pose measurements: observability analysis and applications*, Robotica, 33(6):1250–1280, 2015. 
8. R. Aragues, L. Carlone, G. Calafiore, C. Sagues, *Distributed centroid estimation from noisy relative measurements*, Systems & Control Letters, 61(7):773–779, ISSN: 0167-6911, 2012. 
9. G. Calafiore, L. Carlone, M. Wei, *A distributed technique for localization of agent formations from relative range measurements*, IEEE Transactions on Systems Man and Cybernetics, Part A - Systems and Humans, (42)5:1065–1076, ISSN: 1083-4427, 2012.  

10. B. Bona, L. Carlone, M. Indri, S. Rosa, *Supervision and monitoring of logistic spaces by a cooperative robotic team: methodologies, problems, and solutions*, Intelligent Service Robotics, Springer, 7(4):185–202, 2014.
11. L. Carlone, J. Du, M. Kaouk Ng, M. Indri, B. Bona, *Active SLAM and Exploration with Particle Filters using Kullback-Leibler Divergence*, Journal of Intelligent & Robotic Systems, 75(2):291–311, 2014. 
12. L. Carlone, M. Kaouk Ng, J. Du, B. Bona, M. Indri, *Simultaneous localization and mapping using Rao-Blackwellized particle filters in multi robot systems*, Journal of Intelligent and Robotic Systems, 63(2):283–307, 2011.






### Book chapters

1. G. Calafiore, L. Carlone, M. Wei, *Sensor fusion for position estimation in networked systems*, in Sensor Fusion, Sciyo, ISBN: 978-953-307-101-5, 2010. 










### Ph.D. Thesis


1. L. Carlone, *Nonlinear estimation techniques for autonomous navigation in single and multi robot systems*, Politecnico di Torino, 2012. 















### Preprints





1. C. Cadena, L. Carlone, H. Carrillo, Y. Latif, D. Scaramuzza, J. Neira, I.D. Reid, J.J. Leonard. *Past, Present, and Future of Simultaneous Localization And Mapping: Towards the Robust-Perception Age*, IEEE Trans. on Robotics, 2016, accepted. (arxiv preprint: 1606.05830 )
2. L. Carlone and S. Karaman, *Attention and Anticipation in Fast Visual-Inertial Navigation*, submitted, 2016. (arxiv preprint: 1610.03344 )
3. P. Singh, M. Chen, L. Carlone, S. Karaman, E. Frazzoli, D. Hsu, *Supermodular Mean Squared Error Minimization for Sensor Scheduling in Optimal Kalman Filtering*, submitted, 2016. (preprint: )
4. L. Carlone, A. Axelrod, S. Karaman, G. Chowdhary, *Aided Optimal Search: Data-Driven Target Pursuit from On-Demand Delayed Binary Observations*, submitted, 2016. (preprint: )
5. L. Paull, J. Tani, H. Ahn, J. Alonso-Mora, L. Carlone, M. Cap, Y.F. Chen, C. Choi, J. Dusek, Y. Fang, D. Hoehener, S.-Y. Liu, M. Novitzky, I.F. Okuyama, J. Papis, G. Rosman, V. Varricchio, H.-C. Wang, D. Yershov, H. Zhao, M. Benjamin, C. Carr, M. Zuber, S. Karaman, E. Frazzoli, D. Del Vecchio, D. Rus, J. How, J. Leonard, A. Censi, *Duckietown: an Open, Inexpensive and Flexible and Capable Platform for Autonomy Education and Research*, submitted, 2016. (preprint: )
6. F. Ma, L. Carlone, U. Ayaz, and S. Karaman, *Sparse depth sensing for resource-constrained perception*, in preparation, 2016.

### Conference papers

1. F. Ma, L. Carlone, U. Ayaz, and S. Karaman, *Sparse sensing for resource-constrained depth reconstruction*, Int. Conf. on Intelligent Robots and Systems (IROS), 2016.    (supplemental material: )
2. S. Choudhary, L. Carlone, C. Nieto, J. Rogers, Z. Liu, H.I. Christensen, and F. Dellaert, *Multi Robot Object-based SLAM*, Int. Symposium on Experimental Robotics (ISER), 2016.     

3. D.M. Rosen, L. Carlone, A.S. Bandeira, and J.J. Leonard, *SE-Sync: A Certifiably Correct Algorithm for Synchronization over the Special Euclidean Group*, Workshop on the Algorithmic Foundations of Robotics (WAFR), 2016. (best paper award)  (arxiv preprint: 1611.00128 )
4. A. Axelrod, L. Carlone, G. Chowdhary, and S. Karaman, *Data-driven Prediction of EVAR with Confidence in Time-varying Datasets*, Int. Conf. on Decision and Control (CDC), 2016.
5. S. Choudhary, L. Carlone, C. Nieto, J. Rogers, H.I. Christensen, F. Dellaert, *Distributed Trajectory Estimation with Privacy and Communication Constraints: a Two-Stage Distributed Gauss-Seidel Approach*, Int. Conf. on Robotics and Automation (ICRA), 2016.  
6. L. Carlone, D.M. Rosen, G.C. Calafiore, J.J. Leonard, F. Dellaert, *Lagrangian Duality in 3D SLAM: Verification Techniques and Optimal Solutions*, Int. Conf. on Intelligent RObots and Systems (IROS), 2015.    (supplemental material: )
7. S. Choudhary, L. Carlone, H.I. Christensen, F. Dellaert, *Exactly Sparse Memory Efficient SLAM using the Multi-Block Alternating Direction Method of Multipliers*, Int. Conf. on Intelligent RObots and Systems (IROS), 2015.    (direct link: )
8. S. Rosa, L.O. Russo, G.A. Farulla, L. Carlone, R. Antonini, G. Marco, B. Bona, *An Application of Laser-Based Autonomous Navigation for Data-Center Monitoring*, Intelligent Autonomous Systems 13: Proceedings of the 13th International Conference IAS-13, Volume 302 of the series Advances in Intelligent Systems and Computing, pp. 95–107, 2015.
9. N. Srinivasan, L. Carlone, F. Dellaert, *Structural Symmetries from Motion for Scene Reconstruction and Understanding*, British Machine Vision Conference (BMVC), 2015.   (supplemental material: )
10. L. Carlone, G. Calafiore, F. Dellaert, *Pose Graph Optimization in the Complex Domain: Lagrangian Duality and Optimal Solutions*, Robotics: Science and Systems (RSS), Workshop “Reviewing the review process”, 2015.  
11. R. Tron, D. Rosen, L. Carlone, *On the Inclusion of Determinant Constraints in Lagrangian Duality for 3D SLAM*, Robotics: Science and Systems (RSS), Workshop “The problem of mobile sensors: Setting future goals and indicators of progress for SLAM”, 2015. 
12. C. Forster, L. Carlone, F. Dellaert, D. Scaramuzza, *IMU Preintegration on Manifold for Efficient Visual-Inertial Maximum-a-Posteriori Estimation*, Robotics: Science and Systems (RSS), 2015. (finalist for best paper award)  (supplemental material:  )
13. L. Carlone, J. Dong, S. Fenu, G. C. Rains, F. Dellaert, *Towards 4D Crop Analysis in Precision Agriculture: Estimating Plant Height and Crown Radius over Time via Expectation-Maximization*, Int. Conf. on Robotics and Automation (ICRA), Workshop on Robotics in Agriculture, 2015.  
14. L. Carlone and F. Dellaert, *Duality-based Verification Techniques for 2D SLAM*, Int. Conf. on Robotics and Automation (ICRA), 2015.  
15. L. Carlone, R. Tron, K. Daniilidis, F. Dellaert, *Initialization Techniques for 3D SLAM: a Survey on Rotation Estimation and its Use in Pose Graph Optimization*, Int. Conf. on Robotics and Automation (ICRA), 2015.  
16. R. Tron, L. Carlone, F. Dellaert, K. Daniilidis, *Rigid Components Identification and Rigidity Enforcement in Bearing-Only Localization using the Graph Cycle Basis*, American Control Conference (ACC), 2015. 
17. L. Carlone, P. Alcantarilla, H. Chiu, K. Zsolt, F. Dellaert, *Mining structure fragments for smart bundle adjustment*, British Machine Vision Conference (BMVC), accepted as oral presentation (acceptance rate 7.7%), 2014.  (supplemental material: )

18. L. Carlone, A. Censi, F. Dellaert, *Selecting good measurements via  $\ell_1$  relaxation: a convex approach for robust estimation over graphs*, Int. Conf. on Intelligent Robots and Systems (IROS), 2014. 
19. J. Dong, L. Carlone, G.C. Rains, T. Coolong, F. Dellaert, *4D Mapping of fields using autonomous ground and aerial vehicles*, CSBE/ASABE Joint Meeting Presentation, 2014. 
20. L. Carlone and D. Lyons, *Uncertainty-constrained robot exploration: a mixed-integer linear programming approach*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), 2014.  
21. V. Indelman, L. Carlone, F. Dellaert, *Planning under uncertainty in the continuous domain: a generalized belief space approach*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), 2014.  
22. L. Carlone, Z. Kira, C. Beall, V. Indelman, F. Dellaert, *Eliminating conditionally independent sets in factor graphs: a unifying perspective based on smart factors*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), 2014.
23. H. Chiu, X. Zhou, L. Carlone, F. Dellaert, S. Samarasekera, R. Kumar, *Constrained optimal selection for multi-sensor robot navigation using plug-and-play factor graphs*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), 2014.
24. V. Indelman, L. Carlone, F. Dellaert, *Towards planning in generalized belief space*, in Proc. of the Int. Symposium on Robotics Research (ISRR), 2013.  
25. L. Carlone, *Convergence analysis of pose graph optimization via Gauss-Newton methods*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), pp. 965-972, ISBN: 978146735641-1, 2013. 
26. L. Carlone, J. Yin, S. Rosa, Z. Yuan, *Graph optimization with unstructured covariance: fast, accurate, linear approximation*, in Proc. of the Int. Conf. on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN), 2012.
27. L. Carlone, V. Macchia, F. Tibaldi, B. Bona, *Robot localization and 3D mapping: observability analysis and applications*, in Proc. of the Int. Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS), 2012.
28. L. Carlone, V. Srivastava, F. Bullo, G. Calafiore, *A distributed algorithm for random convex programming*, in Proc. of the Int. Conf. on NETWORK Games, CONTROL and OPTimization (NETGCOOP), pp. 1-7, ISBN: 9781467303835, 2011. 
29. L. Carlone, R. Aragues, J.A. Castellanos, B. Bona, *A linear approximation for graph-based simultaneous localization and mapping*, in Proc. of the Int. Conf. Robotics: Science and Systems (RSS), available online <http://www.roboticsproceedings.org/rss07/p06.html>, pp. 41-48, 2011.   
30. L. Carlone, R. Aragues, J.A. Castellanos, B. Bona, *A first-order solution to simultaneous localization and mapping with graphical models*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), pp. 1764-1771, ISBN: 9781612843865, 2011.
31. R. Aragues, L. Carlone, G. Calafiore, C. Sagues, *Multi agent localization from noisy relative pose measurements*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), pp. 364-369, ISBN: 9781612843865, 2011. 
32. J. Du, L. Carlone, M. Kaouk Ng, M., B. Bona, M. Indri, *A comparative study on active SLAM and autonomous exploration with Particle Filters*, in Proc. of the IEEE/ASME Int. Conf. on Advanced Intelligent Mechatronics (AIM), pp. 916-923, ISBN: 9781457708381, 2011.
33. L. Carlone and B. Bona, *On registration of uncertain three-dimensional vectors with application to robotics*, in Proc. of the 18th IFAC World Congress, pp. 8150-8158, ISBN: 9783902661937, 2011.

34. G. Calafiore, L. Carlone, M. Wei, *Distributed optimization techniques for range localization in networked systems*, in Proc. of the IEEE Conference on Decision and Control (CDC), pp. 2221-2226. ISBN: 9781424477456, 2010. 
35. F. Abrate, B. Bona, M. Indri, L. Carlone, *Cooperative robotic teams for supervision and management of large logistic spaces: methodology and applications*, in Proc. of the 15th IEEE Int. Conf. on Emerging Technologies and Factory Automation (ETFA), pp. 1-8, ISBN: 9781424468485, 2010.
36. L. Carlone, R. Micalizio, G. Nuzzolo, E. Scala, D. Tedone, *STEPS (Sistemi e Tecnologie per l'Esplorazione Spaziale): Predictive and Command System (PCS), results on 1st Demonstration*, in Proc. of the 40th Int. Conf. on Environmental Systems (ICES), 2010.
37. L. Carlone, J. Du, M. Kaouk Ng, B. Bona, M. Indri, *An application of Kullback-Leibler Divergence to active SLAM and exploration with Particle Filters*, in Proc. of the IEEE/RSJ Int. Conf. on Intelligent RObots and Systems (IROS), pp. 287-293, ISBN: 9781424466740, 2010.
38. G. Calafiore, L. Carlone, M. Wei, *A distributed Gauss-Newton approach for range-based localization of multi agent formations*, in Proc. of the 2010 IEEE Multi-Conference on Systems and Control (MSC), pp. 1152-1157, ISBN: 9781424453542, 2010. 
39. G. Calafiore, L. Carlone, M. Wei, *A distributed gradient method for localization of formations using relative range measurements*, in Proc. of the 2010 IEEE Multi-Conference on Systems and Control (MSC), pp. 1146-1151, ISBN: 9781424453542, 2010. 
40. G. Calafiore, L. Carlone, M. Wei, *Position estimation from relative distance measurements in multi-agents formations*, in Proc. of the 18th Mediterranean Conf. on Control and Automation (MED), pp. 148-153, ISBN: 9781424480913, 2010. 
41. G. Calafiore, L. Carlone, M. Wei, *Network localization from range measurements: algorithms and numerical experiments*, in Proc. of the Int. Conf. on Cybernetics & Intelligent Systems, Int. Conf. on Robotics, Automation & Mechatronics, pp. 225-230, ISBN: 9781424464999, 2010.
42. V. Macchia, S. Rosa, L. Carlone, B. Bona, *An application of omnidirectional vision to grid-based SLAM in indoor environments*, in Proc. of the 2010 Int. Conf. on Robotics and Automation (ICRA), Workshop on Omnidirectional Robot Vision, ISBN: 9788895872025, 2010.
43. L. Carlone, M. Kaouk Ng, J. Du, B. Bona, M. Indri, *Rao-Blackwellized Particle Filters multi robot SLAM with unknown initial correspondences and limited communication*, in Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA), pp. 243-249, ISBN: 9781424450381, 2010.
44. L. Carlone, M. Kaouk Ng, J. Du, B. Bona, M. Indri, *Reverse KLD-Sampling for measuring uncertainty in Rao-Blackwellized Particle Filters SLAM*, in Proc. of the IEEE/RSJ Int. Conf. on Intelligent RObots and Systems (IROS), Workshop on Performance Evaluation and Benchmarking for Next Intelligent Robots and Systems, 2009.
45. L. Carlone and B. Bona, *A comparative study on robust localization: fault tolerance and robustness test on probabilistic filters for range-based positioning*, in Proc. of the 14th Int. Conf. on Advanced Robotics (ICAR), pp. 1-8, ISBN: 9781424448555, 2009.
46. L. Carlone and B. Bona, *Preliminary results on robust global localization: fault tolerance and robustness test on Probabilistic Shaping*, in Proc. of 9th Conf. on Autonomous Robot Systems and Competitions, pp. 27-33, ISBN: 9788208972, 2009.
47. L. Carlone and B. Bona, *Probabilistic Shaping with Radial Gaussian: a probabilistic approach to 2D and 3D robotic multilateration*, in Proc. of the Israeli Conf. of Robotics, 2008.

## Patents

1. M. Bianchi, L. Carlone, D. Girlando, A. Mangone, I. Belmonte, B. Bona, A. Bonarini, M. Matteucci, *Apparato di illuminazione robotizzato e metodo di comando*, IT MI20091066, Priority: 16/6/2009,



Publication: 17/12/2010.

2. D. Girlando, A. Mangone, L. Carlone, M. Bianchi, A. Bonarini, B. Bona, M. Matteucci, I. Belmonte, *Robotized lighting apparatus and control method*, WO2010146446, Priority: 16/6/2009, Publication: 23/12/2010.

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More info available at: [www.lucacarlone.com](http://www.lucacarlone.com)