

## Gian-Luca Mariottini

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### Education

- University of Siena, Siena, Italy**                              **Dec. 2002 - Feb. 2006**  
Ph.D., Dept. of Engineering Information (DII)  
Topic: Image-based Robot Navigation using Computer Vision Techniques  
Advisors: Prof. Domenico Prattichizzo, Prof. Antonio Vicino.
- University of Siena, Siena, Italy**                              **Oct. 1996 - Oct. 2002**  
M.S. (*summa cum laude*) in Robot Navigation from Objects' Silhouette  
Advisors: Prof. Domenico Prattichizzo, Prof. Antonio Vicino.

### Positions

- University of Minnesota, Minneapolis, MN**                              **Oct. 2008 - present**  
*Postdoctoral associate*, Computer Science and Engineering Dept.  
Topics: Active Vision-based Localization and Navigation in Large Environments  
3-D Localization and Mapping for the Visually Impaired  
Advisor: Prof. Stergios Roumeliotis
- Georgia Institute of Technology, Atlanta, GA**                              **Dec. 2007 - Oct. 2008**  
*Postdoctoral fellow*, College of Computing (1 year appointment)  
Topic: Wearable Localization System for the Visually Impaired (SWAN project)  
Advisor: Prof. Frank Dellaert
- University of Pennsylvania, Philadelphia, PA**                              **Jan. 2007 - June 2007**  
*Visiting Scientist*, GRASP Laboratory, Dept. of Computer Science  
Topic: Vision-based Navigation and Multi-robot Localization  
Advisor: Prof. Kostas Daniilidis
- University of Siena, Siena, Italy**                              **Oct. 2005 - Oct. 2007**  
*Research Associate*, Dept. of Engineering Information (DII)  
Topic: Single and Multi-robot Systems and Computer Vision  
Advisor: Prof. Domenico Prattichizzo
- University of Pennsylvania, Philadelphia, PA**                              **Nov. 2004 - Apr. 2005**  
*Visiting Student*, GRASP Laboratory, Dept. of Computer Science  
Topic: Nonlinear Observability and Localization for Vision-based Multi-Robot Systems.  
Advisor: Prof. Kostas Daniilidis.

## Research Experience

**University of Minnesota, Minneapolis, MN** **Oct. 2008 - present**  
*Postdoctoral associate*, CSE Dep., with Prof. Stergios Roumeliotis.

**Active Vision-based Localization and Navigation in a Large Environment:** Designed a complete framework for mobile robot active localization and navigation in a visual memory database using *only* a monocular camera as on-board sensor. The algorithm uses a bag-of-features image database created during a previous robot exploration phase to determine the global robot's location in a large-scale (e.g., city-scale). Since vision-based location recognition in a database with million of images can ambiguously lead to an erroneous belief about the current location of the robot, I implemented an active Bayesian approach that exploits the additional images collected by the camera while moving along a selected path towards the desired destination.

**A 3D Localization and Mapping Aid for the Visually Impaired:** Designed a portable indoor 3D localization and mapping system mounted on a white cane for the visually impaired. The basis of the system is an Extended Kalman Filter (EKF) which estimates the 6 DOF position and orientation (pose) of the person, as well as the map of the building. The sensing platform consists of an Inertial Measurement Unit (IMU) and a 2D laser scanner which scans planar features belonging to the surrounding scene (e.g., walls, doors, etc.). Experimental results from a multistory building are presented that demonstrate the reliability of the proposed method for accurate and real-time indoor localization and mapping.

Web: <http://www.cs.umn.edu/~gianluca/research/index.html>

**Georgia Institute of Technology, Atlanta, GA** **Dec. 2007 - Oct. 2008**  
*Postdoctoral fellow*, College of Computing, with Prof. F. Dellaert.

**Vision-based localization for the visually impaired:** I joined GaTech to work on the SWAN project (System for Wearable and Audio Navigation) in the last year of funding for this project. Designed and developed a prototype solution to the localization problem (position and orientation) using a wearable video camera on a helmet as the only sensor. The algorithm uses RANSAC (RANdom Sampling And Consensus) with a Maximum-Likelihood estimator. Used proprietary Ocaml GaTech software library and tested experimentally.

Web: <http://www.cs.umn.edu/~gianluca/research/swan.html>

**University of Pennsylvania, Philadelphia, PA** **Nov.04-Apr.05/Jan.07-Jun.07**  
*Visiting scientist*, Computer Science Dep., with Prof. K. Daniilidis

**Vision-based multi-robot localization and control:** Studied the localization and control problems for a team of autonomous robots (leader-follower) with on-board omnidirectional cameras. Derived a new theoretical observability condition valid for general nonlinear systems. Used a nonlinear observer (the extended Kalman filter, EKF) to estimate the distance between the robots (each camera only provides the view-angle to the other robots, but not the distance). Implemented an input-state feedback control to stabilize the formation. Realized extensive simulation results and experiments on real robot scenario.

Web: [http://www.cs.umn.edu/~gianluca/research/multirobot\\_localization.html](http://www.cs.umn.edu/~gianluca/research/multirobot_localization.html)

University of Siena, Siena, Italy

Dec.02-Feb.06/ Oct.05-Oct.07

*Graduate research/Research Associate*, with Prof. D. Prattichizzo.

**Vision-based Robot Navigation using Computer Vision:** Developed an image-based control strategy for mobile robot that uses multiple-view geometry. The algorithm does not need to know anything about the 3-D environment or the camera parameters. Developed new geometrical property called “disparity-lines” and used it to design a visual navigation strategy that uses omnidirectional cameras. Designed a visual compass algorithm to estimate the camera orientation based on a new geometrical theory for omnidirectional cameras.

Web: <http://www-users.cs.umn.edu/~gianluca/research/VSnonholonomic.html>

**Human-Robot Interaction for Active Rehabilitation in Cognitive Domains:** Designed and developed a new human-robot interface for active interaction with the cognitive and emotional human domains, with potential applications in cognitive rehabilitation in depression. Eye movements convey a lot of information about one subjects cognitive and emotive status; we have designed a new human-robot interface which uses a video-based Eye-Tracker (ET) to observe the subjects line of gaze. The interface can send stimulating inputs to the subject using both a Transcranial Magnetic Stimulator (TMS) and a visual stimulus. The latter elicits the subjects emotions and consists of a set of pictures of facial expressions, which have been shown according to a novel visualization protocol, called Memory-Guided Filtering (MGF). Its effectiveness has been verified by means of many experimental results.

Web: <http://sirslab.dii.unisi.it/medapp/HMI>

## Research Interests

My research is on robot control and computer vision, and their jointly use for autonomous robot navigation and medical applications. In particular, my research fields are:

- Active Sensing for Localization and Robot Navigation
- Vision-based Multi-Robot Localization and Control
- Image-based Visual Servoing for Mobile Robots
- Localization for the Visually Impaired
- Catadioptric Systems (Panoramic Cameras, Planar Catadioptric Stereo, etc.)
- Human-Robot Interface (eye-tracking) for Neuro-Cognitive studies

More information can be found here: [www.cs.umn.edu/~gianluca](http://www.cs.umn.edu/~gianluca)

## Society and Services

- **Program Committee (PC) member:** 2009 Robotics Science and System (RSS) conference.
- **Member:** IEEE-RAS Marine Robotics Technical Committee.
- **Local Arrangement Chair** for the 3DPVT Symposium (3D Data Proc., Visual. and Transmission), Atlanta, GA, June 18-20, 2008.
- **IEEE Member** (S'04-M'06) and **IEEE Robotics and Automation Society** member.
- **I-RAS member** and secretary (Italian Chapter of Robotics and Automation Society).

- **Co-Organizer** of the Ph.D. School “Visual servoing and its applications to Robotics, Computer Vision and Augmented Reality” held by Prof. Francois Chaumette, LAAS, France (co-sponsors: IEEE RAS Italian Chapter, University Siena), Siena, June 2006 (with Prof. D. Prattichizzo) .
- **Journal Reviewer** for many journals in the field of robotics, automatic control and computer vision
  - IEEE Transactions on Robotics
  - IEEE Robotics and Automation Magazine
  - IEEE Transactions on Control Systems Technologies
  - IEEE Transactions on Automatic Control
  - Autonomous Robots
  - Robotics and Autonomous Systems
  - Journal of Intelligent and Robotic Systems
  - Image and Vision Computing
  - Computer Vision and Image Understanding
  - EURASIP Journal on Applied Signal Processing
- **Conference Reviewer** (since 2003) of the world leading conferences in Robotics, Control and Computer Vision (ICRA, IROS, ACC, CDC, CCA/ISIC/CACSD, ECCV, CVPR, RSS).
- Served as a **member** of the engineering department committee as representative of all the research associates at the Department of Engineering Information), SIENA, ITALY.
- Served as a member of the **directive committee** for Ph.D. Students in Technological Areas (2002-2004), University of Siena, Italy.

## Teaching Experiences & Education

- **Attended course:** “GRAD 8101 - Teaching in Higher Education” **Spring 2009**  
University of Minnesota, MN, (US),
- **I.F.T.S., Industrial Course in Robotics, Grosseto (GR), Italy** **June 05 - July 05**  
**Instructor** for the Robotics Foundations course (teaching contract of 12 hours)  
Taught classes and realized course slides, notes and software  
15 participants from companies
- **University of Siena, Siena, Italy** **Jan. 05 - March 05**  
**Teaching Assistant** for the Robotics and Vision class (Prof. D.Prattichizzo)  
Taught classes, prepared homeworks and finals, realized course slides and notes  
Over 30 students
- **I.T.I.S., Industrial course, Grosseto (GR), Italy** **May 05 - June 05**  
**Instructor** for the Robotics and Vision class  
Taught classes and realized course slides and notes  
15 participants from companies
- **University of Siena - Arezzo, Arezzo, Italy** **Jan. 04 - March 04**  
**Teaching Assistant** for the Robotics class (Prof. A. Giannitrapani)  
Taught classes, prepared homeworks and finals, realized course slides and notes  
Over 30 students

- **University of Siena, Siena, Italy** **Jan. 04 - March 04**  
*Teaching Assistant* for the Robotics and Vision class (Prof. D.Prattichizzo)  
 Taught classes, prepared homeworks and finals, realized course slides and notes  
 Over 50 students
- **I.T.I.S., Industrial Course, Pontedera (PI), Italy** **March 04 - April 04**  
*Instructor* for the Robotics Foundations course (teaching contract of 12 hours)  
 Taught classes and realized course slides, notes and software  
 10 participants from companies
- **University of Siena, Siena, Italy** **Apr. 03 - Jul. 03**  
*Teaching Assistant* for the Automation Fundamentals class (Prof. D.Prattichizzo)  
 Taught classes, prepared homeworks and finals  
 Over 100 students
- **University of Siena, Siena, Italy** **Jan. 03 - Mar. 03**  
*Teaching Assistant* for the Robotics and Automation class (Prof. D.Prattichizzo)  
 Taught classes, prepared homeworks and finals, realized course slides and notes  
 Over 50 students
- **Co-advisor** of more than 30 Master and Ph.D. theses in Robotics, Automation and Computer Vision.

## Professional Activities

- **Cesvit Microelectronics, Prato, Italy**  
 Developed a software system that uses a camera to count the number of people that enter and exit from an office. The algorithm is robust to illumination changes and uses image processing techniques under OpenCV libraries.
- **Qualup, S.a.S, Montbellet, France**  
 Developed a 3-D reconstruction engine from image pairs. The engine has been used in PixDim software (by QUALUP S.a.S, France).
- **Research projects**  
 Participation to national and international research projects supported by, MIUR (Ministero Università e Ricerca), CNR (Centro Nazionale Ricerche), ASI (Agenzia Spaziale Italiana), EU.

## Invited Talks and Workshops

- G.L. Mariottini, “Image-based Robot Control: the Multiple View Geometry Approach”, Department of Computer Science and Engineering, University of Minneapolis, Minnesota, Sept. 03, 2008.
- G.L. Mariottini, “A Human-Robot Interface for Interaction with Cognitive and Emotional Human Domains”, Department of Mechanical and Aerospace Engineering, Princeton University, PA, Dec. 2007.

- G.L. Mariottini, “A Human-Robot Interface for Interaction with Cognitive and Emotional Human Domains”, Dep. of Neuroscience, University of Pennsylvania, PA, Feb. 2007.
- G.L. Mariottini, “Epipole-based Visual Servoing for Nonholonomic Mobile Robots via Feedback Linearization”. In *Summer School on Image and Robotics, INRIA Sophia-Antipolis*, June 2004
- G.L. Mariottini, “Panoramic Cameras: theory and application to robotics”. In *Summer School on Image and Robotics, INRIA Sophia-Antipolis*, June 2004
- G.L. Mariottini, “Asservimento Visivo Epipolare di un Robot Anolonomo”, Università degli Studi La Sapienza, Roma, 2 July 2003
- G.L. Mariottini, SIN (Simposio Italiano Neurologia) Riunione annuale Tosco-Umbra, Policlinico “Le Scotte”, Siena (Italy) 19-20 December 2003.
- G.L. Mariottini, “Advanced STImuli Design for Eye Tracking (ASTIDET): easy applicability for ocular movement study in neurology”, SIN03, Simposio Italiano di Neurologia, Rome, Italy, October 2003.
- G.L. Mariottini, CIRA National Ph.D. School, Bertinoro (FC), Luglio 2003 (in collaboration with Prof. Domenico Prattichizzo and Ing. Jacopo Piazzi).

## Publications

### Journal Papers

- [J9] **G.L. Mariottini**, S. Scheggi, F. Morbidi, D. Prattichizzo  
“Planar mirrors for image-based robot localization and 3-D reconstruction”, *submitted*, 2009.
- [J8] F. Morbidi, **G.L. Mariottini**, D. Prattichizzo,  
“Observability and observer design via I&I for vision-based leader-follower formation control”, *Automatica* (Accepted on Sept.28, 2009), 2009.
- [J7] **G.L. Mariottini**, S. Scheggi, F. Morbidi, D. Prattichizzo,  
“A Robust Uncalibrated Visual Compass Algorithm from Paracatadioptric Line Images”, in *First Workshop on Omnidirectional Robot Vision*, Lecture Notes in Computer Science, Springer-Verlag, 2009 (in press).
- [J6] **G.L. Mariottini**, F. Morbidi, D. Prattichizzo, G.J. Pappas, and K. Daniilidis,  
“Vision-based Leader-Follower Formations: Nonlinear Observability and Control”, *IEEE Transactions on Robotics*, (in press), 2009.
- [J5] **G.L. Mariottini** and D. Prattichizzo,  
“Image-Based Visual Servoing with Central Catadioptric Camera”, *International Journal of Robotics Research*, Vol.27, n.1, Jan. 2008.
- [J4] **G.L. Mariottini**, G. Oriolo and D. Prattichizzo,  
“Image-based Visual Servoing for Nonholonomic Mobile Robots using Epipolar Geometry”, *IEEE Transactions on Robotics*, pp.87-100, Vol.23, Issue 1, 2007.
- [J3] G. Chesi, **G.L. Mariottini**, D. Prattichizzo, A. Vicino,  
“Epipole-Based Visual Servoing for Mobile Robots”, *Advanced Robotics*, Vol. 20, No. 2., pp.255–280, 2006.

- [J2] **G.L. Mariottini** and D. Prattichizzo,  
 “EGT for multiple view geometry and visual servoing: robotics vision with pinhole and panoramic cameras”, in *Robotics and Automation Magazine*, vol.12, n.4, pp.26–39, 2005.
- [J1] A. Rufa, **G.L. Mariottini**, D. Prattichizzo, D. Alessandrini, A. Vicino, and A. Federico  
 “Video-Based Eye Tracking: Our Experience with Advanced Stimuli Design for Eye Tracking Software” in *Annals of New York Academy of Sciences*, 2005; 1039:575.

## International Conferences and Invited Sessions

- [C15] J. A. Hesch, F. Mirzaei, **G.L. Mariottini** and S.I. Roumeliotis,  
 “A 3D Navigation Aid for the Visually Impaired in Unknown Indoor Environments”, *2010 Int. Conf. on Robotics and Automation*, (submitted).
- [C14] P.Fernandez, S. Oh, **G.L. Mariottini**, F. Dellaert,  
 “Learning Visibility of Landmarks for Vision-Based Localization”, *2010 Int. Conf. on Robotics and Automation*, (submitted).
- [C13] J. A. Hesch, F. Mirzaei, **G.L. Mariottini** and S.I. Roumeliotis,  
 “A 3D Pose Tracker for the Visually Impaired”, In *Proc. 2009 IEEE International Conference on Intelligent Robots and Systems (IROS’09)*, Seattle, US, 2009 (in press).
- [C12] **G.L. Mariottini** and S. Scheggi and F. Morbidi and D. Prattichizzo,  
 “Planar Catadioptric Stereo: Single and Multi-View Geometry for Calibration and Localization”, in *IEEE 2009 Conference on Robotics and Automation*, pp.1510-1515, 2009.
- [C11] **G.L. Mariottini** and S. Martini and M. Egerstedt,  
 “A Switching Active Sensing Strategy to Maintain Observability for Vision-Based Formation Control”, in *IEEE 2009 Conference on Robotics and Automation*, (in press), 2009.
- [C10] **G.L. Mariottini**, F. Morbidi, D. Prattichizzo,  
 “Vision-based range estimation via Immersion and Invariance for robot formation control” in *2008 IEEE International Conference on Robotics and Automation*, Pasadena, CA;
- [C9] **G.L. Mariottini**, S. Scheggi, F. Morbidi, D. Prattichizzo,  
 “A Robust Uncalibrated Visual Compass Algorithm from Paracatadioptric Line Images” in *Proc. Workshop on Omnidirectional Robot Vision 2008*, Venice, Italy, November 2008;
- [C8] **G.L. Mariottini**, D. Prattichizzo, C. Snickars, M. De Biasi, A. Rufa, A. De Capua, S. Rossi,  
 “Human-Robot Interaction for Active Rehabilitation in Cognitive and Emotional Domains”, in *2007 IEEE International Conference on Intelligent Robots and Systems (IROS’07)*, pp. 528-533, San Diego, CA, USA;;
- [C7] **G.L. Mariottini**, D. Prattichizzo,  
 “Uncalibrated Paracatadioptric Video Compass from Line Images”, in *2007 IEEE International Conference on Intelligent Robots and Systems (IROS’07)*, pp. 226-131, San Diego, CA, USA;
- [C6] **G.L. Mariottini**, F. Morbidi, D. Prattichizzo, G.J. Pappas, and K. Daniilidis,  
 “Vision-Based Localization and Control of Leader-Follower Formations”, in *2007 IEEE International Conference on Robotics and Automation*, pp. 2403-2408, Rome, ITALY;
- [C5] **G.L. Mariottini**, G. Oriolo, D. Prattichizzo,  
 “Image-based Visual Servoing for Nonholonomic Mobile Robots with Central Catadioptric Camera”, in *2006 IEEE International Conference on Robotics and Automation*, Orlando, Florida, USA;

- [C4] **G.L. Mariottini**, G. Pappas, D. Prattichizzo, K. Daniilidis, “Vision-based Localization of Leader-Follower Formations” in *44th IEEE Conference on Decision and Control and 2005 European Control Conference*, pp.635-640, 2005.
- [C3] **G.L. Mariottini**, E. Alunno, J. Piazzi, D. Prattichizzo, “Epipole-based Visual Servoing with Central Catadioptric Cameras”, In *2005 IEEE International Conference on Robotics and Automation (ICRA)*, pp.3516 - 3521, 2005.
- [C2] **G.L. Mariottini**, G. Oriolo, D. Prattichizzo, “Epipole-based visual servoing for nonholonomic mobile robots” ,in *IEEE International Conference on Robotics and Automation (ICRA)*, New Orleans, April 2004.
- [C1] **G.L. Mariottini**, D. Prattichizzo, “Epipolar geometry estimation for contour-based visual servoing” in *World Automation Congress, 2004*, Vol.15, pp.529-534, 2004.

## Book Chapters

- **G.L. Mariottini**, S. Scheggi, F. Morbidi, D. Prattichizzo, “Catadioptric Stereo with Planar Mirrors: Multiple-View Geometry and Camera Localization”, in *Visual Servoing via Advanced Numerical Methods*, G. Chesi and K. Hashimoto, Eds., Lecture Notes in Computer Science, Springer-Verlag, pp. 71-90, 2009.
- **G.L. Mariottini**, D. Prattichizzo, A. Cerbella, “Image-Based Visual Servoing for Mobile Robots with Catadioptric Camera”, in *Springer Tracts in Advanced Robotics*, European Robotics Symposium 2006, E.Christensen Editor., pp. 159-170, 2006.
- **G.L. Mariottini**, E. Alunno, J. Piazzi, D. Prattichizzo, “Visual Servoing for Central Catadioptric Camera”, in *Springer ACTRA*, Ed. Birkhauser 2005.

## Ph.D. Thesis

- **G.L. Mariottini** “Image-based Visual Servoing for Mobile Robots: the Multiple View Geometry Approach”, February 2006, Advisors: Prof. D.Prattichizzo, Prof. A. Vicino, University of Siena, Siena, ITALY.  
**Download:** [www.dii.unisi.it/~gmariottini/PhDthesis.pdf](http://www.dii.unisi.it/~gmariottini/PhDthesis.pdf)

## Master Thesis

- **G.L. Mariottini** “Study of Epipolar-Geometry for the Estimation of Planar Trajectories in Mobile Robots Problems”, Advisor: Prof. Domenico Prattichizzo, Co-Advisors: Ing. Jacopo Piazzi, Prof. Antonio Vicino, 14 October 2002.

## Posters

- Poster session at the *2004 Meeting in Honor of David S.Zee*, Ospedale Le Scotte, Siena.

## Technical Reports

- **G.L. Mariottini**, D.Prattichizzo, “The Epipolar Geometry Toolbox (EGT) for Matlab v1.1”, *Technical Report 07-21-3-DII*, University of Siena, July 2004 - Siena, Italy.

## References

### **Prof. Kostas Daniilidis**

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