

CURRICULUM VITAE

PERSONAL DATA

Name: Iñaki Navarro Oiza
Nationality: Spanish, Swiss B permit
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ACADEMIC BACKGROUND

- 11/2004 - 07/2010. **Ph.D. in Robotics** (Doctorado en Automática y Robótica). *Escuela Técnica Superior de Ingenieros Industriales (ETSII), Universidad Politécnica de Madrid (UPM), Spain.*
 - Thesis: *Collective Movement in Robotic Swarms.*
 - Supervisors: Fernando Matía and Agustín Jiménez.
 - Qualification: *Sobresaliente cum Laude* (maximum)
 - European Doctorate Mention
 - 07/2007. DEA Diploma (*Diploma de Estudios Avanzados*)
- 09/1998 - 10/2004. **M.Sc. in Telecommunication Engineering** (Ingeniero de Telecomunicación). *Escuela Técnica Superior de Ingenieros de Telecomunicación (ETSIT), UPM, Spain.*
 - 09/2003 - 10/2004. LTH (Lund Institute of Technology), Lund University, Sweden. 5th year and Master Thesis with the Erasmus Programme. Master Thesis title: *Reactive Cooperation on AIBO Robots.*

PROFESSIONAL EXPERIENCE

- 02/2013 - 12/2015. Postdoctoral researcher at Distributed Intelligent Systems and Algorithms Laboratory (DISAL) at the Ecole Polytechnique Fédérale de Lausanne (EPFL)
- 01/2012 - 01/2013. Postdoctoral researcher at Laboratorio de Sistemas de Control, ETSI Telecomunicación, UPM.
- 01/2005 - 01/2011. Researcher at Intelligent Control Group, ETSI Industriales, UPM.
 - 10/2005 - 10/2009. Scholarship holder (FPI grant, Formación de Personal Investigador) awarded by Comunidad de Madrid.
- 10/2006 - 04/2007. Research internship as visiting Ph.D. student in the Distributed Intelligent Systems and Algorithms Laboratory (DISAL) at EPFL. Working in formations with *Khepera III* robots, supervised by Alcherio Martinoli.

Research interests: Multi-robot systems, swarm robotics, robot formations, distributed consensus, multi-robot odor search, machine learning, particle swarm optimization, autonomous vehicles.

RESEARCH SUPERVISION

Master student theses (*Proyecto Fin de Carrera*) at ETSII UPM:

- Lorena Martín. Tool Development for the Analysis and Improvement of a Relative Positioning System of the Khepera III Robot. Cosupervisor: Fernando Matía. 10/2007 - 06/2010.
- Guillermo Fernández. Transport of Control Algorithms of Formations of Robots from Simulation to Reality. Cosupervisor: Ricardo Sanz. 12/2008 - 06/2010.

Bachelor theses at ENAC EPFL:

- Guillermo Sierra. Implementation of Collaborative Sensing and Decision Making on two Citroen C-zero Vehicles. Co-Advisor: Milos Vasic. Supervisor: Alcherio Martinoli. 02/2015 - 06/2015.

Semester Projects at ENAC EPFL:

- Raphaël Lüthi. Object Classification in Urban Environments by Means of Machine Learning Techniques Co-Advisor: Milos Vasic. Supervisor: Alcherio Martinoli. 09/2015 - 01/2016.
- Florian Zimmermann. Dynamic Convoy Algorithm for Intelligent Cars. Co-Advisor: Milos Vasic. Supervisor: Alcherio Martinoli. 02/2015 - 06/2015.
- Gael Lederrey. Collaborative Sensing and Decision Making for Intelligent Vehicle Maneuvers. Co-Advisor: Milos Vasic. Supervisor: Alcherio Martinoli. 09/2014 - 01/2015.
- Guillaume Jornod. A visualization tool for Particle Swarm Optimization and other Machine Learning Techniques. Co-Advisor: Ezequiel Di Mario. Supervisor: Alcherio Martinoli. 09/2013 - 01/2014.

COLLABORATION IN RESEARCH PROJECTS AND CONTRACTS

- 11/2014 - 12/2015 *AutoNet2030, Co-operative Systems in Support of Networked Automated Driving by 2030* Co-funded by the EU within the FP7 framework programme. Grant agreement no: 610542.
- 02/2013 - 10/2014 *Project 4. Distributed Robotics. Sub-project 4.3 Evaluative population-based distributed adaptation*, National Centre of Competence in Research (NCCR) Robotics. (Switzerland).
- 02/2013 - 10/2014 *Project 5. Robots for Daily Life. Sub-project 5.2 Robots for daily life in homes*, NCCR Robotics. (Switzerland).
- 03/2012-01/2013. *Estudio de Algoritmos Colectivos para Redes Inteligentes de Sensores*. (Spain).
- 03/2012-11/2012. *Solar Decathlon Europe 2012* (Monitoring Team Member). (Spain).
- 2007-2010. *Robonauta. Integración de modelos de conocimiento para la puesta en operación autónoma de robots móviles de servicios* (DPI2007-66846-c02-01). (Spain).
- 2006-2007. *COSICOLOGI: Control de Sistemas Complejos para la Logística y la Producción de Bienes y Servicios* (S-0505/DPI-0391). (Spain).
- 2005-2007. Project *ROBINT: Integración de Comportamientos Inteligentes en Robots Guía*.(DPI2004-07908-C02-02). (Spain).
- 01/2005-10/2005. Project *RAYO: Simulation of Lightning Effects in Aircrafts* in collaboration with AIRBUS. (Spain).

TEACHING EXPERIENCE

- Fall 2015. Support staff of the course *Distributed Intelligent Systems*, Institute of Environmental Engineering, EPFL. Duties included assignment and exercises testing, supervision of course projects and lab exercises. Conducted in English and French.
- Spring 2015. Support staff of the course *Signals, Instruments and Systems*, Institute of Environmental Engineering, EPFL. Duties included guest lectures, assignment and exam testing testing, and supervision of course projects. Conducted in English and French.
- Spring 2014. Head Teaching Assistant of the course *Signals, Instruments and Systems*, Institute of Environmental Engineering, EPFL. Duties included exercises and exam design, supervision of weekly lab exercises, supervision of course projects. Conducted in English and French.
- Fall 2013. Support staff of the course *Distributed Intelligent Systems*, Institute of Environmental Engineering, EPFL. Duties included guest lectures, assignment and exercises testing. Conducted in English and French.

- Spring 2013. Support staff of the course *Signals, Instruments and Systems*, Institute of Environmental Engineering, EPFL. Duties included assignment and exercises testing and supervision of weekly lab exercises. Conducted in English and French.
- Spring 2009. Teaching assistant of the courses *Computadores I* (Computers I) and *Computadores II* (Computers III), ETSII, UPM. Duties included guest lectures, assignment development, course project supervision, and leading weekly lab exercises. Conducted in Spanish.
- Spring 2008. Teaching assistant of the international course *Introduction to Mobile Robotics. Cybertech BEST*, ETSII, UPM. Duties included main lectures, and leading lab work. Conducted in English.
- Fall 2007. Teaching assistant of the course *Computadores I* (Computers I), ETSII, UPM. Duties included guest lectures, assignment development, course project supervision, and leading weekly lab exercises. Conducted in Spanish.
- Fall 2005. Teaching assistant of the course *Cybertech* (Design and construction of mobile robots), ETSII, UPM. Duties included main lectures, course project supervision, and leading lab work. Conducted in Spanish.
- Fall 2001. Instructor of the workshop *Robots Móviles* (Mobile Robots), ETSIT, UPM. Duties included main lectures, and leading lab work. Conducted in Spanish.

PUBLICATIONS

Journal articles:

- **I. Navarro**, A. Gutiérrez, C. Montero, E. Rodríguez-Ubiñas, E. Matallanas, M. Castillo-Cagigal, M. Porteros, J. Solórzano, E. Caamaño-Martín, M. A. Egido, J. M. Páez and S. Vega, *Experiences and methodology in a multidisciplinary energy and architecture competition: Solar Decathlon Europe 2012*, Energy and Buildings, Volume 83, November 2014, Pages 3-9, ISSN 0378-7788. doi:10.1016/j.enbuild.2014.03.073.
- E. Rodríguez-Ubiñas, C. Montero, M. Porteros, S. Vega, **I. Navarro**, M. Castillo-Cagigal, E. Matallanas, A. Gutiérrez, *Passive Design Strategies and Performance of Net Plus Energy Houses*, Energy and Buildings, Volume 83, November 2014, Pages 10-22, ISSN 0378-7788. doi:10.1016/j.enbuild.2014.03.074.
- E. Matallanas, J. Solórzano, M. Castillo-Cagigal, **I. Navarro**, E. Caamaño-Martín, M. A. Egido, and A. Gutierrez, *Electrical Energy Balance Contest in Solar Decathlon Europe 2012*, Energy and Buildings, Volume 83, November 2014, Pages 36-43, ISSN 0378-7788. doi:10.1016/j.enbuild.2014.03.076.
- M. Castillo-Cagigal, E. Matallanas, **I. Navarro**, E. Caamaño-Martín, F. Monasterio-Huelin and A. Gutierrez, *A Variable Threshold Algorithm for Division of Labor Analyzed as a Dynamical System*, IEEE Transactions on Cybernetics, In press. doi: 10.1109/TCYB.2014.2305194
- **I. Navarro**, *Exploring Split and Join Capabilities of a Robotic Collective Movement Framework*, International Journal of Advanced Robotic Systems, ISBN: 1729-8806, InTech, Vol. 10, 2013, DOI: 10.5772/55390.
- **I. Navarro**, F. Matía, *A Survey of Collective Movement of Mobile Robots*, International Journal of Advanced Robotic Systems, Grazia Cicirelli (Ed.), ISBN: 1729-8806, InTech, Vol. 10, 2013, DOI: 10.5772/54600
- **I. Navarro**, F. Matía, *An Introduction to Swarm Robotics*, ISRN Robotics, vol. 2013, Article ID 608164, 10 pages, 2013. doi:10.5402/2013/608164
- **I. Navarro**, F. Matía, *Distributed Orientation Agreement in a Group of Robots*, Autonomous Robots, Volume 33, Number 4, 2012, Pages 445-465. DOI:10.1007/s10514-012-9300-5.
- **I. Navarro**, F. Matía, *A Framework for the Collective Movement of Mobile Robots Based on Distributed Decisions*, Robotics and Autonomous Systems, Volume 59, Issue 10, October 2011, Pages 685-697. DOI: 10.1016/j.robot.2011.05.001
- M. Hernando, R. Galán, **I. Navarro** and D. Rodríguez-Losada, *Ten years of Cybertech: The Educational Benefits of Bullfighting Robotics*, IEEE Transactions on Education, Volume: 54 Issue:4, November 2011, Pages 569 - 575, ISSN: 0018-9359, DOI: 10.1109/TE.2010.2095014.

Peer-reviewed conference articles:

- **I. Navarro**, F. Zimmermann, M. Vasic and A. Martinoli. *Distributed Graph-Based Control of Convoys of Heterogeneous Vehicles using Curvilinear Road Coordinates*, IEEE Intelligent Transportation Systems Conference, 2016.
- X. Qian, **I. Navarro**, A. de La Fortelle, F. Moutarde. *Cooperative-Aware Motion Planning for Urban Autonomous Driving using Bézier Curves and MPC*, IEEE Intelligent Transportation Systems Conference, 2016.
- **I. Navarro**, E. Di Mario and A. Martinoli. *Noise-Resistant Particle Swarm Optimization for the Learning of Robust Obstacle Avoidance Controllers using a Depth Camera*, 2016 IEEE Congress on Evolutionary Computation (CEC).
- M. Vasic, G. Lederrey, **I. Navarro** and A. Martinoli. *An Overtaking Decision Algorithm for Networked Intelligent Vehicles Based on Cooperative Perception*, IEEE Intelligent Vehicles Symposium, Gothenburg, Sweden, 2016.
- Z. Talebpour, **I. Navarro**, and A. Martinoli. *Human-aware Navigation for Indoor Resource-constrained Robots: A Case-study with the Ranger*, 2015 IEEE/SICE International Symposium on System Integration, 2015.
- J. M. Soares, **I. Navarro**, and A. Martinoli. *The Khepera IV Mobile Robot: Performance Evaluation, Sensory Data and Software Toolbox*, ROBOT'2015: Second Iberian Robotics Conference, 2015.
- **I. Navarro**, E. Di Mario and A. Martinoli. *Distributed Particle Swarm Optimization - Particle Allocation and Neighborhood Topologies for the Learning of Cooperative Robotic Behaviors*, IEEE/RSJ International Conference on Intelligent Robots and Systems 2015.
- **I. Navarro**, E. Di Mario and A. Martinoli. *Distributed vs. Centralized Particle Swarm Optimization for Learning Flocking Behaviors*, in proceedings of the European Conference on Artificial Life 2015, pp. 302-309, DOI:10.7551/978-0-262-33027-5-ch056.
- G. Jornod, E. Di Mario, **I. Navarro** and A. Martinoli. *SwarmViz: An Open-Source Visualization Tool for Particle Swarm Optimization*, 2015 IEEE Congress on Evolutionary Computation (CEC).
- E. Di Mario, **I. Navarro** and A. Martinoli. *Distributed Particle Swarm Optimization using Optimal Computing Budget Allocation for Multi-Robot Learning*, 2015 IEEE Congress on Evolutionary Computation (CEC).
- E. Di Mario, **I. Navarro** and A. Martinoli. *A Distributed Noise-Resistant Particle Swarm Optimization Algorithm for High-Dimensional Multi-Robot Learning*, 2015 IEEE International Conference on Robotics and Automation (ICRA).
- E. Di Mario, **I. Navarro** and A. Martinoli. *Distributed Learning of Cooperative Robotic Behaviors using Particle Swarm Optimization*, 2014 International Symposium on Experimental Robotics, 2014, to appear in Springer Tracts in Advanced Robotics
- E. Di Mario, **I. Navarro** and A. Martinoli. *Analysis of Fitness Noise in Particle Swarm Optimization: From Robotic Learning to Benchmark Functions*, 2014 IEEE Congress on Evolutionary Computation (CEC), Pages 2785 - 2792, DOI: 10.1109/CEC.2014.6900514
- E. Di Mario, **I. Navarro** and A. Martinoli. *The Role of Environmental and Controller Complexity in the Distributed Optimization of Multi-Robot Obstacle Avoidance*, 2014 IEEE International Conference on Robotics and Automation (ICRA), Pages 571-577, 2014.
- E. Di Mario, **I. Navarro** and A. Martinoli. *The Effect of the Environment in the Synthesis of Robotic Controllers: A Case Study in Multi-Robot Obstacle Avoidance using Distributed Particle Swarm Optimization*, in proceedings of the Twelfth European Conference on the Synthesis and Simulation of Living Systems, Advances in Artificial Life, ECAL 2013, 2013, pp. 561-568.
- T. Lochmatter, E. Aydin, **I. Navarro** and A. Martinoli, *A Plume Tracking Algorithm based on Crosswind Formations*, in International Symposium on Distributed Autonomous Robotic Systems, Lausanne, Switzerland, 2010.
- **I. Navarro**, F. Matía, *A Proposal of a Set of Metrics for Collective Movement of Robots*, Workshop on Good Experimental Methodology in Robotics, Robotics Science and Systems 2009, Seattle, WA, USA, June 28, 2009.

- **I. Navarro**, J. Pugh, A. Martinoli, and F. Matía, Distributed Autonomous Robotic Systems 8. Springer Berlin Heidelberg, 2009, ch. *A distributed scalable approach to formation control in multi-robot systems*, pp. 203-214. ISBN: 978-3-642-00643-2.
- **I. Navarro**, A. Gutiérrez, F. Matía, and F. Monasterio-Huelin, *An approach to flocking of robots using minimal local sensing and common orientation*, in Hybrid Artificial Intelligent Systems: 3th International Workshop, HAIS 2008. Lecture Notes in Artificial Intelligence (LNAI), E. Corchado, A. Abraham, and W. Pedrycz, Eds. Berlin, Germany: Springer-Verlag, 2008, vol. 5271, pp. 616-624.
- **I. Navarro** and R. Galán, *Cybertech Robotic Competition*, in EUROBOT 2008, Communications in Computer and Information Science, A. Gottscheber and S. Enderle, Eds. Berlin, Germany: Springer-Verlag, 2009, vol 33, pp. 134-144. ISSN: 1865-0929.
- **I. Navarro**, *Formaciones de Robots*, III Simposio CEA de Control Inteligente, Palma de Mallorca, Spain, 2007.
- A. Gutiérrez, **I. Navarro**, D. Amor, J. M. Castro and J. Donate, *PI2: A new Initiative in Educational Mobile Robotics*, in Proceedings of Eurobot Workshop on Educational Robotics, Catania, Italy, 2006.
- D. Amor, J. M. Castro, J. Donate, A. Gutiérrez, M. Lerena and **I. Navarro**, *PI y TC-EPI: Una Nueva Iniciativa de Hardware Abierto Orientado a la Formación en Robótica Móvil*, in Proceedings of TELECOM2002 International Conference, Santiago de Cuba, July, 2002.

Education book chapters (in Spanish):

- **I. Navarro** and J. Donate, *Exhibición de Robots*, II Feria Madrid por la Ciencia 2001, pages 208-209, SM Editorial, 2002, ISBN: 84-348-8495X.
- D. Amor, J. M. Castro, J. Donate, A. Gutiérrez, M. Lerena and **I. Navarro**, *Granja de robots cooperantes*, III Feria Madrid por la Ciencia 2002, pages 44-45, SM Editorial, 2003, ISBN: 84-348-9247-2.
- D. Amor, J. M. Castro, J. Donate, A. Gutiérrez, M. Lerena and **I. Navarro**, *Los ojos del Robot*, IV Feria Madrid por la Ciencia 2003, pages 146-147, SM Editorial, 2004, ISBN: 84-675-0143-X.

INVITED RESEARCH SEMINARS & TALKS

- *A Framework for the Collective Movement of Mobile Robots Based on Distributed Decisions*, ICRA 2013 Workshop on Towards Fully Decentralized Multi-Robot Systems: Hardware, Software and Integration, Karlsruhe, Germany, May 6, 2013.
- *Autonet2030: towards distributed control of dynamic vehicle convoys*, Navigare 2015: Cooperative & Swarm Navigation, organized by the The Swiss Institute of Navigation ION-CH, Thun, Switzerland, May 5, 2015.

LANGUAGES

- Spanish: Mother tongue.
- English: Fluent. TOEFL Computer Based Test: 247.
- Italian: Fluent.
- French: Intermediate. Level B2.1 of the Institute Française.
- German: Basic understanding. Grundstufe 6 of the Goethe-Institut.

SERVICE

Journal Reviewer:

IEEE Sensors Journal, Robotica, Autonomous Robots, International Journal of Systems Science, IEEE Transactions on Cybernetics, International Journal of Advanced Robotic Systems.

Conference Reviewer:

IEEE/RSJ International Conference on Intelligent Robots and Systems, IEEE International Conference on Robotics and Automation, Brain Inspired Cognitive Systems Conference.

Conference Technical Program Committees:

12th European Conference on Artificial Life (ECAL 2013).

Examination Committees:

12/2014 - Member of the Jury, M. Castillo-Cagigal PhD defence, Universidad Politécnica de Madrid, Madrid, Spain.

7/2016 - Member of the Jury, E. Matallanas PhD defence, Universidad Politécnica de Madrid, Madrid, Spain.

Grant and project reviewer:

Reviewer of Veni Programme 2015 of the Technology Foundation STW dependent from the Dutch Government.

Coorganizer of Robotic Contests:

- CEABOT2006. Humanoid robotic national spanish contest organized by the Comité Español de Automática (CEA, Automatic Spanish Committee)
- Cybertech2005, Cybertech2006 and Cybertech2008. Student robotic contest organized yearly in the "Escuela Técnica Superior de Ingenieros Industriales" as part of an undergraduate course.

OTHER MERITS

2000-2004. Cofounder of the group RBZ Robotics, formed by students of Telecommunication Engineering of the "Universidad Politécnica de Madrid", focused on the design and construction of mobile robots. As member of this group, participation in the next activities:

- 2000-2003. Participation in several national robotic contests (Alcabot, Barcelona, Championbot).
- 2001. Design and development of the educational robotic platform "PI" oriented towards education in mobile robotics.
- 12/2001. Organization of the national robotic contest Championbot, at EUIT Telecommunication - (UPM).
- Fall 2001. Organization of the workshop *Mobile Robots* at ETSI and EUIT Telecommunication - (UPM).
- 05/2002. 1st Award of the Design Contest, with the design of "PI Platform", during IEEE Region 8 Student Branch Congress 2002 (sbc2002) organized by IEEE in Cairo (Egypt).
- 2001-2002 ATT Labs Student Enterprise Award for the project "*Autonomous Mobile Robot for Educational Purposes*".
- 2001-2003. Participations in the 2nd, 3rd and 4th National Fairs "*Madrid with the Science*", in which selected students of all Spain explain science to the public.

Since 2000, member of The Institute of Electrical and Electronics Engineers (IEEE). Active member of the Student Branch of Madrid (2000-2003).

- Member of Robotics and Automation Society.
- Vice-Chair of the local Student Branch during 2001-2002 academic year.
- Coordinator of the robotics group of the Student Branch (2001-2003).
- Member of the Linux group of the Student Branch (2001-2003).
- Organizer of the IV National Student Branch Congress, September 2002, Madrid.

2002-2003. Mentor of foreign Erasmus students at ETSI Telecommunication, helping new students to integrate themselves in the University.