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Personal Information

Date of Birth June 7, 1980
Address Via Palazzo Snc
04023 Formia, Italy
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Education

2009 – 2014 **Ph.D. in Computer Engineering**, *Department of Computer, Control, and Management Engineering Antonio Ruberti*, La Sapienza University of Rome, Italy.

Ph.D Thesis

Title *Multi-layered cognitive control for Unmanned Ground Vehicles*
Supervisor Prof. Fiora Pirri

Abstract Rescue robots have the potentials to assist responders in searching for survivors, in rescuing victims, in providing the responders with a general situation awareness, in creating a reference of the destroyed environment, in sampling suspicious substances from hazardous sites, in navigating through those areas, inaccessible for humans. In the last decades, rescue robots participated in many of the most critical environmental disasters around the world, exhibiting extraordinary abilities in terms of mapping, vision and navigation. In June 2012, at Mirandola, a city of Northern Italy, hit by a tremendous earthquake, we deployed a team of humans and robot to assess damage to historical buildings and cultural artifacts located therein. This in-field experience has been really important because it led us to a better understanding of what are the main research challenges which are not yet widely addressed in rescue robotics. The research work of this thesis aims to investigate, in more detail, some of these challenges, providing solutions and methodological approaches to the research problems, still opened. In particular, we address the problem of building a meaningful, higher level representation of unstructured and dynamic environments, from raw data, coming from the robot sensor suite. We also take care of how to formulate this representation into a domain where decision making and action planning can take place. We tackle with the problem of learning the skills required for a robot to perform a rescue task and formulating such skills into robot actions and plans. Here, the novelty is to use a wearable device, namely, the Gaze Machine (GM), to address the correspondence issues between the physical embodiments of the firefighter, wearing the GM, and the robot. Further, this thesis investigates the problem of increasing the level of autonomy of the robot, in low-level, semi-active and cognitive control.

In low-level control, we propose an approach to design and develop a controller, which endows the robot with the ability to autonomously traverse harsh terrains, climbing stairs, surmounting obstacles, adapting the configuration of the robot to the underlying surfaces. In semi-active control, we propose an approach to coordinate the low-level capabilities of the robot and the interaction between the human and robot, under a mixed-initiative planning setting. In this approach the main components and activities of the robot are explicitly represented as well as the cause-effect relations and the temporal constraints among the activities. This control model is based on a logical framework which combines temporal constraint reasoning and action planning. This framework provides us with a solid logical structure on which to build the set of cognitive functions of the robot. Such functions endows the robot with the ability to flexibly adapt its behavior in response to environmental demands and stimuli. To model this ability, we propose a method for learning the dynamic processes regulating the human inspired paradigm of shifting and inhibition, underlying the task switching mechanism. Finally, this thesis proposes an alternative view of Augmented Reality, as a framework to augment the perceptual model of the robot as well as to build mixed-reality simulation environments, where to validate the performance of the robot, in terms of vision, motion planning and control.

2007 – 2009 **M. Sc. in Artificial Intelligence and Robotics, *with honours***, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.

Master thesis

Title *Learning from observations*

Supervisor Prof. Fiora Pirri

Description Observational learning is that basic form of learning which occurs through observing the behavior of others. This form of learning requires a model which helps the learner to encode what he/she observes and to store it in memory for later imitation, thus facilitating cognitive process behavior. This learning process spontaneously occurs in humans. However, designing a system that automatically replicates this process, requires to specify the sequence of computational steps that bring the system from the observation of a task to the formulation of the causal and effect laws governing such a task. In this thesis we describe the proposed approach to design a system capable of learning from observations. Further we describe the main steps needed to transform quantitative information into a set of permanent qualitative laws. Our observations are sequences of frames illustrating the execution of a simple task, such as *Opening the door*. Vectors of descriptors, extracted from this set of frames, are used to determine the parameters of a statistical model, describing the probabilities of the events ruling the task. The statistical model is then compiled into a probabilistic first-order structure, whose role is to represent the observations in a formal language, conjugating probabilities and the truth properties of the sentences. Finally, measures are eliminated and the ontology can be fully expressed in the language of thoughts.

Languages

Italian Fluent (mother tongue)

English B2 - good (self-valuation according to Language Skills Self-Assessment Grid of European Language Portfolio)

Experience

Research

- September 2014 – now **Post-doctoral Researcher**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.
- September 2013 – August 2014 **Research Assistant**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.
- September 2010 – August 2013 **Research Assistant**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.
- February 2012 – March 2012 **07/Occ.Serv./2012**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.
- January 2010 – May 2010 **22/Co.Co.Co./2009**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.
- October 2010 – January 2011 **10/Co.Co.Co./2010**, Department of Computer, Control, and Management Engineering Antonio Ruberti, La Sapienza University of Rome, Italy.

Teaching

- 2009 – now **Teaching Assistant**, *Logics and Discrete Mathematics for Computer Science*, Bachelor of Engineering in Computer Systems, Department of Computer, Control, and Management Engineering Antonio Ruberti. La Sapienza University of Rome.

Stages

- October 2009 – December 2009 **Software Design and Development, Object Oriented Programming, C/C++ Language**, *Consorzio START*, Via della Bufalotta 378, 00139 Rome, Italy.

Projects

- November 2013 – now **TRADR Project**, *Long-Term Human-Robot Teaming for Robot Assisted Disaster Response*, EU FP7 ICT 609763 Cognitive Systems and Robotics.
- January 2010 – January 2014 **NIFTI Project**, *Natural Human-Robot Cooperation in Dynamic Environments*, EU FP7 ICT 247870 Cognitive Systems and Robotics.

Publications

- Kruijff, G.J.M. Janíček, M. Keshavdas, S. Larochelle, B. Kruijff-Korbayova, I. Colas, F. Liu, M. Pomerleau, F. Siegwart, R. Neerincx, M.A. Looije, R. Smets, N.J.J.M. Mioch, T. van Diggelen, J. **Gianni**, M. Ferri, F. Menna, M. Pirri, F. Worst, R. Linder, T. Tretyakov, V. Surmann, H. Svoboda, T. Reinstein, M. Zimmermann, K. Petříček, T. and Hlaváč, V. *Designing, developing, and deploying systems to support human-robot teams in disaster response*. *Advanced Robotics*, October 2014. (Accepted)
- **Gianni**, M. Ferri, F. Menna, M. and Pirri, F. *Adaptive Robust 3D Trajectory Tracking for Actively Articulated Tracked Vehicles (AATVs)*. *Journal of Field Robotics*, August 2014. (Accepted)

- **Gianni, M.** Kruijff, G.J.M. and Pirri, F. *Learning to adapt behavioral modes to tasks, under salient stimuli*. ACM Transaction on Interactive Intelligent Systems, January 2014. (Accepted)
- Ferri, F. **Gianni, M.** Menna, M. and Pirri, F. *Point Cloud Segmentation and 3D Path Planning for Tracked Vehicles in Cluttered and Dynamic Environments*. In Proceeding of the the 3rd IROS Workshop on Robots in Clutter: Perception and Interaction in Clutter, September 2014.
- Menna, M. **Gianni, M.** Ferri, F. and Pirri, F. *Real-time Autonomous 3D Navigation for Tracked Vehicles in Rescue Environments* . In Proceeding of the IEEE/RSJ International Conference on Intelligent Robots and Systems, September 2014.
- Menna, M. **Gianni, M.** and Pirri, F. *Learning the dynamic process of inhibition and task switching in robotics cognitive control*. In Proceedings of the 12th International Conference on Machine Learning and Applications (ICMLA). Miami, Florida, December 2013.
- Cafaro, B. **Gianni, M.** Pirri, F. Ruiz, M. and Sinha, A. *Terrain Traversability in Rescue Environments*. In Proceedings of the 11th IEEE International Symposium on Safety, Security and Rescue Robotics. Linkoping, Sweden, October 2013. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6719358&tag=1
- **Gianni, M.** Gonnelli, G. Sinha, A. Menna, M. and Pirri, F. *An Augmented Reality approach for trajectory planning and control of tracked vehicles in rescue environments*. In Proceedings of the 11th IEEE International Symposium on Safety, Security and Rescue Robotics. Linkoping, Sweden, October 2013. **Best Paper Finalist**. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6719360
- **Gianni, M.** Ferri, F. and Pirri, F. *ARE: Augmented Reality Environment for Mobile Robots*. In Proceedings of the 14th Conference on Towards Autonomous Robotic Systems, TAROS 2013. Lecture Notes in Artificial Intelligence, Springer 2013. Oxford, UK 2013. <http://www.springer.com/series/1244>
- G.J.M. Kruijff, Tretyakov, V. Linder, T. Pirri, F. **Gianni, M.** Papadakis, P. Pizzoli, M. Sinha, A. Pianese, E. Corrao, S. Priori, F. Febrini, S. and Angeletti, S. *Rescue Robots at Earthquake-Hit Mirandola, Italy: a Field Report*. In Proceedings of the 10th International Symposium on Safety Security and Rescue Robotics. November 2012, College Station, Texas. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6523866
- **Gianni, M.** Papadakis, P. and Pirri, F. *Shifting and inhibition in cognitive control*. In Proceedings of the IROS 2012 Workshop on Cognitive Neuroscience Robotics, October 2012, Vilamoura, Algarve, Portugal.
- Kruijff, G.J.M. Janicek, M. Keshavdas, S. Larochelle, B. Zender, H. Smets, N. Mioch, T. Neerinx, M. Diggelen, J.V. Colas, F. Liu, M. Pomerleau, F. Siegwart, R. Hlavac, V. Svoboda, T. Petricek, T. Reinstein, M. Zimmerman, K. Pirri, F. **Gianni, M.** Papadakis, P. Sinha, A. Balmer, P. Tomatis, N. Wrost, R. Linder, T. Surmann, H. Tretyakov, V. Corrao, S. Pratzler-Wanczura, S. and Sulk, M. *Experience in System Design for Human-Robot Teaming in Urban Search & Rescue*. In Proceedings of the 8th International Conference on Field and Service Robotics. July 2012, Matsushima, Miyagi, Japan. http://link.springer.com/chapter/10.1007/978-3-642-40686-7_8
- Papadakis, P. **Gianni, M.** Pizzoli, M. and Pirri, F. *Constraint-free Topological Mapping and Path Planning by Maxima Detection of the Kernel Spatial Clearance Density*. In Proceedings of the First International Conference on Pattern Recognition Applications and Methods. Vilamoura February 2012

- **Gianni, M.** Papadakis, P. Pirri, F. and Pizzoli, M. *Awareness in Mixed Initiative Planning*. AAAI 2011 Fall Symposium Robot-Human Team-Work in Dynamic Adverse Environment. Arlington VA November 2011
- **Gianni, M.** Papadakis, P. Pirri, F. Liu, M. Pomerleau, F. Colas, F. Zimmerman, K. Svoboda, T. Petricek, T. Kruijff, G. J. M. Zender, H. and Khambhaita, H. *A unified framework for planning and execution-monitoring of mobile robots*. In Proceedings of the AAAI-11 Workshop on Automated Action Planning for Autonomous mobile Robots (PAMR). San Francisco, California, August 2011
- H. Khambhaita, G. J. M. Kruijff, M. Mancas, **M. Gianni**, P. Papadakis, F. Pirri, M. Pizzoli . *Help me help you: how to learn intentions, actions and plans*. AAAI 2011 Spring Symposium Help Me Help You: Bridging the gaps in Human-Agent Collaboration.
- **M. Gianni**, G.J.M. Kruijff, and F. Pirri. *Learning cross-modal translatability: grounding speech act on visual perception*. Workshop on Learning for Human-Robot Interaction Modeling. June 2010, Zaragoza

Demos

Real-Time Autonomous 3D Navigation for tracked vehicles in Rescue Environments.

Scientific Interests

- Knowledge Representation
- Planning and Scheduling, Automated Reasoning
- Temporal Reasoning
- Statistical Graphical Models
- Measure Theory and Probability
- Machine Learning
- Soft Computing
- Cognitive Robotics
- Human-Robot Interaction
- Robot Planning
- Unmanned Ground Vehicles
- Autonomous Navigation
- Trajectory Planning & Control
- Augmented Reality
- Simulation
- Cognitive Architectures
- Urban Search & Rescue Robotics

Organisational skills and competences

- International team work experience

Technical skills and competences

- Design and development of intelligent systems

- Code development for embedded and distributed systems
- Robot programming
- Knowledge Engineering
- Networking

Computer skills and competences

Languages	MATLAB, C, C++, Java, SQL, Oracle, Prolog, OpenCV, OpenGL
Platforms	Linux, Windows
Robot middle-ware	Robot Operating Systems (ROS)
simulation	Player/Stage/Gazebo, V-REP
Tools	Microsoft Office, Latex, Visual C++, Eclipse