

Giulia Vezzani

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Who I am

I am a *PhD student* in *humanoid robotics*, with *automation engineering* background and three year *research experience*.

My current position and my past studies have taught me how to *solve challenging problems*, quickly *develop new skills*, *team up* with people with different backgrounds and *supervise and manage* research activity of other students.

In my future employments, I am eager to keep giving my *personal contribution to research* in humanoid robotics and AI. I feel dealing with challenging problems very exciting and thus I am very prone to work hard and find suitable solutions.

6 facts about me

- Automation engineer with three year experience on *humanoid robotics research*.
- Proven *C++ skills*, with a good knowledge of YARP and iCub libraries.
- *Tensorflow* and *Python* knowledge for Deep Reinforcement Learning.
- Daily research and work activities on *Unix-based* systems.
- *Hardware experience* with the humanoid robotic platform iCub.
- Main interests: *Grasping*, *Object localization*, *Perception* and *Deep Reinforcement Learning*.

Current Position

I am a PhD fellow in Bioengineering and Advanced Robotics - curriculum Advanced and Humanoid Robotics - at Istituto Italiano di Tecnologia in Genova, iCub Facility, in collaboration with Università di Genova.

The goal of my PhD program is to improve *perception and manipulation skills* for humanoid robots, by exploiting both *visual and tactile information*. All my new ideas have been implemented in C++ and tested on the humanoid robot iCub.

Recently, I got interested in *Artificial Intelligence* and, in particular, *Deep Reinforcement Learning* for robotics. I strongly believe that robots autonomous skills can be improved by combining model-based and learning techniques.

Skills

Software **Programming languages**, C++ (experienced), Python (experienced), MATLAB (prior experience), Lua (basic knowledge), Html (basic knowledge).

Libraries, YARP (expert), IpOpt (experienced), OpenCV (basic knowledge).

OS, Linux (experienced), Windows (prior experience).

Machine Learning Frameworks, Tensorflow (experienced).
Physics simulator, Mujoco (experienced).
Build and CI tools, CMake (basic knowledge).
Versioning Systems, Git (experienced).
Hardware **Robots & Platforms**, iCub (expert).
Soft Skills **Work-related**, Time management, Problem solving, Critical thinking, Teamwork, Decision Making, Motivation.
Languages, English (expert), Italian (mother-tongue).

Achievements

- 2017 **Modeling and Grasping Pipeline for the Humanoid Robot iCub (C++)**.
I developed a new modeling and grasping method based on superquadric functions. The C++ implementation is available for the iCub humanoid robot. More information are available at this website: <https://github.com/robotology/superquadric-grasp-demo>.
- 2017 **Handover Pipeline for the Humanoid Robot iCub (C++)**.
I designed an autonomous pipeline for executing the handover task with the humanoid robot iCub. A video of the pipeline execution is available *at this link*.
- 2016 **6-DOF Tactile Localization Algorithm (C++)**.
During my master thesis, I designed a novel localization algorithm, able to localize known objects by using only 3D points belonging to the object surface. This algorithm has been used also for object recognition and visual localization.

PhD Experience

- November, 2015 - currently **Phd Fellow @ iCub Facility (Istituto Italiano di Tecnologia)**, *Bioengineering and Advanced Robotics, curriculum Humanoid and Advanced Robotics*, Istituto Italiano di Tecnologia & Università di Genova, Genova, Italy.
During my PhD activity, I have designed novel algorithms improving 3D object modeling and localization for autonomous and robust grasping, by merging vision and tactile information on the humanoid robot iCub.
- January - July, 2018 **Visiting Research Scholar @ Berkeley Artificial Intelligence Research (BAIR)**, *Electrical Engineer and Computer Science (EECS)*, UC Berkeley, California.
My research activity at Bair focuses on the design of new deep reinforcement learning techniques aimed at improving robot manipulation and grasping capabilities.
- July, 2017 **Mentor @ Easy Peasy Robotics**, *Campus Party Italia*.
I was one of the mentors and organizers of Easy Peasy Robotics, a 2-days crash course whose aim was to provide participants with a brief overview of the research problems and applications related to humanoid robot programming, from perception to control.
- November, 2016 - February, 2017 **European Project TacMan: Tactile Manipulation**, *project founded by the European Union, FP7 ICT Cognitive System and Robotics, no. 610967*.
I developed a novel pipeline in order to make the iCub robot perform the handover task, i.e. transfer an object from one hand to the other.

August - **Brains, Minds and Machines Summer School 2016**, organized by Harvard Medical School
September, and Massachusetts Institute of Technology, Woods Hole, Massachusetts, US..

2016 I attended this intensive three-week course giving a “deep end” introduction to the problem of intelligence – how the brain produces intelligent behavior and how we may be able to replicate intelligence in machines. I also joined a team project, implementing an algorithm capable of detecting and recognize activities in real videos.(Selected students: 30/300 nearly.)

July, 2016 **International Computer Vision Summer School 2016 (ICVSS)**, organized by University of Cambridge and University of Catania, Ragusa, Italy.

This experience gave me both a clear overview and in-depth analysis of the state-of-the-art research in Computer Vision, both in academia and industry. (Selected students: 150/396.)

Past Experience

February, **Research Fellow @ iCub Facility (Istituto Italiano di Tecnologia)**, 6D object tactile
2015 - localization for the humanoid robot iCub, Istituto Italiano di Tecnologia & Università di
October, Firenze, Genova, Italy.

2015 During my M.Sc. thesis in collaboration with IIT, I designed a novel 6-DOF tactile localization algorithm, named Memory Unscented Particle Filter.

July, 2015 **The iCub Summer School - Veni Vidi Vici 2015**, Sestri Levante, Italy.

The school focuses on humanoid robotics, with the goal to foster collaboration on robot software across the boundaries and lifetimes of specific platforms and projects.

December, **52th IEEE Conference on Decision and Control**, Crew Member, Florence, Italy.

2013 I contributed to the organization of the CDC conference as a crew member, learning how to organize an international event with more than one thousands attendees.

Papers

2018 **Learning Complex Dexterous Manipulation with Deep Reinforcement Learning and Demonstrations**, V. Kumar, A. Rajeswaran, A. Gupta, G. Vezzani, E. Todorov, S. Levine, accepted to Robotics: Science and Systems (RSS), 2018.

2018 **Improving Superquadric Modeling and Grasping with Prior on Object Shapes**, G. Vezzani, U. Pattacini, G. Pasquale and L. Natale, IEEE International Conference on Robotics and Automation (ICRA), Brisbane, 2018.

2018 **Markerless Visual Servoing on Unknown Objects for Humanoid Robot Platforms**, C. Fantacci, G. Vezzani, U. Pattacini, V. Tikhonoff and L. Natale, IEEE International Conference on Robotics and Automation (ICRA), Brisbane, 2018.

2017 **A Novel Pipeline for Bi-manual Handover Task**, G. Vezzani, M. Regoli, U. Pattacini and L. Natale, Special Issue on Advanced Manipulation, Advanced Robotics, pp. 1-14, 2017.

2017 **Real-time Pipeline for Object Modeling and Grasping Pose Selection via Superquadric Functions**, G. Vezzani and L. Natale, Frontiers in Robotics and AI: “Building the iCub Mindware: Open-source Software for Robot Intelligence and Autonomy”, 4, 59, 2017.

2017 **A Grasping Approach Based on Superquadric Models**, G. Vezzani, U. Pattacini, and L. Natale, IEEE International Conference on Robotics and Automation (ICRA), pp. 1579-1586, Singapore, 2017.

2017 **Memory Unscented Particle Filter for 6-DOF Tactile Localization**, *G. Vezzani, U. Pattacini, G. Battistelli, L. Chisci, and L. Natale*, IEEE Transaction on Robotics (TRO), 33 (5), pp. 1139-1155.

2016 **A Novel Bayesian Filtering Approach to Tactile Object Recognition**, *G. Vezzani, N. Jamali, U. Pattacini, G. Battistelli, L. Chisci, and L. Natale*, IEEE International Conference on Humanoid Robotics (Humanoids), pp. 256 - 263, Cancun, Mexico, 2016.

Awards

March, 2018 **RAS Travel Grant**, at *IEEE International Conference on Robotics and Automation (ICRA)*, Brisbane.

February, 2017 **RAS Travel Grant**, at *IEEE International Conference on Robotics and Automation (ICRA)*, Singapore.

November, 2016 **Dr. Kanako Miura Travel Support Award**, at *IEEE International Conference on Humanoids Robotics*, Cancun, Mexico.

March, 2016 **AEIT Renato Mariani Award**, as *best student graduated in Information Engineering*, Florence, Italy.

Engineering License

January, 2016 **Professional Practical Examination in Industrial Engineering (qualified)**, *Università degli Studi di Firenze*, Florence, Italy.

Education

September, 2013 - **M. Sc. with honours in Electrical and Automation Engineering (GPA 4.0/4.0)**, *Università degli Studi di Firenze*, Florence, Italy.

October, 2015 **M. Sc. thesis "6D tactile localization for the humanoid robot iCub":**

I designed a novel 6D tactile localization algorithm, the Memory Unscented Particle Filter. Such an algorithm has been tested with real objects and measurements on the iCub robot. The results have been summarized in the regular paper "Memory Unscented Particle Filter for 6-DOF Tactile Localization," accepted at the international journal IEEE Transaction on Robotics.

M. Sc. Projects:

- "Modeling and control of a LEGO Legway".
- "Comparison between two different algorithms of distributed filtering and smoothing for nonlinear systems".

September, 2010 - **B. Sc. with honours in Electronic and Telecommunications Engineering (GPA 3.96/4.0)**, *Università degli Studi di Firenze*, Florence, Italy.

July, 2013

B. Sc. thesis "Trajectory planning and control of an anthropomorphic robot for pick and place operations":

I implemented a kinematic trajectory for an anthropomorphic robot in order to optimize the production in an assembly line of an Italian firm.

B. Sc. projects:

- "Reliability and Failure rate estimation of an electronic board".

2005 - **Scientific high school Diploma with full marks**, *Liceo Scientifico Guido Castelnuovo*, Florence, Italy.