Tommaso Proietti

Postdoctoral Research Fellow

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Experience

Postdoctoral Research Fellow **Jun 2019 - present**
Harvard University *Cambridge, MA, USA*
Harvard John A. Paulson School of Engineering and Applied Science

- Main research topic: development and evaluation of inflatable soft wearable robots for upper-limb assistance.
- Affiliated with the Wyss Institute for Biologically Inspired Engineering.
- Main responsibilities:
  - Lead research project and coordinate interdisciplinary team (Ph.D. students, occupational therapists, functional apparel designers, staff engineers, visiting team members, undergrads).
  - First-hand software development: sensor estimation, control strategies, virtual interfaces, data logging and real-time biofeedback.
  - Assistance in hardware development.
  - Define and run testing protocols. Data processing (filtering, data fusion, statistics, visualization). Redact manuscripts.
- PI: Prof. Conor J. Walsh - Lab: Harvard Biodesign Lab

Control System Engineer **Apr 2017 - Apr 2019**
General Motors *Turin, Italy*
GM Global Propulsion Systems

- Control function development and algorithm design for GM diesel engines sector.
- Main responsibilities:
  - Define system requirements and software architecture by taking into account legislation, standard, and quality.
  - Develop system Failure Mode and Effect Analysis (FMEA).
  - Contribute to definition of calibration methodologies.
  - Communicate with hardware and R&D communities to develop production-oriented technology.
  - Assist in troubleshooting subsystem integration, testing and validation (dyno, in-vehicle, roller bench).

Ph.D. in Robotics Engineering **Jan 2014 - Mar 2017**
Université Pierre et Marie Curie *Paris, France*
ISIR - Institut des Systèm Intelligents et de Robotique

- Main research topic: studying the possibility to induce relearning of motor coordination after a stroke by using an upper-limb robotic exoskeleton.
- Main responsibilities:
  - Study and control the physical Human-Robot Interaction (pHRI), with a specific focus on the human upper-limb motor control (adaptation, learning, after-effects).
  - Model, develop, code, and test innovative control strategies for exoskeletons on a Linux-based RTOS.
  - Define and run testing protocols. Data processing (filtering, data fusion, statistics, visualization). Redact manuscripts.
- PI: Prof. Agnes Roby-Brami

Visiting Pre-Doctoral Fellow **Oct 2012 - Oct 2013**
Northwestern University *Evanston, IL, USA*
McCormick School of Engineering

- Main research topic: trajectory planning and control of a nonprehensile manipulator through hybrid dynamic modelling.
- Main responsibilities:
  - Modelization of a planar robotic manipulator and dynamic contact modes with an object.
  - Development of control strategies for nonprehensile manipulation.
  - Simulation of hybrid sample-based trajectory planning algorithms.
- PI: Prof. Kevin M. Lynch - Lab: NxR - Neuroscience and Robotics Laboratory

Education

Ph.D. in Robotics Engineering **Jan 2014 - Mar 2017**

Université Pierre et Marie Curie *Paris, France*

- Thesis: *Characterizing the reciprocal adaptation in physical Human-Robot Interaction to address the inter-joint coordination in neurorehabilitation*
- Supervisors: A. Roby-Brami, N. Jarrassé

MS in Control Engineering **Nov 2010 - Oct 2013**

Sapienza University of Rome *Rome, Italy*

- Final score: 110/110 magna cum laude
- Thesis: *Hybrid Dynamic Nonprehensile Manipulation: Application to a 3-DOF Robot*
- Supervisors: G. Oriolo (Sapienza University of Rome), K. Lynch (Northwestern University)

BS in Automated Systems Engineering **Sep 2007 - Oct 2010**

Sapienza University of Rome *Rome, Italy*

- Final score: 107/110
- Thesis: *Modeling and Controlling Composability Property in Embedded Systems by applying Hybrid Automata Theory*
- Supervisors: F. Delli Priscoli, A. Fiaschetti

Publications

Google Scholar: 8 publications (+3 under review), 303 citations, H-index 5. Orcid: 0000-0002-8875-8646.

Journal Papers

7. **Proietti T.***, O'Neill C.*, Hohimer C., Nuckols K., Clarke M., Zhou Y.M., Lin D., Walsh C. (2021) Sensing and control of a multi-joint soft wearable robot for upper-limb assistance and rehabilitation, *IEEE Robotics and Automation Letters* (under review). *Authors equal contribution.
6. Zhou Y.M., Hohimer C., **Proietti T.**, O'Neill C., Walsh C. (2021) Kinematics-based control of an inflatable soft wearable robot for assisting the shoulder of industrial workers, *IEEE Robotics and Automation Letters* (under review).
5. Chu X., Lo C.H., **Proietti T.**, Walsh C., Fukuda T., Au S. (2021) Opposite treatment on null space: avoiding null space towards unified and robust feedback stabilization control of underactuated robotic systems, *International Journal of Robotics Research* (under review).
4. O'Neill C.*, **Proietti T.***, Nuckols K., Clarke M., Hohimer C., Cloutier A., Lin D., Walsh C. (2020) Inflatable soft wearable robot for reducing therapist fatigue during upper extremity rehabilitation in severe stroke, *IEEE Robotics and Automation Letters*, vol. 5:3, pp. 3899 - 3906. *Authors equal contribution.
3. **Proietti T.**, Guigon E., Roby-Brami A., and Jarrassé N. (2017) Modifying upper-limb inter-joint coordination in healthy subjects by training with a robotic exoskeleton, *Journal of NeuroEngineering and Rehabilitation*, vol. 14. pp. 55.
2. **Proietti T.**, Crocher V., Roby-Brami A., and Jarrassé N. (2016) Upper-limb robotic exoskeletons for neurorehabilitation: a review on control strategies, *IEEE Reviews in Biomedical Engineering*, vol. 9, pp. 4-14.

1. Jarrassé N., **Proietti T.**, Crocher V., Robertson J., Sahbani A., Morel G. and Roby-Brami A. (2014) Robotic exoskeletons: a perspective for the rehabilitation of arm coordination in stroke patients, *Frontiers in Human Neuroscience*, vol. 8:947, pp. 1-10.

Conference Papers

4. **Proietti T.**, Parry R., Lejeune F., Roby-Brami A., and Jarrassé N. (2018) Adaptation of upper limb movement using exoskeleton-based training and transfer of cinematic patterns to unconstrained movement: A preliminary study, *Annals of Physical and Rehabilitation Medicine*, vol. 61, pp 488, 12th World Congress of the International Society of Physical and Rehabilitation Medicine (Paris, France).
3. **Proietti T.**, Roby-Brami A., and Jarrassé N. (2017) Comparison of different error signals driving the adaptation in assist-as-needed controllers for neurorehabilitation with an upper-limb robotic exoskeleton, *IEEE International Conference on Robotics and Automation* (ICRA17, Singapore), pp. 6645-6650.
2. **Proietti T.**, Roby-Brami A., Jarrassé N. (2016) Learning motor coordination under resistive viscous force fields at the joint level with an upper-limb robotic exoskeleton, *3rd International Conference on NeuroRehabilitation* (ICNR16, Segovia, Spain), in Converging Clinical and Engineering Research on Neurorehabilitation II, pp. 1175-1179, Springer International Publishing.
1. **Proietti T.**, Jarrassé N., Roby-Brami A., and Morel G. (2015) Adaptive control of a robotic exoskeleton for neurorehabilitation, *7th International IEEE/EMBS Conference on Neural Engineering* (NER15, Montpellier, France), pp. 803-806.

Teaching & Mentoring

Guest Lecturer *Harvard University* **2020**

Course: Physiological Foundations for Bioengineering (BS in Biomedical Engineering)

Undergraduate Students Mentoring *Harvard University* **2019 - 2020**

Course: Robotics Projects (BS in Mechanical Engineering)
Responsibilities: Helped in developing research projects, supervised and assisted graduate students during their summer/winter projects in the lab. Projects: (1) a wearable air-bag to protect cyclists from non-fatal injuries, (2) stroke individuals clinical assessment (FMA) by using IMUs and machine learning.
Number of mentored students: 2.

Teaching Assistant *Polytech Sorbonne* **2015**

Course: Mobile Robotics (MS in Robotics Engineering)
Responsibilities: Prepared, supervised, and assisted 15-ish graduate students in weekly 6-hour lab course. Assistance to final project evaluation. The course was provided in French. Main topics: autonomous navigation, trajectory planning, ROS programming, validation on Pioneer P3-DX robots.

Honors & Awards

IEEE Engineering in Medicine and Biology Prize Paper Award - 3rd place with [J2] paper. **2019**

Personal Skills

Languages

Italian: Mother Tongue | **English**: Fluent - C2 | **French**: Proficient - B2/C1

</> Computer skills

Programming: Matlab/Simulink, C, C++, Python, Java, HTML, CSS, PHP, MySQL
Software: Solidworks, ROS, INCA, Git, LaTeX
OSs: Linux, Windows

Certifications

2019 - General Motors Design For Six-Sigma - Green Belt
2014 - “European Computational Motor Control” Summer School - Université de Montpellier 1