Gennaro Raiola

Curriculum Vitae

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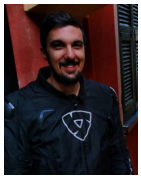

Fields of interest

Robotics, Programming, Controls, Navigation, Machine Learning, Embedded, DevOps, ROS1/2, Unix, Agile, UxVs, ADAS.

Profession

04/2021– current

Senior roboticist in control and navigation, *Leonardo S.p.A.*, Genoa, Italy.

At Leonardo, I work in the joint robotic laboratory with the Italian Institute of Technology (IIT) on the development of software algorithms for the control and autonomous navigation of unmanned ground and aerial vehicles (UxVs).

- Technical work:
  - Developing controllers, navigation state estimation, and detection algorithms for mobile robots.
  - Researching locomotion algorithms for quadruped robots based on whole-body and model predictive control techniques.
  - Developing communication and control frameworks based on the DDS protocol for multi-agent teaming and coordination.
  - Creating virtual environments with Docker to facilitate the deployment of control, navigation and AI software on the robots.
  - DevOps tasks such as setting up the git repository, internal Docker registry, CI/CD pipelines, etc.
  - Setting up the robot software, pilot stations, and network capabilities with LTE and 5G technologies.
- Management work:
  - Supervising the research activities of junior research fellows.
  - Working on European project proposals.
  - Preparing and organizing demos for Leonardo stakeholders, including the Italian Army and various divisions within Leonardo.
  - Defining the activities and the necessary hardware and software to develop and build robotic platforms for navigation and exploration of unstructured environments.

09/2019–9/2020 **Postdoctoral researcher**, *Jet Propulsion Laboratory (NASA-JPL)*, Pasadena, CA, United States.

At JPL I worked on demonstration of autonomous berthing, assembly and installation of scientific payloads using a robotic platform mounted on a testbed simulating a scientific space station.

- Autonomous berthing:
  - created a state estimator to track the full pose and velocity of an incoming payload using Kalman filtering via a fiducial detector,
  - developed a new software module for the testbed to generate coordinated motions of the robotic arm in order to intercept and dock the incoming payload by means of inverse kinematics and force control,
  - performed experiments in preparation for the paper *Validating an Architecture for Robotic Assembly and Servicing of Hosted Payloads on a Persistent Platform*,
  - gained experience with the JPL testbed software architecture and the m3tk simulation software,
  - integrated some of the functionalities of the testbed with the robotic operating system (ROS).
- Autonomous assembly:
  - developed code to perform assembly of instruments using fiducial movements for localization and positioning of the instrument and force control for interaction,
  - performed two demos in which the robot is able to autonomously assemble a starshade and a satellite dish,
  - created new modules and autonomous behaviors for the testbed.

06/2017–06/2019 **Postdoctoral researcher**, *Istituto Italiano di Tecnologia (IIT)*, Genoa, Italy.

During my work at IIT, I had the opportunity to work on several aspects of the development and maintenance of software and electronics for the quadruped robots HyQ and HyQReal.

- Developed a real-time control framework and communication system with EtherCAT,
- developed the software control architecture with ROS-Control, in order to make the robot capable of executing different types of gaits (e.g. crawl, trot, etc.) in complex and changing terrains,
- developed the low level safety software layer to protect the robot hardware and human operators.
- DevOps processes, including:
  - creating and maintaining fully automated CI/CD pipelines for code testing and deployment using GitLab-CI,
  - deploying apt servers to track the software dependencies,
  - developing Docker containers for code testing and development.
- Sensor integration and calibration for the HyQReal robot.
- Research work to create a novel whole-body locomotion framework for quadrupedal robots using inverse dynamics and task optimization which led to the publication of the journal paper *A simple yet effective whole-body locomotion framework for quadruped robots*.
- Collaboration with external work groups such as Moog and Vodafone to define the requirements and functionalities of the robots for various real-world scenarios.

03/2017–06/2017 **Postdoctoral researcher**, *Robotics and Mechatronics group, University of Twente*, Enschede, The Netherlands.

At the University of Twente, I worked on the development of a safety- and energy-aware impedance controller for the KUKA LWR 4+ robotic arm.

- publication of the journal paper *Development of a Safety and Energy Aware Impedance Controller for Collaborative Robots* on IEEE Robotics and Automation Letters which was selected for presentation at ICRA 2018.

01/2016-12/2016 **Software engineer**, *CEA-List (French Alternative Energies and Atomic Energy Commission - Laboratory for Integration of Systems and Technology)*, Gif-sur-Yvette, France.

During the last year of my PhD, I had the opportunity to transfer my research results to a startup at CEA-List (ISybot).

- development of a force controller to generate virtual guides through kinesthetic teaching to be used within the software framework of the startup's collaborative robot.

01/2013–12/2013 **Research engineer**, *PAL Robotics S.L.*, Barcelona, Spain.

At PAL Robotics, I worked on a team to design and test the ROS-Control package. The aim of ROS-Control is to implement a Hardware Abstraction Layer for different kinds of robots (e.g. humanoids, manipulators, mobile robots, etc.).

- implemented via ROS-Control an inverse kinematics controller with task optimization for REEM-H and REEM-C robots in collaboration with LAAS-CNRS in France.

06/2012–12/2012 **Intern**, *ENSTA-ParisTech and UPMC-ISIR*, Paris, France.

I developed a library in Matlab and C++ to generate motion primitives and perform skill optimization for humanoid robots (MEKA, NAO, ICub and Pepper). This library has been successfully used with the SoftBank robot Pepper to learn and play the "ball in the cup" dexterous game.

Education

2014–2016 **Ph.D. in Robotics**, *École polytechnique*, Palaiseau, France.

2009–2012 **Master's Degree (M.Sc) cum laude in Automation and Control Engineering**, *University of Naples "Federico II"*, Naples, Italy.

2006–2009 **Bachelor's Degree (B.Sc) in Computer Engineering**, *University of Naples "Federico II"*, Naples, Italy.

Technical skills

- Proficient in the following programming languages: **C/C++**, **Python** and **Matlab**
- Competent with **Bash** scripting.
- Competent with **Qt**, **Eigen** and **ROS** and **ROS2**
- Excellent knowledge of **GIT**.
- Excellent knowledge of **CMake** and **Makefile** for managing the build process of software and Doxygen for code documentation.
- Competent with **Docker** and **Virtual Machines** deployment for testing and development.

- Deep knowledge of **Linux**-based operating systems (Ubuntu, Kali, Debian).
- Experienced with real time operating systems **RTOS** (RTAI, Xenomai, RT-PREEMPT), Kernel configuration and **EtherCAT**.

Selected projects

- "**WoLF** - Whole-body Locomotion Framework for quadruped robots"
- "**ros-controls** - A ROS based hardware interface to make controllers generic to all robots"
- "**DmpBbo** - C++ framework for Dynamic Motion Primitives and Black-Box Optimization"

Publications

I have an extensive record of publications in various conferences and journals. For a comprehensive list of my publications, please visit my Google Scholar profile by following this link.

Certifications

Management	Google ProjectManagement Specialization
Management	Fundamentals of Project Planning and Management
AI & ML	Stanford Machine Learning Course
ADAS	University of Toronto Self-Driving Cars Specialization

Languages

italian	native proficiency
english	professional working proficiency
french	limited working proficiency