LUIGI BERDUCCI

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Research Engineer in Robotics

I am a highly motivated research scientist with expertise in robot learning and safe autonomy, eager to drive innovation and achieve excellence with a collaborative spirit to with brilliant minds.

EMPLOYMENT

Robot Learning Team • Swiss-Mile Robotics • Robotics Intern *(07/2024) - (10/2024)*

- Robust locomotion for wheeled-legged robots (Unitree B2) for various industrial use cases.
- Refined policies and transferability of trained policies into the real world.
- Skills: *IsaacSim, Pytorch, IsaacLab, ROS2, Unitree B2, Sim-to-real transfer*

xLab (GRASP) • University of Pennsylvania • Visiting Associate *(02/2023) - (05/2023)*

- Reinforcement learning for adaptive safety and long-term performance in multi-agent systems.
- Designed an adaptive CBF safety filter, cutting collisions with unknown opponents to <20%.
- Supported development and maintenance of the F1Tenth racecar simulator and planning stack.
- Skills: *Python, Pytorch, clean-rl, OpenAI-Gym, CasADI, CVXPY, Vehicle-dynamics Simulation*

F1Tenth Autonomous Racing Team • TU Wien • Team Member *(09/2021) - (06/2024)*

- Developed planning/control algorithms with ROS, Python, C++ for LiDAR-based F1Tenth navigation.
- Implemented RL, RRT, Frenet planners for real-world racing on embedded devices (NVIDIA Jetson).
- Coordinate work-group activities in 2024 for System Identification and Raceline Optimization.
- Skills: *C++, ROS2, Python, SB3, PyTorch, Torch-Script, Linux, Git, Docker, Sim-to-real transfer*

CPS Group • TU Wien • University Assistant *(10/2020) - (12/2024)*

- Published works on safe reinforcement learning in top-tier robotics conference (ICRA, A* CORE23).
- Developed a learner-verifier framework for provably safe model-based RL with adaptive CBF.
- Developed a multi-agent environment for racing with Bullet physics simulation (`racecar_gym`).
- Supervised theses and projects on reinforcement learning, deep learning, and computer vision.
- Skills: *Python, PyTorch, TensorFlow, SB3, MBRL-Lib, CasADI, PyBullet, CARLA simulation*

LEGEND-200 Experiment • INFN RomaTre • Machine Learning Engineer *(01/2020) - (09/2020)*

- Created a dataset of cosmic events and ambiental noise for the LEGEND-200 experiment.
- Extended the optical maps to simulate realistic detections of events with SiPM sensors.
- Developed a two-stages machine learning classifier to efficiently reject 95% of background noise.
- Skills: *Python, Pandas, Scikit-learn, GEANT4 simulation*

EDUCATION

TU Wien, Vienna • PhD Student *(10/2020) - (12/2024)*

Safe Learning Algorithms for Intelligent Robotics Systems

University of Rome La Sapienza, Rome • BSc and MSc in Computer Science *(01/2014) - (05/2020)*

Full marks with honours (MSc Avg Grade: 30.3/31.0, BSc Avg Grade: 27.7/31.0)

SKILLS

Programming Languages - **Python**, C++, **ROS**
Machine Learning - **PyTorch**, TensorFlow, Scikit-learn
RL Tools - **SB3**, OpenAI-Gym, clean-rl, MBRL-Lib, IsaacLab
Optimization - **CasADI**, CVXPY, Gurobi
Simulators - PyBullet, **IsaacSim**
Misc - **Docker**, Version Control, **Git**

RESEARCH PUBLICATIONS

Conference Proceedings

- Berducci, L., Yang, S., Mangharam, R. & Grosu, R. (2023). **Learning adaptive safety for multi-agent systems.** *IEEE International Conference on Robotics and Automation (**ICRA**).*
- Berducci, L. & Grosu, R. (2022). Safe policy improvement in constrained markov decision processes. *International Symposium on Leveraging Applications of Formal Methods* (**ISoLA**).
- Brunnbauer*, A., Berducci*, L., Brandstätter*, A., Lechner, M., Hasani, R., Rus, D. & Grosu, R. (2022). **Latent imagination facilitates zero-shot transfer in autonomous racing.** *IEEE International Conference on Robotics and Automation (**ICRA**).*

Workshops & Preprints

- Berducci, L., Yang, S., Giacobbe, M., Mangharam, R., G. Pappas, & Grosu, R. (2024). Neural-abstract control barrier certificates for provably safe and robust reinforcement learning. *Under Review.*
- Berducci, L., Yang, S., Giacobbe, M., Mangharam, R. & Grosu, R. (2024). FoSRL: A tool for formally-guaranteed safe reinforcement learning. *Workshop on Software Challenges in Formal Methods for Robotics (**ICRA**).*
- Berducci, L., Yang, S., Giacobbe, M., Mangharam, R. & Grosu, R. (2024). Safe learning under assumptions in human-robot systems, *Workshop on Design, Shared Control, and Robot Learning for Physical Human-Robot Interaction (**ICRA**).*
- Scheuchenstuhl, D., Ulmer, S., Resch, F., Berducci, L. & Grosu, R. (2023). Enhancing robot learning through learned human-attention feature maps. *Workshop on effective Representations, Abstractions, and Priors for Robot Learning (**ICRA**).*
- Berducci, L., Aguilar, E. A., Nickovic, D. & Grosu, R. Hierarchical potential-based reward shaping from task specifications. *Under review.*

COMPETITIONS

9th, 10th, 11th F1TENTH Autonomous Grand Prix *(2021-2023)*

Team-based competition to deploy reliable autonomous racing solutions on F1Tenth miniature vehicles. This experience helped me develop a collaborative spirit (*8-people team*) and gain hands-on experience in robotic programming. The team *Scuderia Segfault won* the 1st prize in 2021, 3rd in 2022, and 2nd in 2023.

SCOLARSHIPS & GRANTS

Marshall Plan Scholarship (EUR 6 500) *(12/2022)*

Academic exchange program between Austria and the U.S. that offers scholarships for students from applied sciences and technical universities to conduct research abroad in the field of technical sciences.

TU Wien 30 Under 30 *(07/2022)*

Campaign to present 30 people under 30 years of age who have proved their potential in various areas and have distinguished themselves through extraordinary achievements in scientific research.

GARR Scholarship Orio Carlini (EUR 19 000) *(01/2020)*

Prestigious grant sponsored by Consortium GARR Association for innovation in the field of information technology, which recognizes excellence and supports achievements in research and development.

LANGUAGES

Italian - Native.
English - Level C1 (IELTS 7.0 in 2019), enforced by living/working in foreign countries since 2019.
German - Studying German (Level B1) and living in a German-speaking country.

References from academic and industrial partners are available upon request.