LUIGI BERDUCCI

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I am a highly motivated Computer Scientist with a passion for robot learning and safe autonomy.
Eager to drive innovation and achieve excellence with a collaborative spirit to work with brilliant minds.

EMPLOYMENT

Learning Team, Swiss-Mile Robotics • Robotics Intern *(07/2024) - Present*

- Student-teacher RL for locomotion in industrial use cases with wheeled-legged robot (Unitree M1).
- Robust sim-to-real transfer of trained policy through domain randomization models.
- Skills: *IsaacSim, pytorch, IsaacLab, ROS2, M1 Unitree, sim-to-real transfer*

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

- Reinforcement Learning to adapt safety levels for long-term performance in multi-agent systems.
- Designed a safety filter (CBF) for collision avoidance of autonomous vehicles in competitive racing.
- Supported lab activities in the development and maintenance of the F1Tenth racecar simulator.
- Skills: *python, pytorch, clean-rl, openai-gym, casadi, cvxpy, vehicle-dynamics simulation*

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

- Worked with ROS, Python, and C++ code for planning and control algorithms for robot navigation.
- Experience in software development on embedded devices (NVIDIA Jetson) for F1Tenth vehicles.
- Implemented RL-based, RRT, and Frenet planners for real-world autonomous racing.
- Adopted domain randomization for transferring policies from simulation to the real world.
- Skills: *C++, ROS2, python, sb3, pytorch, torch-script, linux, git, docker, sim-to-real transfer*

CPS Group, TU Wien • University Assistant *(10/2020) - Present*

- Research project on safe reinforcement learning for autonomous robotics systems.
- Developed a learner-verifier RL framework to formally guarantee safety 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*

INFN Roma Tre, Rome • Machine Learning Engineer, LEGEND-200 *(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-stage machine learning classifier able to reject 95% of background noise.
- Skills: *python, pandas, scikit-learn, geant4 simulation*

EDUCATION

TU Wien, Vienna • PhD Student *(10/2020) - Present*
Safe Learning Algorithms for Intelligent Robotics Systems

University of Rome La Sapienza, Rome • BSc and MSc in Computer Science *(01/2018) - (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, isaac-lab
Optimization - **casadi**, cvxpy, gurobi
Simulators - isaac-sim, pybullet
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. & 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., Ničković, D. & Grosu, R. (2022). Hierarchical potential-based reward shaping from task specifications. Under review.

COMPETITIONS

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

Team-based competition to deploy autonomous racing algorithms on F1Tenth miniature racecars. This experience helped me develop a collaborative spirit (*team 6-8 people*) 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.