

## Learning adaptive reusable skills for intelligent autonomous agents

### Postdoc & Ph.D. student position @ TU Darmstadt

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The TriFORCE project, funded by the German Federal Ministry of Education and Research (BMBF) and led by Dr. Carlo D'Eramo, at the Technical University of Darmstadt (TU Darmstadt), is seeking 1 Postdoc and 2 Ph.D. students with a strong interest in one or more of the following research topics:

- Reinforcement Learning for decision-making;
- Lightweight methods for efficient deep Reinforcement Learning;
- Multi-task and transfer Reinforcement Learning for adaptive agents;
- Multi-agent Reinforcement Learning in collaborative and competitive scenarios.

The Ph.D. student will work on the highly interdisciplinary topic of Reinforcement Learning (RL), which burst since the recent coupling with deep learning methods (deep RL) and is becoming pervasive in a wide range of research fields. Despite the recent extraordinary success, (deep) RL has crucial open problems of sample-efficiency and generalization that are hindering its applicability to realistic problems.

Our research will revolve around the problem of *how agents can efficiently acquire expert skills that account for the complexity of the real world*. We will investigate novel methods spanning several RL subfields. We will study multi-task and transfer learning for endowing agents with the ability to adapt across multiple tasks, and effectively react to previously unseen situations. Moreover, we will consider hierarchical and curriculum learning to enhance the autonomy of learning agents and curb the need for human expert supervision. Additionally, we will extend our analysis to multi-agent problems to obtain autonomous and adaptive group dynamics in collaborative and competitive scenarios. Our research will shed light on the unexplored fundamental connections among the mentioned subfields and show that a concerted use of our methodological advances is of pivotal importance to fostering the applicability of RL in realistic problems.

#### **ABOUT THE APPLICANT**

The Postdoc applicant needs to have a Ph.D. in a relevant field (e.g., Computer Science/Engineering, Machine Learning, Robotics, Math, and Statistics), a remarkable list of publications, and proven supervision skills. Significant experience in Robotics and working with *Python* and/or *C/C++*, and Robotics (e.g., ROS, Gazebo) and Machine Learning libraries (e.g., *Pytorch/Tensorflow*) is required. Experience with application on learning locomotion skills is a big plus.

Ph.D. applicants need to have an M.Sc. degree (high grade required) in a relevant field (e.g., Computer Science/Engineering, Machine Learning, Math, and Statistics). Significant experience in working with *Python* and/or *C/C++*, and Machine Learning libraries (e.g., *Pytorch/Tensorflow*) is required. A track record of peer-reviewed publications and experience in writing scientific papers is a big plus, together with a strong interest or past experience in working with an interdisciplinary team. Experience in applications of RL methods in robotics is desirable.

## THE POSITION

The 1 postdoc position is for a **36-month** contract. Payment will be according to the German TVL payment scheme, at the **E14 (100%)** level.

The 2 Ph.D. positions are for a **36-month** contract. Payment will be according to the German TVL payment scheme, at the **E13 (100%)** level.

## HOW TO APPLY?

All complete applications submitted through our online application system found at <https://www.ias.informatik.tu-darmstadt.de/Jobs/Application> will be considered.

The position is planned to start on **01/09/2022**. The applicants should provide a research statement, a PDF with their CV, degrees, grade sheets, and two references who are willing to write a recommendation letter. Please state clearly how your past experience relates to the topics in your research statement. Note that we heavily favor candidates with hands-on experience in implementing RL experiments and writing scientific papers or reports. Please ensure to include your date of availability for starting the position and, after submitting the application, send a quick notification with the subject line "Postdoc/Ph.D. student applicant for TriFORCE" to Dr. Carlo D'Eramo ([carlo.deramo@tu-darmstadt.de](mailto:carlo.deramo@tu-darmstadt.de)) and include your application number in the e-mail.

## ABOUT TriFORCE and TU Darmstadt

**TriFORCE** is a newly funded research project from the German Federal Ministry of Education and Research (BMBF) for researching Reinforcement Learning (RL) methods for obtaining autonomous adaptive agents, led by [Dr. Carlo D'Eramo](#). To conduct the research of TriFORCE, we will create the TriFORCE junior research group at TU Darmstadt. Moreover, TriFORCE will rely on the essential collaboration with the Robot Learning of Mobile Manipulation for Intelligent Assistance (iROSA) group and the spin-off Freemotion Systems at TU Darmstadt, and on the advice of an advisory board with world-renowned researchers in RL and robotics: **Marco Hutter (ETH)**, **Jean-Baptiste Mouret (INRIA)**, **Auke Jan Ijspeert (EPFL)**, and **Tuomas Haarnoja (DeepMind)**.

The TriFORCE group will have access to the work environment and the computational resources of TU Darmstadt, including the powerful [Lichtenberg cluster](#). [TU Darmstadt](#) is one of Germany's top technical universities and is well known for its research and teaching. It was one of the first universities in the world to introduce electrical engineering programs, and it is Germany's first fully autonomous university.

## ABOUT the PI: Dr. Carlo D'Eramo

Besides obtaining this BMBF funding for TriFORCE, [Dr. Carlo D'Eramo](#) has been recently promoted to independent junior research group leader in the DEPTH program within 3AI, and, before this, he has been a postdoctoral researcher at the Intelligent Autonomous Systems group (IAS) in the Department of Computer Science at TU Darmstadt. During the years, he gained extensive experience in RL and provided key methodological advances in several related topics; moreover, he made important and well-recognized contributions to AI uncertainty quantification and exploitation, multi-task and curriculum RL, skill decomposition, residual learning, and planning. He is the developer of [MushroomRL](#), a widely accepted RL

library for simplifying the implementation of RL experiments. The work of Carlo D'Eramo has been broadly published in top ML and Robotics conferences, e.g., ICML, NeurIPS, AAI, ICLR, ICRA, RSS, and journals, e.g., JMLR, Frontiers in Robotics and AI ([Google Scholar](#)).

### **ABOUT DARMSTADT**

Darmstadt is a well-known high-tech center with essential activities in spacecraft operations (e.g., through the European Space Operations Centre, the European Organization for the Exploitation of Meteorological Satellites), chemistry, pharmacy, information technology, biotechnology, telecommunications, and mechatronics, and consistently ranked among the Top high-tech regions in Germany. Darmstadt's important centers for arts, music and theater allow for versatile cultural activities, while the proximity of the Odenwald forest and the Rhine valley allows for many outdoor sports. The 33,547 students of Darmstadt's three universities constitute a significant part of Darmstadt's 140,000 inhabitants. Darmstadt is located close to the center of Europe. With just 17 minutes driving distance to the Frankfurt airport (closer than Frankfurt itself), it is one of Europe's best-connected cities. Most major European cities can be reached within less than 2.5 hours from Darmstadt.