

# Antonio Pio Ricciardi

COMPUTER SCIENCE PHD STUDENT

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## Education

PhD student in Computer Science at Sapienza, University of Rome. My research focus is on generalization and improving sample efficiency in reinforcement learning.

### PhD Student

SAPIENZA UNIVERSITY OF ROME - DEPARTMENT OF COMPUTER SCIENCE

### Master Degree in Computer Science (English) (110 with honours and GPA: 3.92)

SAPIENZA UNIVERSITY OF ROME

2017 - 2020

### Bachelor in Computer Science (98/110)

SAPIENZA UNIVERSITY OF ROME

2013 - 2017

## Skills

**Research Interests** Reinforcement Learning, Deep Learning

**Competences** Python, PyTorch, OpenAI Gym, StableBaselines, Unity, Java, MATLAB, C#, Git,  $\LaTeX$

**Languages** Italian (Native), English (C1 - According to TOEFL iBT), French (beginner)

## PhD Research

### Current PhD Research

USING RELATIVE REPRESENTATION FOR ROBUST RL AGENTS IN ENVIRONMENTS WITH CHANGING CHANGING BACKGROUNDS

2023

Using relative representations in visual RL, we train agents whose encoders produce very similar representations on slight variations of the same environment. For example, in a top-down racing game, different encoders trained using relative representations and on different background colours would produce the same representations. A single policy trained can then be used with each of these encoders, in a zero-shot fashion.

LEARNING ENTITIES DYNAMICS FROM PIXELS IN VISUALLY COMPLEX REINFORCEMENT LEARNING ENVIRONMENTS

2023

Developing neural models to learn the dynamics in a model-free setting, directly from pixels in visually complex environments (like the Atari games in the OpenAI Gym suite), and use these dynamics as additional information for reinforcement learning agents, allowing faster training and generalisation to varying dynamics. Work in progress.

SHAPE MODELING WITH REINFORCEMENT LEARNING

2022

Implementation of a reinforcement learning agent to create a digital sculptor that models 2D and 3D shapes by moving vertices in the 2D/3D space. Given a starting mesh, the objective is to model it by moving its vertices to the position of a given target mesh.

## Work

### Teaching Assistant - Introduction to Algorithms

SAPIENZA, UNIVERSITY OF ROME

February - June 2022

Bachelor of computer science course. Teaching assistant and member of the Exam Committee

### Data Scientist - Part time

DSTECH

November 2020 - February 2021

Data Scientist and researcher working on Horizon Europe projects: AI empowered and explainable personalized medicine system for cancer treatment; Reinforcement Learning agents to help the transition to Nearly-Zero or Net-Plus energy buildings.

### Python Developer - Stage

SAYDIGITAL

June 2020

Python developer for the Odoo platform.

## Other experiences

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### Artificial Intelligence and Games - 4th International Summer School

GAME JAM

September 2022

Participation in the game jam as a team of 5. We developed a game where a reinforcement learning agent had to survive in a grid-based environment, defeating enemies and collecting apples. A human player could decide whether to aid or obstruct the agent by building or removing walls so that enemies could/could not easily surround the agent.

### Conference - The Ethics and Law of AI

CHAMBER OF DEPUTIES - ROME

21-22 November 2019

Chosen to be part of a delegation of 20 best students to represent La Sapienza at the Conference, held by Fondazione Leonardo to discuss about the technical, ethical and legal matters concerning Artificial Intelligence.

### Volunteer

ACM WOMEN ENCOURAGE

16-18 September 2019

Volunteered to help organize the various activities held during the three-days conference.

## Projects

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### Personal and University projects

MODERN REINFORCEMENT LEARNING: DEEP Q LEARNING AND ACTOR-CRITIC METHODS

2021

Personal project (linked to Udemy Course, by Dr. Phil Tabor). Implemented Deep Reinforcement Learning Research papers into agents that beat classic Atari games, or agents that can perform model-based control in a physics engine (MuJoCo and PyBullet), such as robot arms, 2D and 3D walker, ant, cheetah.

UNCOMPRESSED INFERENCE FOR INTERPRETABLE TEXT CLASSIFICATION

2020

Master Degree Thesis. This work has two contributions: the introduction of a novel method, called uncompressed inference, which allows to perform interpretable predictions for neural networks; the use of uncompressed inference and sparse word embeddings to perform text classification and rank words by their importance.

SELF DRIVING CAR IN UNITY

2019

Computer Vision project. This project is realized with Unity, a 3D development platform. The objective was to teach a car to stay on a track, by steering in a 3D simulated world. Cameras are placed on top of the car and captured images are analysed by a Convolutional Neural Network. A classifier predicts the steering angle accordingly to the features coming from the CNN. This is a Supervised Task.

REINFORCEMENT LEARNING CAR IN UNITY

2019

Machine Learning project. This project is realized within the Unity 3D game development platform. In a wall-bounded track and by only using distance sensors, a car learns to drive in a wall-bounded track without crashing. Reinforcement Learning is used, with positive rewards at every timestep, negative rewards if it crashes.

NATURAL LANGUAGE PROCESSING - HOMEWORKS

2018

The completion of three homeworks - *generating Word Embeddings*, *Word Sense Disambiguation* and *Semantic Role Labeling* - was required to pass this course.

NATURAL INPUT INTERFACES FOR A MULTIMODAL DESKTOP ENVIRONMENT

2019

Project for the Multimodal Interaction Course. Provide an alternative way to control a desktop environment, by using a camera-based gaze-controlled pointer and voice commands for other interactions (such as *Open*, *Close*, navigating through pages ...), thanks to the Speech-to-Text Google API.

## Relevant Courses

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### Post-university courses:

CURIOSITY DRIVEN DEEP REINFORCEMENT LEARNING - UDEMY, BY DR. PHIL TABOR

2021

Study and implementation of important Deep Reinforcement Learning Research papers: How Agents Can Learn In Environments With No Rewards.

FUNDAMENTALS OF REINFORCEMENT LEARNING - COURSERA, BY UNIVERSITY OF ALBERTA

2021

Key concepts of Reinforcement Learning, underlying classic and modern algorithms in RL: Markov Decision processes, exploration/exploitation tradeoff, value and action-value functions, designing dynamic programming algorithms

MODERN REINFORCEMENT LEARNING: ACTOR-CRITIC METHODS - UDEMY, BY DR. PHIL TABOR

2021

Study and implementation of the latest Deep Reinforcement Learning algorithms and breakthrough Research papers: MonteCarlo, Deep Policy Gradient, Actor-Critic methods and their variants to teach agents to perform model-based control in a physics engine (MuJoCo).

MODERN REINFORCEMENT LEARNING: DEEP Q LEARNING METHODS - UDEMY, BY DR. PHIL TABOR

2020

Study and implementation of Deep Reinforcement Learning algorithms and breakthrough Research papers: DQN, DDQN, DuelingDDQN.