Samuel **Garcin**

Research and Industry Experience

University of Edinburgh
Edinburgh, United Kingdom

PHD CANDIDATE - GENERALISATION IN DEEP REINFORCEMENT LEARNING
Sep. 2021 - Jun. 2025

To improve the generalisation capabilities of agents training over a task distribution, I am investigating methods to represent this distribution within a structured latent manifold, and how to leverage this representation for synthetic task generation.

Additional Key Words: Unsupervised Environment Design, Generative Modelling, Representation Learning, Adversarial Training

- Member of the Autonomous Agents research group and co-advised by Dr Stefano Albrecht and Dr Christopher G. Lucas
- Tuition, stipend and travel costs fully covered for 4 years by the EPSRC Centre for Doctoral Training in Robotics and Autonomous Systems Studentship.

TEACHING ASSISTANT
Sep. 2022 - Jun. 2023

- Teaching assistant for the Reinforcement Learning course, an advanced module taught to final year undergrad and masters students. Responsible for the Deep Reinforcement Learning part of the course, consisting of a series of lectures, labs and coursework amounting for 50% of the module's assessment.

RESEARCH ASSISTANT, AUTONOMOUS AGENTS RESEARCH GROUP
May 2021 - Sep. 2021

Open-source implementation of IGP2, an integrated goal prediction and planning system for autonomous driving originally developed at Five AI. See five.ai/igp2 and github.com/uoe-agents/IGP2.

Mila & McGill University
Montreal, Canada

VISITING RESEARCHER
Oct 2022 - Dec. 2022

Investigating how contrastive state representations based on behavioral metrics (such as the bisimulation metric) may improve the generalisation capabilities of actor critic algorithms. Advised by Prakash Panangaden (McGill RL lab, Mila) and Pablo S. Castro (Brain).

Wecorp Industries
London, UK

AUTONOMOUS CONTROL SYSTEMS LEAD
Mar. 2019 - Dec. 2020

Aerial robotics startup valued at £35M tasked with the development on an indoor/outdoor autonomous multirotor craft with 1-1.5kg payload for the British Armed Forces. Initial offering aimed to support and reduce risk for soldiers operating in urban areas.

- Responsible for the autonomy stack of the aircraft. Leading an R&D team of 5 senior software, control and robotics engineers.
- Led and directly contributed to the development of dynamics models and simulators for the craft's control, sensing and powerplant systems (Simulink, Gazebo) to inform design decisions on our autonomy stack and powerplant hardware requirements. These dynamics models were later integrated within digital twin supporting hardware emulation and hardware-in-the-loop simulation to validate and test nightly builds of our software stack.
- Led and directly contributed to the development of state estimation and sensor fusion algorithms, including visual and laser inertial odometry, Kalman filtering and state-machine driven sensor switchover during indoor to outdoor transitions or sensor failure.
- Implemented Agile and SCRUM methodologies to carry out project planning, coding reviews and progress tracking.

CONTROL SYSTEMS ENGINEER
Aug. 2018 - Mar. 2019

- Developed low latency, high accuracy "follow-me" capability for an indoor multi-rotor aircraft, using sensor fusion between the on-board camera and a 2D lidar. Solution was delivered to the customer and used in military exercises.
- Designed adaptive real-time C++ multirotor control and sensing algorithms which included setpoint tracking, robustness to air disturbances in confined areas and dynamic filtering of propeller-induced vibrations.
- Live prototype demonstrations with clients and stakeholders, technical presentations of aircraft's key capabilities.

Publications

Garcin, Doran, Guo, Lucas, Albrecht. "How the Level Sampling Process impacts Zero-Shot Generalisation in Deep Reinforcement Learning" *Currently under review*. 2023.

Ahmed, Brewitt, Carlucho, Christianos, Dunion, Fosong, **Garcin**, Guo, Gyevnar, McInroe, Papoudakis, Rahman, Schäfer, Tamborski, Vecchio, Wang and Albrecht. "Deep Reinforcement Learning for Multi-Agent Interaction" AI Communications. 2022.

C. Brewitt, B. Gyevnar, **S. Garcin**, S. Albrecht. "GRIT: Fast, Interpretable, and Verifiable Goal Recognition with Learned Decision Trees for Autonomous Driving" IROS. 2021.

Cappello, **Garcin**, Mao, Sassano, Paranjape, Mylvaganam. "A Hybrid Controller for Multi-Agent Collision Avoidance via a Differential Game Formulation" IEEE Transactions on Control Systems Technology. 2021.

Prior Education

Imperial College London
London, United Kingdom

MEng in aeronautical engineering - first class honours, final year dean's list award (top 10 %)
Oct. 2014 - Jun. 2018

MASTER THESIS: COLLISION AVOIDANCE IN GROUND VEHICLES USING GAME THEORY

Addressed a key limitation in the Differential Game multi-agent path planning framework that caused convergence to a local minima and agent deadlock. Implemented the framework on a real system for the first time by employing Model Predictive Control (MPC).

- Resulted in a journal publication in IEEE Transactions on Control Systems Technology presenting the thesis' key findings.
- Employed MPC to anticipate collisions or deadlock, and designed a meta-optimisation method to adapt hyperparameters online in order to systematically generate new collision- and deadlock-free trajectories.
- Conducted experiments on robotic hardware and demonstrated the method's ability to robustly avoid collisions, while also generating trajectories of higher complexity than other path planning algorithms.

UNMANNED AERIAL SYSTEM DESIGN COMPETITION

Pioneered Imperial College's debut in IMechE's Unmanned Aerial System challenge. 30 university teams compete each year to design a fully autonomous aircraft capable of surveying an area and drop packages at ground-marked locations.

- Project lead of a team of 21 voluntary students. My role consisted of translating the competition requirements into a technical roadmap for the team, conducting design reviews and securing funding, equipment and manufacturing space.
- The award-winning team now participates in the competition every year (progress report: https://bit.ly/3AX7xXi).
- I was awarded the Exceptional Achievement Award from the Aeronautics Department for building the project and team from scratch, and completing the journey from the white board sketches to the maiden flights.

STUDENT POSITIONS

President, Imperial College Aeronautical Society	*2016 - 2017*
Industrial Liaison Officer, Imperial College Aeronautical Society	*2015 - 2016*
Year Representative, Imperial College Aeronautics Department	*2014 - 2017*

Awards & Scholarships

2022	**Heidelberg Laureate Forum Young Researcher**, HLFF
2022	**Abbe Grant**, Carl-Zeiss-Stiftung Foundation
2021	**EPSRC Studentship**, Centre for Doctoral Training in Robotics and Autonomous Systems
2018	**Head of Department's Award for Exceptional Achievement**, Imperial College
2018	**Head of Department's Award for Overall Contribution**, Imperial College
2018	**Dean's list, Faculty of Engineering, Aeronautical Engineering**, Imperial College
2016 & 17	**Faculty of Engineering Dean's fund scholarship**, Imperial College
2017	**CGCA Old Centralians' Trust Student Activity Award**, Imperial College
2016	**Aeronautics Scholar for excellent performance in Year 1 & 2**, Imperial College
2016	**Wind turbine challenge, best overall design & team performance**, Imperial College
2015	**Structural design challenge, best overall design & team performance**, Imperial College

Skills & Hobbies

Programming Languages: Python, C++, MATLAB, Octave

Languages: French (native), English (fluent)

Hobbies: Sport climbing (Boulder and Rock), Swimming, Scuba diving