# Aurelio Noca

*U.S. Citizen / Swiss / French*

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## Education

**MS in Computational Science and Engineering**, *Swiss Federal Institute of Technology (EPFL)* | Switzerland        *2020 - 2024*
**BS in Physics**, *Swiss Federal Institute of Technology (EPFL)* | Switzerland        *2017 - 2020*
   3rd year exchange, *McGill University* | Canada

## Experience

**California Institute of Technology,** *Research Engineer @ Burdick Lab* | Pasadena        *July 2024 - Now*
- Played key role in development and integration of perception system for DARPA LINC program, which aims to develop methods to assist crane operators during ship-to-ship transfers of supplies
- Designed visual perception pipelines integrating object tracking, semantic segmentation, and 3D modeling for robust pose estimation of payloads and targets, enabling payload stabilization and planning

**Jet Propulsion Laboratory, NASA,** *Robotics & Computer Vision Master's Thesis* | Pasadena        *Sept 2023 - Mar 2024*
- Collaborated in the development of a semantic segmentation model for novel voxel mapping method, contributing to the paper Few-shot Semantic Learning for Robust Multi-Biome 3D Semantic Mapping in Off-Road Environments by Atha, Deegan et al.
- Developed a novel approach for pseudo-label generation using complementary decoder architectures for semantic segmentation of off-road environments. Implemented and deployed method on an off-road vehicle platform for the DARPA RACER program

**Swiss Federal Institute of Technology (EPFL),** *Academic Research Project @ NLP Lab* | Lausanne        *Jan 2023 - June 2023*
- Elaborated a novel method to construct a comprehensive (translation) Word Sense Disambiguation (WSD) dataset by leveraging sentence and word translation pairs, providing a robust foundation for further research in the field
- Demonstrated the efficacy of multi-task finetuned LLM encoders in generating task- and language-specific embeddings for the decoder. Additionally, highlighted the sufficiency of multilingual pretraining for WSD, underscoring its potential standalone effectiveness

**MathWorks,** *Software Engineer Intern, Engineering Development Group* | Natick        *Sept 2022 - Dec 2022*
- Built a graphical user interface in MATLAB for visualizing information from the HDL Coder product, which was deployed to production in MATLAB 2023a
- Led the development of a user-friendly command line and graphical interface for a code synthesis tool and actively engaged in discussions with client to discern interface requirements and ensure alignment with user needs and preferences

**Harvard University,** *Academic Research Project @ CSELab* | Cambridge        *Sept 2021 - Aug 2022*
- Applied Bayesian Optimal Experimental Design to address a fluid flow control problem in low-Reynolds conditions, strategically determining optimal locations for acquiring maximum information about the fluid flow
- Deployed advanced optimization techniques on high performance computing cluster (HPC), including CMA-ES and Deep Reinforcement Learning, to master the control of actuators. The primary objective was to generate a desired flow velocity profile, aiming to lay the foundation for deterministic control methods in the development of a new generation of wind tunnels

**McGill University,** *Academic Research Project @ CIM* | Montreal        *June 2020 - July 2020*
- Doubled dataset size via data augmentation of mobile rover modalities, including LiDAR, RGB images, and IMU, to improve the performance of a vehicle dynamics model
- Established a polynomial baseline for predicting rover velocity using IMU data and PyTorch, contributing to the work Multimodal dynamics modeling for off-road autonomous vehicles by Tremblay, J.-F. et al.

## Projects

**Obstacle Detection using Stereo Depth Camera**        *Feb 2023 - Sept 2023*
EPFL Xplore
- Spearheaded the design of a stereo depth-based obstacle detection method, optimizing it for GPU usage and significantly reducing CPU utilization by 30%. This strategic approach played an important role in guiding obstacle avoidance planning for a student rover competition, culminating in a 3rd place finish at the 2023 European Rover Challenge
- Integrated the developed obstacle detection method seamlessly into the ROS2 environment, facilitating the provision of crucial obstacle points to the traversability map for enhanced rover navigation and performance

**Control Station Software Engineer**        *Sept 2020 - Aug 2021*
EPFL Xplore
- Played a key role in the development and debugging of ROS and C++ software, catering to remote control and sensor data acquisition. Collaborated effectively with a cross-functional team of 50+ members to integrate communication software onto onboard hardware and interfaces. Additionally, contributed to the implementation of software governing the finite state machine of the rover.
- Secured a notable 3rd place in the European Rover Competition 2021 as a part of the Argos project, showcasing expertise in software development and system integration. Details of the accomplishment can be found at: `https://epfl-xplore.ch/argos-project/`

**Oscillator Physics Simulator**                                       *Feb 2018 - June 2018*

EPFL (Object-oriented programming in C++)

- Engineered a sophisticated physics simulation engine using C++, focusing on oscillators such as pendulums and springs. Implemented advanced numerical integration methods, such as Newmark and RK4, for accurate modeling. Introduced 3D visualization capabilities with OpenGL to enhance the simulation experience. Additionally, elevated user accessibility by integrating a user-friendly GUI using Qt. The code is available at `https://github.com/aenoca/OscilloSim`

## Skills

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| **Programming** | Python, C/C++, MATLAB, OpenMP, MPI, CUDA, ROS, ROS2 |
| **Software** | Linux, PyTorch, Docker, OpenCV, Git, LaTeX |

## Teaching

**EPFL**                                                                *Feb 2023 - June 2023*

Teaching Assistant

- Instructed Computational Physics II to a diverse cohort of over 100 students in a project-oriented course. Emphasized hands-on learning through projects, fostering a practical understanding of computational concepts. Additionally, provided guidance by supervising and grading the work of 10 students, ensuring individualized attention and support
- Conducted a comprehensive review section for an experimental physics course, guiding a group of 16 students. Facilitated a collaborative learning environment by addressing queries, clarifying concepts, and providing valuable insights

**Harvard University**                                                  *Sept 2021 - May 2022*

Teaching Fellow

- Spearheaded the introduction of linear programming concepts to over 70 students within a dynamic flipped classroom environment. Presented the AMPL programming language to facilitate practical understanding and collaborated with the professor to enhance course materials, ensuring a comprehensive learning experience
- Led a review section for a Python class, overseeing a group of 17 students. Designed and supervised three coding projects aimed at enhancing the programming abilities of the students. Through strategic guidance and project-based learning, contributed to the development of practical programming skills in the student cohort

## References

**Prof. Joel Burdick**, *Caltech*, jburdick@caltech.edu

**Deegan Atha**, *Jet Propulsion Laboratory, NASA*, deegan.j.atha@jpl.nasa.gov

**Prof. Antoine Bosselut**, *NLP Lab, EPFL*, antoine.bosselut@epfl.ch

**Prof. Petros Koumoutsakos**, *CSELab, Harvard University*, petros@seas.harvard.edu

## Languages

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| **English** | Native proficiency |
| **French** | Native proficiency |