Daniel Felipe **Ordoñez Apraez**

ELLIS Ph.D Student in Bioengineering and Robotics - M.Sc. Artificial Intelligence

Contact

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Google Scholar

Profile

Second year ELLIS Ph.D. student exploring the applications of group theory in robot modeling, control and design. My research strives to enhance robotic functionality through mathematically driven innovation. I have a specialized focus on the exploitation of structural/morphological symmetry groups in locomoting robotic and dynamical systems. Born in: 1995.

Interests

Geometric Deep Learning
Group theory
Control Theory
Differential Geometry
Dynamical System's theory

Languages

Spanish	Mother Tongue
English	C1 (TOEFL)
German	Intermediate - B2
Italian	Basic

Programming

Python
C++
Matlab
LaTeX

Software

Pinocchio
Drake
Crocoddyl
ROS
ESCNN
OMPL
Torch

References

Dr. Massimiliano Pontil
Italian Institute of Technology
Massimiliano.Pontil@iit.it

Dr. Mario Martin
Universitat Politècnica de Catalunya
mmartin@cs.upc.edu

Dr. Claudio Semini
Italian Institute of Technology
claudio.semini@iit.it

Education

Oct-2022/25 — Genova / Edinburgh
Italian Institute of Technology (IIT) – University of Genova
European Laboratory for Learning and Intelligent Systems (ELLIS)
Ph.D. in Bioengineering and Robotics
Project topic: Exploration of applications of group theory in analytical and data-driven modeling, control, and design of robotic systems
Supervisors: Dr. Massimiliano Pontil (CSML), Dr. Claudio Semini (DLS), and Dr. Carlos Mastalli (RoMi).

2019–2021 — Barcelona, Spain
Universitat Politècnica de Catalunya – Barclona Tech
M.Sc. in Artificial Intelligence
Thesis: Learning to run naturally: guiding policies with the Spring-Loaded Inverted Pendulum
Part time researcher at the institute of Industrial Robotics and Informatics (IRI)

2013–2018 — Bogota, Colombia
Universidad Nacional de Colombia
B.Sc. in Mechatronics Engineering - Major in robotics
Exchange Semester: Technical University of Munich

Experience

Institut de Robòtica i Informàtica Industrial (IRI-CSIC)
2021–2022 Assistant Researcher
2019–2021 Student Researcher
Barcelona, Spain
Research Projects: - Learning realistic legged locomotion by enforcing sagittal symmetry control equivariance and contact spring-mass dynamics.
- Learning human hand synergies of motion with Variational Autoencoders

INVITE GmbH research center (TU Dortmund & Bayer Technology Services)
2018–2019 Junior Research Assistant
2017–2018 Robotics Intern
Cologne, Germany
Research project: Manipulation of plastic bags using a two-arm robot with 3D vision and force feedback. (see presentation video
- EP-Patent: *Autonomous Drum and Inliner Handling*

Publications - Patents

- [Preprint] **Dynamics Harmonic Analysis of Robotic Systems: Application in Data-Driven Koopman Modeling**. Ordoñez-Apraez Daniel, Kostic Vladimir, Turrisi Giulio, Novelli Pietro, Mastalli Carlos, Semini Claudio, Pontil Massimiliano. 2023
- **On discrete symmetries of robotics systems: A group-theoretic and data-driven analysis**. Ordonez-Apraez, Daniel - Agudo, Antonio - Moreno, Francesc - Martin, Mario. Robotics Science and Systems RSS-2023
- [Worshop] **Morphological symmetries in robot learning**. Ordonez-Apraez, Daniel - Agudo, Antonio - Moreno, Francesc - Martin, Mario. RSS-2023 Workshop on Symmetries in Robot Learning
- **An Adaptable Approach to Learn Realistic Legged Locomotion without Examples**. Ordonez-Apraez, Daniel - Agudo, Antonio - Moreno, Francesc - Martin, Mario. 2022 International Conference on Robotics and Automation (ICRA)
- [Patent] **Autonomous Drum and Inliner Handling**. INVITE GmbH., Bayer A.G. Published European and US patent EP4112238A1/US2023009062A1.

Awards

2019 Top 1% score on the Colombian Saber-Pro national exam, which evaluates all students near graduation of a higher education's degree
2019 Selected to the Colombian COLFUTURO's recruitment of talent program and awarded scholarship/loan for higher education
2015 University tuition exception

Academic and Open-Source Projects

- **MorphoSymm repository:** Open-access repository for exploiting morphological/structural symmetry groups in robotics
- **Implementation of DeepMind's Multi-Agent Reinforcement Learning model of common-pool resource appropriation**
- **Measuring Parkinson's disease progression**
- **Protein evolution/structure prediction** Design of custom permutation invariant CNN layers targeted at processing protein's Multiple Sequence Alignments
- **Transition INVITE's robotics research platform to ROS**.
- **Mechanic, electronic and control design of a Micromouse**
- **Mechanic and control design of a two-DoF RP robot**
- **Control design of a 1-DoF air propelled system** experimenting with different robust control techniques (H_∞ , Slide Mode Control and Adaptive control)

Teaching and Invited Lectures

Feb 2023
Bogotá
Colombia

Modern techniques of machine learning and control to robotics
Seminar - Universidad Nacional de Colombia
Lecture: On the role of symmetries in machine learning and control of robotic systems

Jan-Feb 2022
Barcelona
Spain

Laboratories on scene reconstruction and structure from Motion
M.Sc. in Computer Vision - Universitat Autònoma de Barcelona
Course: 3D-Vision
Main Lecturer: Prof. Dr. Gloria Haro

Dec 2021
Barcelona
Spain

Introduction to AI for speech–language pathology students
Bs in Speech–language pathology - Universitat Autònoma de Barcelona
Higher cognitive functions seminar series. Main Lecturer: Prof. Paula Resina

Mar–Dec 2016
Bogotá
Colombia

Universidad Nacional de Colombia
Engineering Faculty Tutor
Courses tutored: - Data structures and algorithms - Numerical methods - Control theory - Object-oriented programming - Basic programming

Presentations

Oct 2023
Berkley
US

Symmetries in robot modeling and control
Remote seminar presentation: slides
Hybrid Robotics Laboratory University of California, Berkeley

May 2023
London
UK

Morphological Symmetries in Robot Learning
Spotlight workshop presentation: youtu.be/vxTKCbNNU8M
ICRA-2023 workshop on Effective Representations, Abstractions, and Priors for Robot Learning (RAP4Robots)

May 2023
Daegu
Korea

Morphological Symmetries in Robot Learning
Workshop presentation: youtu.be/E2L16T0biu4
RSS-2023 workshop on Symmetries in Robot Learning

Dec 2021
Barcelona
Spain

An Adaptable Approach to Learn Realistic Legged Locomotion without Examples
Poster at Deep Learning Barcelona Symposium