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 – Present
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: Study the modeling, control and design of symmetric dynamical systems with structural/morphological symmetry groups. Including:
- Modeling equivariant dynamics with learned integral linear operators.
- Exploitation of harmonic analysis of structural groups for modeling/control.
- Optimal control of Markov Decision Processes with state-action symmetries.

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. An approach to learn of realistic locomotion policies by exploiting sagittal reflectional symmetry and the passive dynamics bias.
- 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
Five year bachelor's program.
Exchange Semester: Technical University of Munich

Experience

2021–2022
2019–2021
Barcelona Spain

Institut de Robòtica i Informàtica Industrial (IRI-CSIC)
Assistant Researcher
Student Researcher
Research Projects:
- Learning realistic legged locomotion by imitating low order template passive models.
- Learning human hand synergies of motion with Variational Autoencoders

2018–2019
2017–2018
Cologne Germany

INVITE GmbH research center (TU Dortmund & Bayer AG)
Junior Research Assistant
Robotics Intern
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

- **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
- **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)
- [Worshop] **Morphological symmetries in robot learning**. Ordonez-Apraez, Daniel - Agudo, Antonio - Moreno, Francesc - Martin, Mario. RSS-2023 Workshop on Symmetries in Robot Learning
- [Patent] **Autonomous Drum and Inliner Handling**. INVITE GmbH., Bayer A.G. Published European and US patent EP4112238A1/US2023009062A1.

Awards

2020 Awarded COLFUTURO's scholarship/loan for higher education
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

Open-Source Projects

- **MorphoSymm**: Repository with tools for exploiting morphological/structural symmetry groups in robotics. Including:
  - A library of symmetric robotic systems and the relevant group representations needed for transforming state/action spaces and proprioceptive/exteroceptive measurements.
  - Tools for the construction of equivariant/invariant neural networks based on ESCNN.
  - [In development] Tools for exploiting harmonic analysis of structural groups for modeling/control.
- **SLIP Control**: Repository with tools for optimal control of the Spring-Loaded Inverted Pendulum (SLIP). A low order template model used for capturing the dynamics of legged locomotion. Including:
  - An model predictive control based on the differential flatness of the actuated SLIP model.
  - Tools for multi step/hops planning.
- **ROS driver for Robotiq 2F-85/140 Grippers**: ROS packages enabling the control, visualization and simulation of the Robotiq 2 Fingers Adaptive Grippers model version C3.

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

Scene reconstruction and structure from Motion
Laboratory series of 3D-Vision course - Universitat Autònoma de Barcelona
Main Lecturer: Prof. Dr. Gloria Haro

Dec 2021
Barcelona
Spain

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

Mar–Dec 2016
Bogotá
Colombia

Engineering faculty tutor
Universidad Nacional de Colombia
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
Hybrid Robotics Laboratory seminar series. University of California, Berkeley
Invited seminar lecture (Slides)

July 2023
Daegu
Korea

Morphological symmetries in robot learning
Workshop on Symmetries in Robot Learning (RSS-2023)
Workshop presentation: youtu.be/E2l16T0biu4

May 2023
London
UK

[Spotlight] Morphological symmetries in robot learning
Worshop Effective Representations, Abstractions, and Priors for Robot Learning (ICRA-2023)
Workshop presentation: youtu.be/vxTKCbNNU8M

Dec 2021
Barcelona
Spain

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