Maximino Linares, Ph.D Candidate

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Education

Sorbonne Center for Artificial Intelligence - SCAI Paris, FR
Ph.D candidate in Computer Science (co-funded by the EU) Nov 2023 – Nov 2026

Thesis title: *Musical instrument synthesis using physics-informed neural networks.*
Thesis supervisors: Guillaume Doras, Axel Roebel and Thomas Hélie.
Synopsis: Developing physics-informed neural networks (PINNs) for digital musical instrument synthesis, combining physical models with deep learning to produce high-quality and interpretable sound synthesis. Leveraging port-Hamiltonian systems, this research aims to enhance synthesis quality with reduced data by integrating physics-based priors as well as provide interpretable parameters for sound analysis and intuitive control. Evaluation includes quantitative and qualitative assessments, as well as usability case studies with IRCAM's artistic community.

Sorbonne Université Paris, FR
Master in Mathematics and Applications, specialization in Machine Learning Sept 2022 – Apr 2023

Relevant Mathematics courses: Statistical Learning, Mathematical Foundations for Machine Learning, Non-Convex Optimization, Simulation Methods for Generative Models.
Relevant Computer Science courses: Advanced Machine Learning and Deep Learning, Reinforcement Learning, Machine Learning for Medical Data, Stochastic Algorithms: from finance to Big Data.

Universidad Complutense de Madrid Madrid, SP
Double Bachelor of Science in Mathematics and Physics Sep 2017 – June 2022

Relevant Mathematics courses: Linear Algebra, Ordinary Differential Equations, Statistics, Classical Theory and Numerical Analysis of Partial Differential Equations, Algebraic Group Theory, Differentiable Manifolds
Relevant Physics courses: Classical Mechanics, Electromagnetism, Thermodynamics, Quantum Mechanics, Statistical Mechanics, Structure of Matter, Solid State Physics, Physics of the Atmosphere, Geophysics

Research Experience

LIMICS - Laboratoire d'Informatique Médicale et d'Ingénierie Paris, FR
Research intern Apr 2023 – Oct 2023

Supervised by: Professor Xavier Tannier and Post-Doc Student Aude Girault
Research topic: *Prediction of the fetal metabolic acidosis during labor by automated fetal heart rate reading.* Developed predictive tools for fetal metabolic acidosis using machine learning methods based on heterogeneous data never before exploited for this purpose.

Universidad Complutense de Madrid Madrid, SP
Graduate Research Student Jan 2022 – July 2022

Supervised by: Professor Jose María Arrieta and Professor Álvaro de la Cámara
Project 1: *Chaotic dynamics and bifurcation diagram of the logistic equation.* Proved different theoretical results in relation to the bifurcation diagram.
Project 2: *The limits of weather prediction based on the Lorentz equations.* Conducted research on the importance of the initial conditions in weather forecasting and gained familiarity with the use of deep learning in meteorology.

Research Activities

Introduction to Optimal Control and Machine Learning Remote
Universidad de Sevilla Oct 2024

Organized by: Enrique Fernández Cara and Diego Araujo de Souza
Lecturer: Enrique Zuazua Iriondo
Online lecture series focused on the interplay between Control Theory and Machine Learning (ML), highlighting their applications in optimization, game theory, numerical analysis of partial differential equations, and dynamic systems.

Modeling and Control of Distributed Parameter Systems: Port-Hamiltonian Approach Besançon, FR
EECI International Graduate School on Control Apr 2024

Organized and lectured by: Yann Le Gorrec and Hans Zwart
Held at: FEMTO-ST
Advanced course focused on the modeling, analysis, and control of Distributed Parameter Systems (DPS) governed by partial differential equations (PDEs), with applications in control engineering and smart materials. Explored the port-Hamiltonian framework for studying interconnection laws, energy exchange, stability, and control design for linear infinite-dimensional systems.

Doctoral Workshop on Port-Hamiltonian Systems Toulouse, FR
Fifth Edition of the Franco-German Doctoral College Mar 2024

Organized by: Denis Matignon
Lecturers: Laurent Joly, Andrea Brugnoli, Hans Zwart and Yulia Akisheva
Held at: ISAE-Supaero
Lectures focused on structured, energy-based methods for the modeling, numerical approximation, and control of multiphysical systems. Participated in doctoral presentations and interactive sessions, preparing and presenting research problems for group discussions and contributing to collaborative problem-solving initiatives..

Teaching Experience

Master in Mathematics and Applications - Machine Learning for Medical Data Paris, FR
Teaching Assistant (Sorbonne Université) Feb 2024

Professor: Xavier Tannier
Delivered practical sessions on the *prediction of the fetal metabolic acidosis during labor by automated fetal heart rate reading* based on my research carried at LIMICS.

Other activities

IRCAM Machine Learning Journal Club Paris, FR
Co-Organizer Jan 2024 – Currently

Role: Co-organized discussions on recent advancements and general topics in Machine Learning.
Personal highlights: Delivered a presentation on *Physics-Informed Neural Networks* (PINNs) focusing on *Hamiltonian* and *port-Hamiltonian Neural Networks* as examples to leverage physical conservation properties and structured dynamics to the models.

General Skills

Programming languages: Python (advanced), Matlab (advanced), R (beginner), C++ (beginner).
Languages: English (proficient), Spanish (native), French (proficient), Italian (intermediate).
Interests: Piano, Guitar, Cinema.