PABLO VILLANUEVA DOMINGO

PHD IN PHYSICS & DEEP LEARNING SCIENTIST

I obtained my **PhD in theoretical physics** at the University of València, Spain, researching **deep learning** techniques in cosmology and astrophysics. During my PhD, I led international collaborations, published scientific articles and presented the results in multiple seminars. Currently, I am working as **deep learning scientist** in the autonomous driving simulator project CARLA.

CONTACT

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SKILLS

Computation

Programming languages
Python, C, C++, C#, Fortran, SQL
General software
Git, Docker, LaTeX, MATLAB, Mathematica
Data analysis
Numpy, SciPy, Pandas, OpenCV, Networkx
Visualization
Matplotlib, Seaborn, Plotly, Folium
3D engines
Basics of Unreal, Godot, Unity
Autonomous driving software
Carla, ROS2
Simulation software
Chrono, Flex
Web development
HTML, CSS, Javascript, Jekyll, Flask

Machine learning

ML libraries
PyTorch, TensorFlow, PyTorch Lightning, PyTorch Geometric, Scikit-learn, ONNX
Neural Nets experience
Graph (GNNs), Convolutional (CNNs), U-Nets, Diffusion models, GANs, LSTMs
Fields
Computer vision, Natural Language Processing, Reinforcement Learning
See my work in ML and programming at https://pablovd.github.io/codes

Soft skills

Communication
Public speaking, writing skills
Project management
Collaboration, teamwork, initiative, organization
Problem solving
Logical reasoning, lateral thinking, creativity, data modeling

Languages

Spanish	Mother tongue
Catalan	Mother tongue
English	Fluent
Portuguese	Basics

WORK HISTORY

- Deep Learning Scientist

Jan. 2022- Now | Computer Vision Center - Universitat Autònoma de Barcelona

Data-driven traffic models, AI behavior agents, neural terramechanics and computer vision at the autonomous driving simulator CARLA

- Research assistant

Jun. 2021- Dec. 2021 | Instituto de Física Corpuscular - Universitat de València

Técnico superior de apoyo a la investigación, CIDEGENT/2018/019, CPI-21-108

- PhD fellowship

Oct 2016 - Mar. 2021 | Instituto de Física Corpuscular - Universitat de València

FPI Severo Ochoa, Ref. SEV-2014-0398-16-3

- Research introduction fellowship

May-Oct. 2016 | Instituto de Física Corpuscular

Iniciación a la investigación Severo Ochoa

EDUCATION

- PhD in Physics, *cum laude*

2016-2021 | Instituto de Física Corpuscular - Universitat de València

- Master in Advanced Physics

2015-2016 | Universitat de València

- Bachelor of Physics

2011-2015 | Universitat de València

As well as multiple PhD schools and courses which can be found here.

RESEARCH STAYS

I have led several international research collaborations, visiting universities from different countries:

Nov.- Dec. 2019 | 3 weeks at Service de Physique Théorique, Université Libre de Bruxelles, Brussels, Belgium.

Sep.- Oct. 2019 | 1 month at Department of Astrophysical Sciences, Princeton University, New Jersey, USA.

Sep.- Nov. 2018 | 2 months at Kavli IPMU, University of Tokyo, Japan.

Jun.- Aug. 2017 | 2 months at Fermi National Accelerator Laboratory (Fermilab), Illinois, USA.

AWARDS

Feb. 2023 | CSIC 2021 relevant PhD Thesis Award, by Consejo Superior de Investigaciones Científicas (CSIC).

Dec. 2016 | 1st prize in the *XXVII edición del Premio Rotary al Fomento del Trabajo Experimental en Física*.

TALKS

I have given **9 seminars** at the universities of Princeton (USA), Tokyo, Nagoya (Japan), Brussels and València; as well as **8 talks** in conferences, meetings and schools.
A complete list can be found at https://pablovd.github.io/talks.pdf These are some selected talks:

• *Neural Terramechanics and the RACER-SIM project*
Jul. 28 2022 | EAI Tech Forum, Intel Labs, online

• *Weighing the Milky Way with AI*
Jan. 17 2022 | *Cosmology Talks*, online (Youtube channel) | Video

• *Machine Learning at galactic and cosmological scales*
Nov. 17 2021 | Instituto de Física Corpuscular | Video and slides

SELECTED PUBLICATIONS

I have published **21 scientific articles** in high impact journals based on my research on cosmology and astrophysics. The full list of publications can be found in my INSPIRE profile P.Villanueva.Domingo.1. I have applied **deep learning** methods in part of my research, such as in the following works:

• *Weighing the Milky Way and Andromeda with Artificial Intelligence*
Pablo Villanueva-Domingo, Francisco Villaescusa-Navarro, Shy Genel, Daniel Anglés-Alcázar, Lars Hernquist, Federico Marinacci, David N. Spergel, Mark Vogelsberger and Desika Narayanan
Nov. 2021 | Physical Review D 107, 103003, 2023, arXiv:2111.14874
The total masses of the Milky Way and Andromeda galaxies are predicted using AI for the first time, via Graph Neural Networks.

• *Inferring halo masses with Graph Neural Networks*
Pablo Villanueva-Domingo, Francisco Villaescusa-Navarro, Daniel Anglés-Alcázar, Shy Genel, Federico Marinacci, David N. Spergel, Lars Hernquist, Mark Vogelsberger, Romeel Dave and Desika Narayanan
Nov. 2021 | The Astrophysical Journal, Volume 935(1):30, 2022, arXiv:2111.08683
Graph Neural Networks in PyTorch Geometric are trained in simulations to infer the mass of dark matter halos.

• *Removing Astrophysics in 21 cm maps with Neural Networks*
Pablo Villanueva-Domingo and Francisco Villaescusa-Navarro
Jan. 2021 | The Astrophysical Journal, 907(1):44, 2021; arXiv:2006.14305
The cosmic density field is predicted from maps of distribution of hydrogen training a U-Net in PyTorch.

OUTREACH & ADDITIONAL WORK EXPERIENCE

Feb. 2021 | Outreach video about the astronomer Sandra M. Faber within the project *Pioneras - Recordando a Lise Meitner*.

2020 - Now | Journal referee for journals such as MNRAS and ApJ. See reviews in my Publons profile

Jun. 2019 | Member of the local organizing committee of the Invisibles19 Workshop at València and Invisibles19 School at Laboratorio subterráneo de Canfranc (LSC)

2016-2017 | Collaboration in the organization of the outreach event *Feria-Concurso Experimenta*, València.

REFERENCES

• Dr. Olga Mena Requejo
Instituto de Física corpuscular, CSIC | omena@ific.uv.es
• Dr. Francisco Villaescusa Navarro
Center for Computational Astrophysics, Flatiron Institute, New York | villaescusa.francisco@gmail.com
• Dr. Sergio Palomares Ruiz
Instituto de Física corpuscular, CSIC | Sergio.Palomares.Ruiz@ific.uv.es
• Dr. Laura Lopez Honorez
Université Libre de Bruxelles, Vrije Universiteit Brussel | llopezho@ulb.ac.be