

Héctor Barreiro Cabrera, Ph.D. in Computer Science

PORTFOLIO hecbarcab.github.io

EMAIL hecbarcab@gmail.com

GITHUB [hecbarcab](https://github.com/hecbarcab)

RESIDENCE Valencia, Spain

WORK EXPERIENCE

Jun 2022 –
Today

Senior Scientist

[SEDDI Inc, Madrid, Spain](#)

- Implemented state-of-the-art methods to generate personalized avatars using statistical models, with a focus on seamless integration within a PyTorch-based machine learning framework.
- Led the refactorization of the avatar generation pipeline to enhance maintainability and resilience to bugs, adhering rigorously to industry-leading quality standards and design best practices.
- Optimized critical data structures to enable vectorized evaluation of algorithms, resulting in dramatic reductions in execution times by up to two orders of magnitude.
- Modeled and implemented new functionalities within a real-time cloth simulation engine. This resulted in greater robustness and realism, allowing users to accurately predict drape.

SEDDI

May 2021 –
Apr 2022

Research Engineer

[Meta Reality Labs Research, Redmond, USA](#)

- Developed robust techniques for simulating interactive soft-body objects, meticulously designed to leverage CPU vectorization instructions (SIMD) for superior performance.
- Overhauled the simulation framework to support both CPU and GPU-accelerated solvers through template metaprogramming, reducing code redundancy across multiple backends.



Aug. 2020 –
Nov. 2020

Research Intern

[Meta Reality Labs Research, Redmond, USA](#)

- Prototyped GPU-based acceleration strategies for high-fidelity finite element analysis, resulting in significant performance improvements over baseline CPU implementations.



Nov. 2015 –
Apr. 2021

Student Researcher

[Universidad Rey Juan Carlos, Móstoles, Spain](#)

- Conducted research and development on a novel XPBD-based constraint model for simulating extremely viscous and viscoelastic fluids. This project was developed in collaboration with AnyVerse (formerly Next Limit), and integrated into the commercial CFD solver RealFlow.
- Explored haptic rendering methods for interacting with virtual fluids. Devised novel optimization strategies for driving ultrasonic haptic devices to replicate simulated pressure fields on users' hands. Implemented GPU-accelerated Eulerian fluid solvers for real-time simulation.
- Engaged in reading seminars to discuss the latest advancements in physics-based simulation within computer graphics, their foundational principles and avenues for further development.
- Collaborated closely with fellow lab members on the production of papers and demos, ensuring timely submissions to meet project deadlines.



Feb. 2020 –
Mar. 2020

Research Intern

[Ultraleap Ltd, Bristol, UK](#)

- Developed a model to describe the pressure exerted by single focal-point ultrasonic transducer arrays. Integrated this model into a soft-body simulation framework to estimate the deflection and propagation of mechanical waves within a skin phantom.



Dec. 2017 –
Sept. 2018

Student Researcher

[AnyVerse \(formerly Next Limit\), Madrid, Spain](#)

- Explored machine learning-based methods to infer the time evolution of fluid dynamic states. Funded by Spain's government under the *Doctorados Industriales* program (ref. DI-16-08640).



Oct. 2013 –
Feb. 2015

Junior Programmer

[IRTIC, Paterna, Spain](#)

- Ported training simulator for cargo handling in port operations under Unity.
- Developed multiple Augmented Reality interactive marketing applications and demos using Unity and Vuforia.



EDUCATION

Sep. 2016 –
Sep. 2021

Ph.D. in Computer Science

[Higher School of Computer Engineering, Universidad Rey Juan Carlos, Spain](#)

- Supervised by Prof. Miguel A. Otaduy.

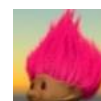
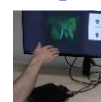
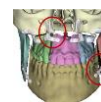


- Sep. 2015 – Jul. 2016 **Master's Degree in Computer Graphics, Videogames and VR**
Higher School of Computer Engineering, Universidad Rey Juan Carlos, Spain
- Covering diverse subjects such as rendering techniques, graphic processors, and physics-based simulation, as well as videogames and virtual reality.
- Sep. 2010 – Sep. 2015 **Bachelor's Degree in Multimedia Engineering**
Higher School of Engineering, Universitat de València, Spain
- Combines audiovisual communication with computer engineering, especially deepening in multimedia systems and all related areas (graphics, simulation, sound, ...).



PUBLICATIONS

- Aug. 2021 **Soft-Tissue Simulation for Computational Planning of Orthognathic Surgery**
 P. Alcañiz, J. Pérez, A. Gutiérrez, H. Barreiro, Á. Villalobos, D. Miraut, C. Illana, MA. Otaduy
 Journal of Personalized Medicine
- Jul. 2021 **Natural Tactile Interaction with Virtual Clay**
 H. Barreiro, J. Torres, MA. Otaduy
 Proc. of World Haptics Conference, 2021
- Jul. 2020 **Robust Eulerian-on-Lagrangian Rods**
 R.M. Sánchez-Banderas, A. Rodríguez, H. Barreiro, MA. Otaduy
 ACM Trans. on Graphics (Proc. of ACM SIGGRAPH), Volume 39, Number 4 - 2020
- Feb. 2020 **Path Routing Optimization for STM Ultrasound Rendering**
 H. Barreiro, S. Sinclair, MA. Otaduy
 IEEE Trans Haptics. 2020 Feb 24. doi: 10.1109/TOH.2019.2963647.
- Jul. 2019 **Ultrasound Rendering of Tactile Interaction with Fluids**
 H. Barreiro, S. Sinclair, MA. Otaduy
 2019 IEEE World Haptics Conference (WHC). IEEE, 2019
- Nov. 2017 **Conformation Constraints for Efficient Viscoelastic Fluid Simulation**
 H. Barreiro, I. García-Fernández, I. Alduán, MA. Otaduy
 ACM Trans. on Graphics (Proc. of ACM SIGGRAPH Asia), 2017
- Jul. 2015 **Real-time Inextensible Hair with Volume and Shape**
 R. M. Sánchez-Banderas, H. Barreiro, I. García-Fernández, M. Pérez Martínez
 Congreso Español de Informática Gráfica, 2015



AWARDS

Best Doctoral Thesis Award
 Congreso Español de Informática Gráfica (CEIG), Eurographics Spanish Section

PATENTS

System and method for representing the tactile interaction employed by an array of ultrasound transducers
 H. Barreiro, S. Sinclair, MA. Otaduy
 U.S. Patent Application No. 17/904,042

CERTIFICATIONS

Machine Learning
 Stanford Online @ Coursera

Neural Networks and Deep Learning
 DeepLearning.ai @ Coursera

Improving Deep Neural Networks: Hyperparameter tuning
 DeepLearning.ai @ Coursera

PROFESSIONAL INTERESTS



OTHER SKILLS AND PERSONAL INTERESTS

Tools	Visual Studio, VS Code
Frameworks	Eigen, PyTorch, Numpy, Sympy
HPC	CUDA, OpenCL, OpenGL, GLSL, HLSL
Game Engines	Unity, Godot
Hobbies & Interests	Single player videogames, travelling, trying out new food, comedy shows, petting dogs, naps

For further information, please contact me or visit my online portfolio.

Thank you for your time