WORK EXPERIENCE

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| 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 Logo |
| 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. | Logo, company name  Description automatically generated |
| 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*). | Text, logo  Description automatically generated |
| 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

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| 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. | Logo, company name  Description automatically generated |
| 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. | Logo, company name  Description automatically generated |
| 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

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| 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 | A close-up of a helmet  Description automatically generated with low confidence |
| 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 |  |

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| 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   |  |  |  | | --- | --- | --- | | Rocket with solid fill  Mechanical simulation | Hill scene with solid fill  Real-time rendering | Gauge with solid fill  High-perf. computing | | Artificial Intelligence with solid fill  Machine learning | Virtual Reality headset with solid fill  Mixed reality  (AR & VR) | Touchscreen with solid fill  Haptic rendering | | | 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