

MARCELO ORENES-VERA

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I am a second-year graduate student in Computer Science at Princeton University with a focus on Computer Architecture. My research interests include hardware innovations for application data supply and data transfer, to minimize the memory bottleneck resulted from compute acceleration. I am also interested in software programmability of heterogeneous hardware and memory access specialization. I work within the context of the DECADES project, which plans two chip tapeouts to demonstrate the promise of a heterogeneous tile-based architecture designed for several emerging workflows in the broad areas of Machine Learning and Graph Analytics. Thus far, I have developed a hardware-software co-design to provide an out-of-core latency tolerance mechanism, that outperforms hardware prefetching without modifying the core.

EDUCATION

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|------------|--|-----------------------------|
| PhD | Princeton University, New Jersey Computer Science Advisors: Prof. Margaret Martonosi and Prof. David Wentzlaff | August 2019-May 2024 (Exp) |
| BS | Universiteit Hasselt, Belgium Computer Science, Exchange Semester | September 2015-January 2016 |
| BS | Murcia University, Spain Computer Science, Cum Laude, GPA 3.9 | September 2013-June 2017 |

EXPERIENCE

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|---|-----------------------|
| Princeton University , Dept. of Computer Science Research Assistant Advisors: Prof. Margaret Martonosi and Prof. David Wentzlaff | August 2019-Present |
| <ul style="list-style-type: none">• Developing and testing hardware-software co-design approaches to mitigate the long latency of irregular memory accesses in graph applications and sparse linear algebra kernels.• Software programmability and OS support of specialized memory access hardware.• Contributing to the development and verification of a reconfigurable heterogeneous SoC that provides compiler-time specialization based on applications needs, as part of DARPA's Software Defined Hardware (SDH) program. | |
| ARM Ltd , Trondheim, Norway Hardware Engineer , Full-time | July 2017-August 2019 |
| <ul style="list-style-type: none">• Investigation and design of optimizations to the current implementation of several modules within the Texture Mapper of the Mali GPU, specifically Texture Cache and fetch engine.• Multilevel cache systems development and replacement policies optimizations for improved performance density and bandwidth saving.• Formal Verification of several modules at unit-level and bug hunting for liveness properties across units. Constrained randomized testing using UVM for the whole Texture Mapper.• Worked on design and verification across the MALI GPUs G76, G77 and G78 projects. | |

Murcia University, Dept. of Computer Science
Research Assistant

February 2016-June 2017

Advisor: Prof. Mercedes Valdes-Vela

- Developing a platform for indoor location based on Bluetooth 4.0 LE technology.
- Deploying Android and iOS Apps that based on the location of a visitor in a museum, it provides media content of cultural events near their location.
- Analysis of real museum visitor trajectories using Machine Learning and classifying them in profiles using clustering techniques.

SecondLemon SL, Murcia, Spain
Software Engineer, Internship

June 2015-September 2015

- Full-stack analysis and development of iOS apps in native Objective-C.
- Deployment of backend web services in Java with JSON-REST and XML-SOAP.

TEACHING EXPERIENCE

Princeton University, New Jersey

January 2020-May 2020

Senior Independent Work and Thesis Co-Mentor, Computer Science

- Co-mentored Independent Work and Thesis of a Senior student, about hardware Formal Verification of a memory-fetch engine within the context of a heterogeneous ASIC that will be eventually taped-out. This project got the SEAS Calvin Dodd MacCracken Award.

PUBLICATIONS

Opeoluwa Matthews, Aninda Manocha, Davide Giri, **Marcelo Orenes-Vera**, Esin Tureci, Tyler Sorensen, Tae Jun Ham, Juan L. Aragón, Luca P. Carloni, and Margaret Martonosi. “MosaicSim: A Lightweight, Modular Simulator for Heterogeneous Systems.” In *The International Symposium on Performance Analysis of Systems and Software*. IEEE Press, 2020.

Marcelo Orenes-Vera, Aninda Manocha, Jonathan Balkind, Fei Gao, Juan Luis Aragón, David Wentzlaff, and Margaret Martonosi. “OpenLT: Kicking Latency Tolerance Out of the Core.” Submitted for publication, 2020.

Marcelo Orenes-Vera, Fernando Terroso, Mercedes Valdes-Vela, “RECITE: A Framework for User Trajectory Analysis in Cultural Sites.” Submitted for publication, 2020.

HONORS AND AWARDS

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| ISPASS 2020 Best Paper Nomination | February 2020 |
| ARM Norway MicroBit Hackathon, Winner | February 2019 |
| Murcia University Computer Science Extraordinary Prize | June 2017 |
| Santander Bank Mathematical Contest, Murcia Region Winner | May 2015 |
| Murcia University Admission Test Highest Score Fellowship | July 2013 |

PATENTS

Antonio Garcia-Guirado, **Marcelo Orenes-Vera**, “Data Processing Systems”, US Patent Pending.
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PROJECTS

Handling of Non-Idempotent operations at [Ariane RISC-V core](#) April 2020
Collaborated in the Ariane 6-stage RISC-V core project, adding support for Non-Idempotent operations and differentiating them from the Non-Cacheable ones in the Load-Store Unit and WB.

Automated Generation of Models for Formal Verification with SVA March 2020-May 2020
A **Python** and **Verilog** framework that can automatically generate transactional models and their corresponding assertions to ensure that unit-level hardware liveness properties are not violated.

[InfoArt](#): location-based user navigation in cultural facilities March 2015-June 2017
Founded a startup that provided museums with a Bluetooth-based indoor location platform so can users could easily navigate the museum through an app and learn about what they have around them. It also leveraged machine learning to analyse the visitor's trajectories to improve the cultural facility. This project won the 3rd prize on the regional YUZZ Young Entrepreneurs contest in 2016 and 2nd prize on the Murcia University Startup creation contest in 2017.

[TASER](#): Tactical Automated Space Exploration and Reaction May 2017
A multi-robot collaborative system to explore and patrol an indoor environment, involving an omni-wheel robot with sonar, infrared rays and a Kinect to monitor and analyze the space around, and a Bluetooth-based location system to pinpoint each bot. Developed using **Java**, **Python** and **C#**, in the context of the NASA Space Apps Challenge, for which my team won the best concept prize in Murcia region.

[MySiri](#): Voice recognition and pattern matching April 2016
An **Android** app to prank friends with pre-defined answers to given questions. It achieved over 100k downloads in 2 years and over 10 million different question petitions from users.

[Augmented Reality Pong game](#) using Microsoft Surface September-December 2015
An HCI game developed in **C#** using Microsoft Surface Table 2.0. It involved QR-detected tangibles as game obstacles, gesture and voice recognition for power-ups, and light-tracking for paddle control. The user managed the game from an Android app that communicated with the Surface server.

Hands-free visualization and handling of X-ray photograph September-December 2015
An HCI-application using Microsoft Kinect to visualize and handle X-ray photographs using solely hand and body gestures. Training and Inference of patterns. Developed in **C#**.

[Tetris game in assembly MIPS32](#) April 2014
Developed a Tetris game with several levels and power-ups entirely in MIPS32 assembly code, emulated on MARS MIPS emulator, for computer architecture class.

SKILLS

Programming: C/C++/C#, Java, Python, Javascript, MIPS and RISC-V Assembly, Bash, iOS/Objective-C, OpenMP, MPI, Pascal

Hardware design/verification (certified by Doulos): Verilog, SystemVerilog, SVA, UVM.

EDA Tools: JasperGold, VCS, GTKWave, Xcelium, Simvision

Development Tools: Git, Eclipse, IntelliJ, VSCode, Vim

Frameworks: HTML/CSS, JQuery, JSF, Django, REST-JSON, SOAP-XML

Operating Systems: Linux, UNIX, Android, MacOS, Windows

Other knowledge: 3D Graphics pipeline, WebGL, SQL.

COURSEWORK

Advanced **Computer Architecture** · Digital Systems · Automated Reasoning about Software · Computer Networks · Computer Science for Technology Policy · **Systems and Machine Learning** · Fundamentals of Machine Learning · Multimedia Compression · Telematic Systems · Algorithms and Data Structures · Human Computer Interaction · Microelectronic Devices · Operating Systems · Programming Languages · **Object-oriented Programming** · Linear Algebra · Discrete Mathematics · Distributed Systems · Formal Languages · Compilers · Entrepreneurship · Technologies for Software Development · Software Architecture · **Software Quality** · Programming Mobile Applications for Android System · iOS Development

PROFESSIONAL AFFILIATIONS

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| IEEE Computer Society , Graduate Student Member | March 2020-Present |
| Association of Computer Machinery (ACM) , Graduate Student Member | March 2020-Present |

COMMUNITY SERVICE

After I return from my exchange program in Belgium, I volunteer for a year in the Exchange Student Network, where I organized social and sports activities with exchange students like, visiting primary schools and going hiking and kayaking. I also participated 3 semesters on the Murcia University Buddy program, mentoring exchange students during their stay, inside and outside the university.

During the time I work at ARM in Norway I led the sports committee, and organized activities for employees and their families, like a skiing trip, weekly running activities, and coast plastic cleaning. I also was the ARM company representant in the NTNU ADA program to encourage high school and college girls to pursue a career in STEM.

LANGUAGES

Spanish: Native Language

English: Proficient Listening, Speaking, Reading and Writing

Norwegian/Italian/Portuguese: Advanced Reading, Intermediate Listening, Speaking and Writing

German/Dutch/Finnish: Intermediate Reading, Novice Speaking, Reading and Writing