Ismael Medina Suarez

Senior Algorithm Developer at RIZM

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Summary

Applied mathematician with a PhD in optimization and a broad experience in machine learning, data science and scientific computing. Helping power the energetic transition using optimization and data science at RIZM.

Education

PhD in Optimization and Data Science — Nov. 2020 – Dec. 2024
Georg-August-Universität Göttingen — *Göttingen, Germany*

- Defended on 11.12.2024.
- See entry in Experience for more details.

Master in Mathematics — Oct. 2018 – Oct. 2020
TU München — *München, Germany*

- Operations research and optimization.
- Deep learning, machine learning and computational statistics.
- Dynamical systems, differential equations and stochastics.

Bachelor in Mathematics + Bachelor in Physics — Oct. 2013 – Jun. 2018
Universidad Complutense de Madrid — *Madrid, Spain*

Experience

Senior Algorithm Developer — Apr. 2025 - present
RIZM — *Remote, based in München, Germany*

- Developed optimization and forecasting algorithms to power the energetic transition of large industrial companies.
- Integration in the energy system modeling RIZM, which companies can use to optimize their operation and energy investments in the current and future years.

Scientific Staff (as a PhD candidate) — Nov. 2020 – Feb. 2025
Georg-August-Universität Göttingen — *Göttingen and München, Germany*

- Developed and implemented GPU optimization algorithms for data science and machine learning, showing 10x-100x speed-up with respect to the state of the art.
- Designed and trained neural networks in PyTorch for scientific inference and classification pipelines.
- High Performance Computing using Slurm, MPI, Julia and CUDA at GWDG's Grete cluster.
- 4 scientific papers on optimization [1, 2, 5, 6].
- Supervision of 3 bachelor and master students in their final theses.

Scientific Trainee — Oct. 2023 - Feb. 2024
Joint Research Center, European Commission — *Ispra, Italy*

- Employed the geo-spatial PV GIS tool (relying on ERA5 and SARAH3) to design a climatic classification for PV.
- Developed and tested mathematical models for the performance of photovoltaic (PV) devices.
- Gave internal trainings in Python packaging, unit testing, git and CI/CD.
- 3 scientific papers on PV science [3, 8, 4]

Research assistant — Feb. - Jul. 2020
Faculty of informatics, TU München — *München, Germany*

- Contributed to the Python open-source, fermion simulation package Fermifab.
- Contributed to the Julia open-source, quantum computing packages Qaintessent.jl and Qaintensor.jl.
- Enforced strict code quality guidelines, with comprehensive unit-testing and an automated CI/CD pipeline.
- 1 peer-reviewed scientific paper on quantum computing [7].

Software

DomDecGPU | *Python, C++, CUDA* | *PyTorch* 2022 – Present

- A GPU implementation of domain decomposition for optimal transport.
- Achieves 10-100x speed up with respect to the state of the art (`geomloss`) on large problems on grids.

LogSinkhornGPU | *Python, C++, CUDA* | *PyTorch* 2022 – Present

- A GPU implementation of the Sinkhorn algorithm for optimal transport.
- Achieves up to 10x speed up with respect to the state of the art (`geomloss`) on medium-sized, batched problems.

DomDecOT.jl | *Julia, multiprocessing* 2020 – 2022

- A parallel, Julia implementation of domain decomposition for optimal transport.
- Outperformed sparse Sinkhorn and MPI implementations of domain decomposition.
- Superseded by the GPU implementation DomDecGPU.

Technical Skills

Machine learning and data science: Neural networks, clustering, principal component analysis, regression.
Optimization: Linear programming, network optimization, convex optimization, non-convex optimization.
Programming languages: Python, Julia, C/C++, CUDA, Bash/Shell, R, Matlab.
Libraries: PyTorch, NumPy, Scikit-learn, Pandas, Matplotlib, Seaborn, Keops, Geomloss.
High Performance Computing: Slurm, MPI, GPU computing, CUDA.

Languages

Spanish. Native speaker
English. C1 (113/120 in TOEFL iBT) ETS, April 2018
German. B2.2 Ludwig-Maximilian Universität's Language Center, 2023

References

[1] Mauro Bonafini, Ismael Medina, and Bernhard Schmitzer. Asymptotic analysis of domain decomposition for optimal transport. *Numerische Mathematik*, 153:451–492, 2023.

[2] Clément Cancès, Daniel Matthes, Ismael Medina, and Bernhard Schmitzer. Continuun of coupled wasserstein gradient flows, 2024.

[3] Anatoli Chatzipanagi, Nigel Taylor, Ismael Medina, Teodora Lyubenova, Ana Martinez, and Ewan D. Dunlop. An updated simplified energy yield model for recent photovoltaic module technologies. *Progress in Photovoltaics*, 2025.

[4] Ismael Medina, Ana Martinez, and Ewan D. Dunlop. Parametric and distribution-based definition of climatic zones for pv. *Submitted for publication*, 2025.

[5] Ismael Medina, The Sang Nguyen, and Bernhard Schmitzer. Domain decomposition for entropic unbalanced optimal transport, 2024.

[6] Ismael Medina and Bernhard Schmitzer. Flow updates for domain decomposition of entropic optimal transport. *ESAIM: Mathematical Modelling and Numerical Analysis*, 59(3):1239–1270, 2025.

[7] Philipp Seitz, Ismael Medina, Esther Cruz, Qunsheng Huang, and Christian B. Mendl. Simulating quantum circuits using tree tensor networks. *Quantum*, 2024.

[8] Ewan Dunlop Teodora Lyubenova, Ismael Medina. Climate specific energy rating (cser) analysis of outdoor pv field data. *Progress in Photovoltaics, 2024*, 2024.