Moises Hernandez, Ph.D. | Resume

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Overview

Computational Scientist. GPGPU and CUDA specialist, passionate about solving challenging problems efficiently using parallel computing.

Technical skills

Expert in Parallel Computing and software development: CUDA, OpenMP, MPI, C/C++.
Extensive experience with numerical optimization, Bayesian inference, Machine Learning, Python and Matlab.

Education

University of Oxford **Oxford (United Kingdom)**
Ph.D. Computational Neuroscience, *2013–2017*
Accelerating computational diffusion MRI and white matter tractography using GPUs.
HPC for scientific computing applications. Design of GPU parallel solutions.

University of Murcia **Murcia (Spain)**
B.Sc. (5-year) in Computer Engineering, *2010*
Area of expertise: Parallel Computing. Final-year Thesis: Accelerating computing processes in medicine: Nvidia GPUs for accelerating MRI reconstruction.
Course 2006/2007 at **Université Claude Bernard, Lyon (France)**

Awards

- Nvidia GPU Center of Excellence Achievement Award 2016: Using GPUs to speedup the analysis of the human brain's underlying anatomical and structural organization.

Experience

University of Pennsylvania **Philadelphia (USA)**
Postdoctoral Researcher *2017–Present*
Using Machine Learning techniques to study brain connectivity in Autistic infants.

University of Oxford **Oxford (United Kingdom)**
Software Engineer *2015–2017*
Developing software for a Brain MRI Analysis library (FSL, more than 5000 users):
- Author of the CUDA tools included in the library.
- Development of diffusion MRI analysis tools (C++).
- Provide research support to worldwide researchers (3000 subscribers to the email list).

The Human Connectome Project **Oxford (United Kingdom)**
Software Developer *2012–2015*
I designed, implemented and deployed parallel solutions for the most computationally demanding software components of the project:
- I designed GPU-based solutions for Bayesian inference of computational models in diffusion MRI. Accelerations of up to 200 times were achieved.
- I developed a parallel global Tractography (3D reconstruction of human brain tracts) tool on GPUs. Accelerations of up to 200 times were achieved.
- I collaborated in building and configuring a 74-GPU cluster.

University of Murcia **Murcia (Spain)**
Research Assistant *2011–2012*
I developed CUDA-parallel solutions for analysing MRI data.

Software developed by me

- cuDIMOT: GPU tool for fitting models to 4D data. The tool includes optimization and Bayesian routines such as Levenberg-Marquardt and MCMC.
- Probtrackx-GPU: GPU tool for performing brain tractography.
- Bedpostx-GPU: GPU tool for estimating white matter fibre orientations.

Languages

Spanish: Native speaker **English:** Excellent

Invited Talks and Interviews

- NVIDIA Interview. Share Your Science: Analyzing Human Brain Connectivity with GPUs.
- cuDIMOT: A CUDA Toolbox for Modelling the Brain Tissue Microstructure from Diffusion MRI. GPU Technology Conference Europe, Munich, Germany, October 2017.
- *"White Matter Tractography and Human Brain Connections Using GPUs"*, Many-Core Seminar. Invited Talk at Oxford e-Research Centre, Oxford, UK, June 2016.
- White matter tractography and Human Brain Connections using GPUs. GPU Technology Conference, San Jose, CA, US, April 2016.
- Parallelization of computational diffusion MRI using GPUs. Centre for Medical Image. Computing Seminar Programme. Invited Talk at University College London, UK, March 2016.
- *"Practical Applications of Probabilistic Tractography"*, Neurometrics 2014. Invited Talk at the Official College of Medicine in Valencia (COMV), Valencia, Spain, October 2014.
- *"Probabilistic Brain Fiber Tractography on GPUs"*, Many-Core Seminar. Invited Talk at Oxford e-Research Centre, Oxford, UK, March 2014.
- Electronic publication. A case study about the software I developed using GPUs for analysing brain diffusion MRI data: Imaging Software Bring the Brain into Fuller Focus, The Science and Engineering South Consortium, UK.

Key Publications (Google Scholar Link)

Journal Papers:

- Accelerating fibre orientation estimation from diffusion weighted magnetic resonance imaging using GPUs. Hernandez, Moises, et al. PLoS One. 2013.
- Advances in diffusion MRI acquisition and processing in the Human Connectome Project Sotiropoulos S.N., et al. NeuroImage. 2013.
- Image Processing and Quality Control for the first 10,000 Brain Imaging Datasets from UK Biobank Alfaro-Almagro F., et al. NeuroImage. 2018.
- Running Neuroimaging Applications on Amazon Web Services: How, When, and at What Cost? Madhyastha T.M., et al. Frontiers in Neuroinformatics. 2017.
- Fusion in diffusion MRI for improved fibre orientation estimation: An application to the 3T and 7T data of the Human Connectome Project Sotiropoulos S.N., et al. NeuroImage. 2016.
- Using Diffusion Tractography to Predict Cortical Connection Strength and Distance: A Quantitative Comparison with Tracers in the Monkey. Donahue C.J., et al. The Journal of Neuroscience: The Official Journal of the Society for Neuroscience. 2016.

Conference Proceedings:

- Using GPUs to accelerate computational diffusion MRI: From microstructure estimation to tractography and connectomes. Hernandez-Fernandez M., et al. In: *International Society for Magnetic Resonance in Medicine (ISMRM) 27th Annual Meeting*, Paris (France). (2018).
- A fast and flexible toolbox for tracking brain connections in diffusion MRI datasets using GPUs. Hernandez-Fernandez M., et al. In: *The Organization for Human Brain Mapping (OHBM)*, Geneva (Switzerland). (2016).
- Accelerating fibre orientation estimation from diffusion weighted magnetic resonance imaging using GPUs. Hernandez M., et al. In: *International Conference on Parallel, Distributed and Network-based Processing (PDP)*, Garching (Germany). (2012).

Reviewer for the following international Journals:
PLoS One, Frontiers in Neuroinformatics, Neuroinformatics.