Mauricio Cespedes Tenorio

London, Ontario, Canada

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Personal Profile

Biomedical engineering MESc candidate at Western University, with a BEng in electrical engineering. Fascinated by the fields of signal processing, image processing and machine learning, especially their application to biomedical sciences. With experience in the medical industry thanks to my previous job at Boston Scientific. Currently pursuing a specialization in machine learning as part of my master's program, where I am working on improving the analysis of neurological recordings of patients with epilepsy by combining signal processing and machine learning algorithms.

Education

The University of Western Ontario

London, ON, Canada

Master of Engineering Science in Biomedical Engineering

Sept 2022 - Current

- **Anticipated graduation:** Sept 2023.
- **Master's Thesis:** An open pipeline for the analysis of recordings from intracranial electroencephalography.
- **Courses:** Introduction to Machine Learning, Introduction to Biomedical Engineering, Principles of Communication and Knowledge Translation for Biomedical Engineers, Introduction to Neural Networks.

University of Costa Rica

San Jose, Costa Rica

Bachelor of Engineering in Electrical Engineering

March 2017 - July 2021

- **Grade Average:** 9.63
- **Graduation project:** Control algorithm for imaging-guided photothermal therapy: mathematical modeling, design and simulation.

Research Experience

Khan Computational Imaging Lab, The University of Western Ontario

London, ON, Canada

Graduate MESc Student

Aug 2022 - Current

- Developing algorithms and pipelines for the preprocessing of intracranial electroencephalography recordings for clinical and research usage.
- Researching to characterize normal brain activity using intracranial electroencephalography.
- Developing an open source pipeline for the analysis of intracranial electroencephalography recordings.
- Collaborating in projects related to the segmentation of medical images using convolutional neural networks.
- Preparing posters presentations for conferences and grant proposals.
- **Technical Skills:** Python, Numpy, Scipy, scikit-learn, Pytorch, Keras, pybids, snakemake, snakebids, Linux, Bash, HPC systems, Multiprocessing with Python.
- **Soft Skills:** Teamwork, Time Management, Communication, Presentation skills.

Biomedical Engineering Research Lab, UCR

San Jose, Costa Rica

Research Assistant

July 2020 - Aug 2021

- Worked in the simulation of systems involving photoacustic and ultrasound imaging and ablation procedures.
- Developed automatic control systems for the coupling of photoacustic imaging and thermal ablation.
- Presented different projects at multiple international conferences.
- Published multiple articles on international journals.
- Helped with the preparation of research reports, presentations and grant proposals.
- Led the management of the lab, including guiding and supervising other graduation projects.
- **Technical Skills:** MATLAB, Git, Python, Wordpress.
- **Soft Skills:** Leadership, Time Management, Communication, Presentation skills.

Energy Conversion for Sustainability Lab, UCR

San Jose, Costa Rica

Research Assistant

July 2020 - December 2020

- Helped with the preparation of research reports and proposals.
- Worked with simulations related to power electronics for renewable energy systems.
- Helped with the writing of conferences papers related to power electronics.
- **Technical Skills:** MATLAB, Simulink, power electronics.
- **Soft Skills:** Writing, Communication, Research skills.

Working Experience

Robarts Research Institute
London, ON, Canada

Software/Hardware Technician
Sept 2022 - Current

- Preparation of scenes using 3D Slicer.
- Testing and replacing computer hardware, including RAMs, CPUs, HDDs and SSDs.
- Setting up and troubleshooting of VR equipment and SlicerVR.
- Development of 3D Slicer extensions using Python.
- Lab management to keep track of equipment.
- Leading and helping in meetings related to VR for medical applications.
- **Technical Skills:** Python, 3D Slicer, 3D Slicer development, Docker, Computer HW.
- **Soft Skills:** Management of resources, Presentation skills.

Boston Scientific
Heredia, Costa Rica

R&D Software Test Engineer I
Sept 2021 - Aug 2022

- Worked with a cardiac electrophysiology mapping system called Rhythmia Mapping System.
- Studied important concepts related to cardiac electrophysiology; for example, normal and abnormal cardiac rhythms, and cardiac ablation techniques.
- Worked closely to the Concepts team, responsible for the development of the signal processing algorithms for the Rhythmia Mapping System, to create manual and automated tests that covered relevant clinical cases.
- Executed manual testing for the Rhythmia Mapping System as part of the Software Development Life Cycle.
- Reviewed the development of automated tests for the cardiac mapping system to verify that the most important clinical features were tested.
- Analyzed the software and system requirements to create test scenarios and test cases for medical and non-medical software, including the Rhythmia Mapping System and tools like Subversion.
- Developed a side project for the neuromodulation R&D team at Boston Scientific for the automatic testing of neuromodulation signals using Python and signal processing.
- Trained and guided new interns of their first months.
- Worked as the lab manager for a few months, which included the tracking of equipment and incoming/outgoing international shipments.
- **Technical Skills:** Python, Linux, Bash, Squish GUI Automation Testing, Cardiac Electrophysiology.
- **Soft Skills:** Teamwork, Leadership, Time Management, Communication skills.

Boston Scientific
Heredia, Costa Rica

R&D Software Test Engineer Intern
March 2021 - Sept 2021

- Worked with a cardiac electrophysiology mapping system called Rhythmia Mapping System.
- Received training related to cardiac electrophysiology and software tools like Squish, Bitbucket and Jira.
- Executed manual, automated and sanity testing for several software tools, including the Rhythmia Mapping System.
- **Technical Skills:** Cardiac Electrophysiology, Bitbucket, Jira, Squish, Python, Jama.
- **Soft Skills:** Teamwork, Time Management, Communication, Presentation skills.

University of Costa Rica
San Jose, Costa Rica

Teaching Assistant
Jan 2018 - Dec 2019

- Worked as a teaching assistant for several courses, including: Physics for engineers I, Physics for engineers II, Linear circuits I.
- Grading of assignments and evaluations.
- Preparation of reports using LaTeX.
- **Technical Skills:** LaTeX scripting.
- **Soft Skills:** Communication skills.

Volunteer Work

Python and Arduino Workshop
San Jose, Costa Rica

University of Costa Rica
Aug 2020 - Oct 2020

- I gave a course on Python and Arduino programming to students from a low income rural school in Costa Rica.

Electronic Projects for Special Education Schools
San Jose, Costa Rica

University of Costa Rica
Jan 2021 - April 2021

- Work on the design and construction of three prototypes oriented to help students and teachers from special education schools.

University Projects

An open pipeline for the analysis of recordings from intracranial electroencephalography *London, ON, Canada*

The University of Western Ontario *Sept 2022 - Current*

- Normal brain activity is being investigated using intracranial electroencephalography recordings with the aim of finding a normative behavior to help detect abnormal rhythms in patients with epilepsy.
- A computational pipeline is being constructed for the analysis of iEEG recordings, which will allow the replication or extension of the normative baseline using other datasets and brain parcellation atlases.
- A machine learning algorithm will also be developed to allow automatic detection of activity out of these found average brain profiles, which could help in the better detection of electrophysiological abnormalities.
- **Technical Skills:** Python, Signal Processing, Machine Learning, Deep Learning, HPC systems management, Snakemake.

iEEGPrep: towards standard preprocessing for the analysis of intracranial EEG recordings *London, ON, Canada*

The University of Western Ontario *Jan 2023 - Current*

- A standard preprocessing of intracranial electroencephalography recordings is essential for the quality control of the results found using this data.
- Currently, there's no standard preprocessing of these recordings neither a tool that integrates all the common preprocessing steps.
- The automation of preprocessing steps in a single tool is a pathway towards standardized and reliable preprocessing of iEEG data
- An open-source tool for the preprocessing of these recordings is currently being developed.
- **Technical Skills:** Python, Signal Processing, Snakemake.

Control algorithm for imaging-guided photothermal therapy: mathematical modeling, design and simulation *San Jose, Costa Rica*

University of Costa Rica *July 2020 - July 2021*

- A fuzzy logic control algorithm was developed to optimize the ablation of target tissue as a cancer therapy.
- The minimization of undesired side effects are also taken in consideration by the control system, specially the thermal damage of surrounding healthy tissue.
- Simulations were implemented to test the algorithm.
- **Technical Skills:** Python, MATLAB.

Publications and Conferences

Journal Articles

Tissue damage-tracking control system for image-guided photothermal therapy of cancer
Mauricio Céspedes Tenorio, Carlos A. Wattson Sánchez, Diego S. Dumani
Frontiers in Thermal Engineering 2 (2022). 2022

Conference Proceedings

Modeling thermometry image perturbations during photoacoustic imaging-guided photothermal therapy
Mauricio Céspedes Tenorio, Diego S. Dumani
2021 IEEE UFFC Latin America Ultrasonics Symposium (LAUS), 2021

Multivariable Fuzzy Logic Controlled Photothermal Therapy
Mauricio Céspedes Tenorio, Diego S. Dumani
IFAC-PapersOnLine 54.15 (2021) pp. 400–405. 2021

Multivariable fuzzy logic controlled photothermal therapy
Mauricio Céspedes Tenorio, Diego Dumani Jarquín
Ingeniería 31 (Dec. 2020) pp. 35+. 2020

Scholarships and Academic Honours

2022-2023	**Western Graduate Research Scholarship**, Awarded to research graduate students.	*Canada*
2021	**Bachelor's degree with honours**, Recognition due to my outstanding GPA (9.63)	*Costa Rica*
2019	**Academic Excellence Award**, Awarded for the achievement of a GPA above 9 in 2018. Value: annual tuition + fees.	*Costa Rica*
2018	**Academic Excellence Award**, Awarded for the achievement of a GPA above 9 in 2017. Value: annual tuition + fees.	*Costa Rica*
2017	**Entrance Award**, Excellence admission scholarship due to my admission score. Value: annual tuition + fees.	*Costa Rica*
2017	**Top 10**, Admission score to the Technological Institute of Costa Rica	*Costa Rica*

Certifications and Training

Signal Processing problems, solved in Matlab and Python *March 2022*

Udemy

- Course focused on the basics of signal processing using Python and MATLAB.
- Some topics covered: time series denoising, spectral analysis, filtering, wavelet analysis, resampling, intrapolating and extrapolating.

Course certificate C++ *July 2021*

Sololearn

- C++ basics.
- Topics covered: basic concepts, functional programming, OOP, inheritance, polymorphism, files management, among others.

Professional Development Program *April 2020 - Dec 2020*

Centro Universitario Miravalles

- Seminar series focused in soft skills and ethics formation.

Skills

Programming Python (Pandas, NumPy, Scipy, Multiprocessing, Snakemake, Scikit-learn, Pyplot, Seaborn, PyTorch, etc.), C/C++, MATLAB.
Signal Processing Time analysis, spectral analysis, digital filters (FIR and IIR), machine learning, etc.
Miscellaneous Linux, Bash, LaTeX(Overleaf), Markdown, Microsoft Office, Git/Github, Docker.

Languages

English Professional proficiency
Spanish Native proficiency

References

Dr. Ali Khan *ali.khan@uwo.ca*

Western University *London, Ontario, Canada*

- Scientist at the Robarts Research Institute and Assistant Professor in the Department of Medical Biophysics and Medical Imaging at Western University.

Eng. Diego Dumani Jarquin, PhD. *diego.dumani@ucr.ac.cr*

University of Costa Rica *San Jose, Costa Rica*

- Director of Biomedical Engineering Research Laboratory (LIIB) and professor of the School of Electrical Engineering at the University of Costa Rica.