

Mauricio Cespedes Tenorio

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Personal Profile

Master of Engineering Science candidate at Western University, holding a BEng in electrical and computer engineering. Pursuing my graduate degree in biomedical engineering, with a special focus on machine learning for image and signal processing. Enrolled in a machine learning specialization as part of the master's program. Actively engaged in diverse machine learning projects during the master's program, emphasizing image processing, LLMs, and signal processing, alongside software development initiatives. With 1.5 years of industry experience in software testing and development gained at Boston Scientific.

Education

The University of Western Ontario

London, ON, Canada

Master of Engineering Science in Biomedical Engineering

Sept 2022 - Current

- **Anticipated graduation:** Sept 2024.
- **Specialization:** Machine Learning.
- **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 MEng Student

Aug 2022 - Current

- Developing algorithms and pipelines for the preprocessing of intracranial electroencephalography (iEEG) recordings for clinical and research usage.
- Collaborating in projects related to the segmentation of medical images using convolutional neural networks.
- Developing an automatic classifier for intracranial EEG signals using deep learning (CNNs and RNNs) and traditional machine learning techniques (XGBoosting and Random Forests).
- 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 photoacoustic and ultrasound imaging and ablation procedures.
- Developed automatic control systems for the coupling of photoacoustic 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

Software/Hardware Technician

London, ON, Canada

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.
- **Technical Skills:** Python, 3D Slicer, 3D Slicer development, Docker, Computer HW.
- **Soft Skills:** Management of resources, Presentation skills.

Boston Scientific

R&D Software Test Engineer I

Heredia, Costa Rica

Sept 2021 - Aug 2022

- Worked with a cardiac electrophysiology mapping system called Rhythmia Mapping System.
- Executed and developed manual and automated tests for software systems and tools using Python.
- 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.
- 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

R&D Software Test Engineer Intern

Heredia, Costa Rica

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

Teaching Assistant

San Jose, Costa Rica

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

University of Costa Rica

San Jose, 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

University of Costa Rica

San Jose, 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

Classification of Intracranial EEG Segments in Epilepsy Patients

London, ON, Canada

The University of Western Ontario

Sept 2022 - Current

- Led a research project aimed at classifying intracranial EEG segments from epilepsy patients into pathological, physiological, and noisy categories.
- Developed and implemented deep learning models, including Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), to improve the detection compared to traditional approaches such as decision trees and logistic regression.
- Evaluated the performance of various features extraction techniques, including Discrete Wavelet Transform (DWT), Continuous Wavelet Transform (CWT), and Hilbert Transform, to optimize classification accuracy.
- Investigated the impact of sampling rate on classification results by comparing model performance using 1024 Hz versus 2048 Hz sampling rates.
- Conducted comprehensive analysis to determine the average performance of different classification models and feature extraction methods, contributing valuable insights to the field of epilepsy diagnosis and treatment.
- **Technical Skills:** Python, Signal Processing, Machine Learning, Deep Learning.

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

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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.

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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.