

# JOSE CASTILLO

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## EDUCATION

### University of California, San Diego – Jacobs School of Engineering

(Admitted, Fall 2026)

M.S. in Electrical Engineering

### University of California, San Diego – Jacobs School of Engineering

(Sept 2022 - Present)

B.S. in Bioengineering: Biosystems | GPA: 3.4 Overall / 3.9 Major | Provost Honors (8 consecutive quarters) | Relevant Coursework: Analog Design, Circuits & Systems, Linear Systems Fundamentals, Biomedical Signals & Systems, BioSystems Engineering Lab, Modeling & Computation in Bioengineering, Numerical Analysis, Intro to Autonomous Vehicles

## Skills

**Programming Languages:** Python, C++, MATLAB

**Software & Frameworks:** ROS/ROS2, Docker, OpenCV, SLAM, TensorFlow, PyTorch, Scikit-Learn, OpenSIM, SOLIDWORKS, AutoCAD, Altium Designer, LabVIEW, PTrace, PSpice, Arduino IDE

**Hardware & Fabrication:** Circuit & PCB Design, Analog/Digital Signal Processing, Embedded Systems, Microcontroller Programming (Arduino Mega 2560, Jetson Nano, RPI 5, ESP32/C3), Instrumentation Amplifiers (AD622, LM741, AD8232, MAX30101), PID Control, Microfabrication, Sputtering (Denton Discovery 365), Potentiostat, 3D Printing

**Biomedical & Electrochemical Techniques:** Amperometry, Square Wave Voltammetry, Microneedle Array Fabrication, Hydrogel Synthesis (PEDOT: PSS-PVA), Electrode-Skin Impedance Characterization, Bluetooth Sensor Integration

## Publications

Djassemi, O.; Chang, A.-Y.; McGuire, W. C.; Mitchell, E.; Saha, T.; Fernandes, T.; Yang, J.; Miller, M.; Wurster, C.; Morales-Fermin, S.; McGregor, I.; Castillo-Valdovinos, J.; Malhotra, A.; Wang, J. "Clinical Evaluation of Microneedle Biosensors for Continuous Lactate Monitoring in Critically Ill Patients." ACS Sensors 2026, 11 (2), 1413-1424. DOI: 10.1021/acssensors.5c03699

- Contributed as co-author by fabricating microneedle array devices used in clinical experiments and producing the supplementary figure and fabrication workflow video documenting the full device preparation protocol.

## Research Experience

### Research Assistant - NanoBioElectronic Lab (NBE), UC San Diego

(May 2025 - Present)

Principal Investigator: Dr. Joseph Wang | PhD Mentor: Omeed Djassemi

- Perform microfabrication and iterative optimization of microneedle arrays for continuous monitoring of biomarkers including glucose, lactate, and cortisol.
- Integrate electrochemical sensors with biocompatible substrates, emphasizing reliable skin-sensor interfaces, and low-noise signal acquisition.
- Implement and debug square wave voltammetry and amperometric detection routines; integrate the NBE coinboard with Python Bluetooth files for wireless real-time tracking.
- Develop hydrogel electrode formulations and perform breadboard validation of dry electrode performance for the LegoEEG capstone project.
- Support experiment planning, data collection, and analysis in collaboration with the PI and PhD mentor, contributing to translational medical device development.

### ECG and PPG Signal Analysis for Biomedical Pattern Recognition - NBE Lab, UC San Diego

(Jun 2025 - Sept 2025)

- Designed an integrated acquisition system using an Arduino Mega, AD8232, and MAX30101 instrumentation amplifiers for simultaneous ECG and PPG recording.
- Applied advanced DSP techniques (Butterworth filtering, Savitzky-Golay smoothing, baseline correction) in MATLAB to enhance signal quality and enable precise waveform analysis.
- Conducted time-domain synchronization analysis, identifying meaningful correlations between cardiac activity and peripheral perfusion signals with potential diagnostic value.

### "LegoEEG" Modular EEG Headset - Capstone Project, UC San Diego

(Jun 2025 - Present)

- Co-designing a modular EEG headset featuring interchangeable PEDOT: PSS-PVA hydrogel electrodes and custom low-noise amplifier and control PCBs designed in Altium Designer.
- Lead the electrical subsystem; coordinating with the biomaterials subgroup to align electrode formulation with amplifier interface requirements.
- Characterizing electrode-skin impedance and EEG signal quality through iterative design cycles to optimize hydrogel composition, front-end circuitry, and board layout.
- Performing breadboard-level prototyping to validate dry electrode performance prior to PCB integration.

## Work Experience

### Teaching Assistant - Intro to Autonomous Vehicles (ECE/MAE148), UC San Diego

(Jul 2025 - Present)

- Support 50+ students across two quarters in ROS/ROS2, computer vision, machine learning, and embedded systems for autonomous vehicle development.
- Deliver approximately 20 hours per week of hands-on lab instruction, technical debugging, and project support, improving student completion rates and technical confidence.
- Developed and maintained course documentation and step-by-step guides for the course website, enabling students to seamlessly follow hardware integration workflows.
- Collaborated closely with faculty to refine lectures and curriculum, incorporating new hardware integrations (Winter 2026, 60+ students under Dr. Jack Silberman).

## Relevant Projects

### Autonomous Vehicle with Jetson Nano & Machine Learning, UC San Diego

(Jan 2025 - Mar 2025)

- Designed and 3D-printed a fully autonomous scale vehicle; integrated sensors and a Jetson Nano into a unified embedded system.
- Implemented OpenCV-based visual perception and ML-driven control algorithms for real-time navigation and obstacle avoidance in ROS2.
- Trained and evaluated models on collected datasets to optimize real-time decision-making and object recognition accuracy.

### Prosthetic Hand with EMG-Controlled Servo Motors, UC San Diego

(Jan 2025 - Mar 2025)

- Designed and fabricated a 3D-printed prosthetic hand actuated by servo motors under real-time EMG control.
- Developed analog signal-processing circuitry (DC offset removal, LM741 op-amps, AD622 instrumentation amplifiers, low-pass/high-pass filters) and Arduino firmware to map EMG features to distinct grasp motions.

### Enhancing Breast Cancer Diagnostics: A Machine Learning Approach, UC San Diego

(Sept 2024 - Dec 2024)

- Trained and evaluated Logistic Regression and K-Means clustering models in MATLAB, achieving 96.49% accuracy in benign vs. malignant tumor classification on a dataset of 569 patient samples.
- Applied Principal Component Analysis (PCA) for dimensionality reduction, improving feature interpretability and model efficiency.

## Extracurricular Activities

### Biomedical Engineering Society, UC San Diego

(Sept 2023 - Present)

- Design hands-on device projects and lead twice-per-quarter technical workshops covering circuits, coding, and hardware builds.
- Produce step-by-step project documentation to ensure students of all skill levels can follow instructions independently.
- Support the BMES mentorship program by advising underclassmen on coursework, research opportunities, and faculty engagement strategies.

### Executive Board - Phi Gamma Delta, UC San Diego

(Dec 2024 - Dec 2025)

- Managed communication between chapter members, alumni, and the national organization; implemented structured record-keeping to streamline chapter operations.
- Organized alumni networking events that connected undergraduates with industry professionals, directly facilitating internship and job placements.
- Co-led community service initiatives, including environmental cleanups at the USS Midway and a kayak-based litter removal event in San Diego Bay with nonprofit Ocean Connectors.