

Joseph T. Costello

(734) 660-4490 costellj@umich.edu

Education

University of Michigan, Ann Arbor, MI
Ph.D. Candidate, Electrical Engineering

Expected Graduation 2024

- Relevant Coursework: Statistical Machine Learning, Reinforcement learning, Probability and Random Processes, Nonlinear Control Systems, Neural Engineering, Neuromodulation, Embedded Systems

University of Michigan, Ann Arbor, MI

B.S.E., Electrical Engineering, Summa Cum Laude, May 2020

- GPA: 3.98 / 4.00
 - Relevant Coursework: Signals and Systems, Digital Signal Processing, Analog Circuit Design, Semiconductor Devices, Electromagnetics, Programming Data Structures, Wireless Communications, MEMS
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Work Experience

Graduate Research Assistant, Cortical Neuroprosthetics Lab, Dr. Cindy Chestek

Aug 2020 – Present

- Developed power-efficient algorithms for high performance and high channel-count neural decoding systems. Ann Arbor, MI
- Optimized neural network algorithms for real-time movement prediction from neural data.
- Advised & managed multiple undergraduate and masters students in small research projects.
- Collaborated with and presented to multidisciplinary engineering and research teams.

Engineering Intern, Boston Scientific Neuromodulation

Jan 2020 – June 2020

- Developed novel algorithms and optimization strategies for closed-loop DBS (patent in submission). Santa Clarita, CA
- Translated research ideas to implementation on an implantable medical device, safe for patient use.

Research Assistant, Univ of Michigan Center for Translational Neuroengineering, Dr. Parag Patil

May 2017 – Dec 2019

- Developed statistical mapping techniques for optimizing deep brain stimulation (DBS) clinical outcomes. Ann Arbor, MI
- Designed data visualization tools and a novel brain segmentation system and computational model using MATLAB.
- Implemented machine learning models for predicting optimal stimulation settings from electrophysiology data.

International Program for the Advancement of Neurotechnology (IPAN) Research Fellowship

June 2018 – August 2018

- Used machine learning techniques to decode neural population data from calcium imaging. Seoul, South Korea
- Developed a signal processing pipeline and automated tools for analyzing neural recordings.

Company Founder, App Designer and Software Engineer, Ann Arbor Tech LLC

April 2017 – December 2017

- Developed a Swift app and backend server to manage reservations and payments. Ann Arbor, MI
 - Worked with a partner in test-market distribution and promotion.
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Project Experience

Michigan Health Engineered for All Lives (M-HEAL), Clear Lung Project

October 2016 – December 2020

- Lead the engineering sub-team to design, build, and test a device to diagnose pneumonia in underdeveloped countries.
- Designed a portable system to analyze respiratory sounds with a custom PCB and embedded microcontrollers.
- Effectively managed, delegated tasks, and resolved conflicts within the team to exceed goals.

App-driven Device for Improving Gait in Parkinson's Disease Patients (vimeo.com/161125752)

March 2016

- Worked with a Parkinson's patient with advanced gait abnormalities to develop an electronic foot vibrator and connected phone application. The system significantly improved the patient's mobility.
- Winner of the Cognizant Making the Future Scholarship 2016.

Team Lead for Real-Time Underwater Heart-Rate Monitor and RF Transmitter

Jan 2019 – August 2019

- Designed and built a custom HR sensor (using Eagle) and Arduino-based transmitter for the UM Swim Team.
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Awards

- NSF Graduate Research Fellowship *2020 - 2024*
- Class of 1931e Scholar Society *2017 - 2020*
- William Harvey Seeley Award for Top EE First-year Student *2017*

- Dean's List and University Honors
- Recipient, Innovative Signal Analysis Scholarship

2016 – 2019
2017

Activities

- Volunteer with Science Education & Engagement for Kids (SEEK) at low-income elementary schools 2022 – Present
- Michigan Triathlon Team, National and World Championship Qualifier 2016 – Present
- UM Amateur Radio Club, Amateur Radio Technician License Class holder 2016 – Present
- Weekly Volunteer at UM Hospital Cancer Center 2017 – 2018

Programming & Software Skills

- Programming (MATLAB, Python, C/C++, Android and Swift App Design and Development, git)
- Python Development (PyTorch, Pandas, Numpy, Matplotlib, Jupyter, Optuna)
- Electronics & Embedded systems (Simulink, Eagle, Circuit Analysis, DSP, Arduino)

Publications

Joseph T. Costello, Hisham Temmar, Luis Cubillos, Matthew J. Mender, Dylan M. Wallace, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek. "Balancing Memorization and Generalization in RNNs for High Performance Brain-Machine Interfaces." *NeurIPS Spotlight Paper*, 2023.

Joseph T. Costello, Hisham Temmar, Luis Cubillos, Matthew J. Mender, Dylan M. Wallace, Omer Benharush, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek. "Power Efficient Brain-Machine Interfaces Through Sparse Neural Networks." *In preparation*, 2023.

Matthew J. Mender, Samuel R. Nason-Tomaszewski, Hisham Temmar, **Joseph T. Costello**, Dylan M. Wallace, Matthew S. Willsey, Nishant G. Kumar, Theodore A. Kung, Parag G. Patil, Cynthia A. Chestek. "The Impact of Task Context on Predicting Finger Movements in a Brain-Machine Interface." *Elife*, 2023.

Dylan M. Wallace*, Miri Benyamini*, Samuel R. Nason-Tomaszewski, **Joseph T. Costello**, Luis Cubillos, Matthew J. Mender, Hisham Temmar, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek, Miriam Zacksenhouse. "Error detection and correction in intracortical brain-machine interfaces controlling two finger groups". *Journal of Neural Engineering*, 2023.

Joseph T. Costello, Samuel R. Nason, Jungho Lee, Hyochan An, Matthew J. Mender, Hisham Temmar, Dylan M. Wallace, Jongyup Lim, Matthew S. Willsey, Parag G. Patil, Hun-Seok Kim, David Blaauw, Cynthia A. Chestek. "A low-power communication scheme for wireless, 1000-channel brain machine interfaces." *Journal of Neural Engineering*, 2022.

Matthew S. Willsey, Samuel R. Nason-Tomaszewski, Scott R. Ensel, Hisham Temmar, Matthew J. Mender, **Joseph T. Costello**, Parag G. Patil, Cynthia A. Chestek. "Real-time brain-machine interface in non-human primates achieves high-velocity prosthetic finger movements using a shallow feedforward neural network decoder." *Nature Communications*, 2022.

Karlo A. Malaga, Layla Houshmand, **Joseph T. Costello**, Jayashree Chandrasekaran, Kelvin L. Chou, Parag G. Patil. "Thalamic Segmentation and Neural Activation Modeling Based on Individual Tissue Microstructure in Deep Brain Stimulation for Essential Tremor." *Neuromodulation: Technology at the Neural Interface*, 2022.

Matthew Willsey, Samuel Nason, Scott Ensel, Hisham Temmar, Matthew Mender, **Joseph Costello**, Parag G Patil, Cynthia Chestek. "Real-Time, High-Velocity Prosthetic Finger Movements Using Brain-Machine Interfaces with Biomimetic Artificial Neural Networks." *Journal of Neurosurgery*, 2022.

Jongyup Lim, Jungho Lee, Eunseong Moon, Michael Barrow, Gabriele Atzeni, Joseph Letner, **Joseph Costello**, Samuel R. Nason, Paras R. Patel, Parag G. Patil, Hun-Seok Kim, Cynthia A. Chestek, Jamie Phillips, David Blaauw, Dennis Sylvester, and Taekwang Jang, "A Light Tolerant Wireless Neural Recording IC for Motor Prediction With Near-Infrared-Based Power and Data Telemetry." *IEEE Journal of Solid-State Circuits*, 2022.

Karen J. Kluin, James M. Mossner, **Joseph T. Costello**, Kelvin L. Chou, Parag G. Patil, "Motor speech effects in subthalamic deep brain stimulation for Parkinson's disease." *Journal of Neurosurgery*, 2022.

Jongyup Lim, Jungho Lee, Eunseong Moon, Michael Barrow, Gabriele Atzeni, Joseph Letner, **Joseph Costello**, Samuel R. Nason, Paras R. Patel, Parag G. Patil, Hun-Seok Kim, Cynthia A. Chestek, Jamie Phillips, David Blaauw, Dennis Sylvester, and Taekwang Jang, "A Light Tolerant Neural Recording IC for Near-Infrared-Powered Free Floating Motes." *IEEE Symposium on VLSI Circuits* 2021.

Eunseong Moon, Michael Barrow, Jongyup Lim, Jungho Lee, Samuel R. Nason, **Joseph Costello**, Hun Seok Kim, Cynthia Chestek, Taekwang Jang, David Blaauw, Jamie D. Phillips. "Bridging the Last Millimeter Gap of Brain-Machine Interfaces via Near-Infrared Wireless Power Transfer and Data Communications." *ACS Photonics*, 2021.

Karlo A. Malaga, **Joseph T. Costello**, Kelvin L. Chou, Parag G. Patil. Atlas-independent, N-of-1 tissue activation modeling to map optimal regions of subthalamic deep brain stimulation for Parkinson disease. *NeuroImage: Clinical*, 2021.

Conference Presentations

Joseph T. Costello, Hisham Temmar, Luis Cubillos, Matthew J. Mender, Dylan M. Wallace, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek. "Balancing Memorization and Generalization in RNNs for High Performance Brain-Machine Interfaces." *NeurIPS*, 2023. *Poster Presenter*.

Joseph T. Costello, Hisham Temmar, Luis Cubillos, Matthew J. Mender, Dylan M. Wallace, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek. "Balancing Memorization and Generalization in RNNs for High Performance Brain-Machine Interfaces." *Society for Neuroscience*, 2023. *Poster Presenter*.

Joseph T. Costello, Hisham Temmar, Luis Cubillos, Matthew J. Mender, Dylan M. Wallace, Matthew S. Willsey, Parag G. Patil, Cynthia A. Chestek. "Balancing Memorization and Generalization in RNNs for High Performance Brain-Machine Interfaces." *International Conference on Intelligent Robots and Systems (IROS)*, 2023. *Oral Presentation and Poster Presenter*.

Joseph T. Costello, Samuel R. Nason, Jungho Lee, Hyochan An, Matthew J. Mender, Hisham Temmar, Dylan M. Wallace, Jongyup Lim, Matthew S. Willsey, Parag G. Patil, Hun-Seok Kim, David Blaauw, Cynthia A. Chestek. "A low-power communication scheme for wireless, 1000 channel brain-machine interfaces." *Society for Neuroscience*, 2022. *Poster Presenter*.

Matthew J. Mender, Samuel R. Nason-Tomaszewski, Hisham Temmar, **Joseph T. Costello**, Dylan M. Wallace, Matthew S. Willsey, Nishant G. Kumar, Theodore A. Kung, Parag G. Patil, Cynthia A. Chestek. "Predicting Finger Movements in a Brain-Machine Interface Across Task Contexts". *Society for Neuroscience*, 2022. *Poster Presenter*.

Hisham Temmar, Matthew S. Willsey, Matthew J. Mender, **Joseph T. Costello**, Dylan M. Wallace, Samuel R. Nason-Tomaszewski, Parag G Patil, Cynthia Chestek. "Characterizing improvements to finger movement predictions by artificial neural networks in real-time brain-machine interfaces." *Society for Neuroscience*, 2022. *Poster Presenter*.

Matthew Willsey, Samuel Nason-Tomaszewski, Scott Ensel, Hisham Temmar, Matthew Mender, **Joseph T. Costello**, Parag G Patil, Cynthia Chestek. "Artificial Neural Network Control of Two Finger groups in Real-time Brain Machine Interfaces." *ASSFN*, 2022. *Poster Presenter*.

Joseph T. Costello, Samuel R. Nason, Jungho Lee, Hyochan An, Matthew J. Mender, Hisham Temmar, Dylan M. Wallace, Jongyup Lim, Matthew S. Willsey, Parag G. Patil, Hun-Seok Kim, David Blaauw, Cynthia A. Chestek. "A pulse-interval modulation communication scheme for low-power, wireless brain machine interfaces." *Society for Neuroscience*, 2021. *Poster Presenter*.

Karlo A. Malaga, **Joseph T. Costello**, Kelvin L. Chou, Parag G. Patil. "Atlas-independent, N-of-1 tissue activation modeling to map optimal regions of subthalamic deep brain stimulation for Parkinson disease." *Society for Neuroscience*, 2019. *Poster Presenter*.