Daniel Carbonero

danny.carbonero@gmail.com | Website | LinkedIn

INTERESTS

I enjoy being at the forefront of BioTech innovation, leveraging cutting-edge science to translate emerging technologies into healthcare solutions. Technically, my research develops machine learning methods for analyzing large neuroscientific data sets to understand the brain. I am excited, post research, to contribute deep technical expertise, along with an emerging commercialization and investing skill set, to drive innovation forward.

EDUCATION

PhD	**Biomedical Engineering, Boston University**	2019 - Present

Dissertation: "Machine Learning Framework for Analyzing State-Dependent Neuronal Network Dynamics in Calcium Recordings"
Advisors: John A. White, PhD & Mark A. Kramer, PhD

MS	**Biomedical Engineering, Boston University**	2019 - 2022

BS	**Biomedical Engineering, University of Miami**	2015 - 2019

GPA: 3.8/4.0, Cum Laude

PROFESSIONAL AND RESEARCH EXPERIENCE

Graduate Research Fellow   September 2020 – Present
Kramer Neurodata & Modeling Group, Department of Mathematics and Statistics, Boston University
Advisor: Mark A. Kramer, PhD

- Applied transfer learning to implement and fine-tune pre-trained Long Short-Term Memory (LSTM) Deep Neural Networks (DNNs) for automatic spike ripple detection in human epilepsy voltage recordings.

Graduate Research Fellow   March 2020 – Present
Neuronal Dynamics Laboratory (NDL), Department of Biomedical Engineering, Boston University
Advisor: John A. White, PhD

- Developed and adapted linear and non-linear dimensionality reduction (DR) machine learning methods for unsupervised neuronal network analyses of calcium recordings under unique neural contexts.
- Built constraining for Non-Negative Matrix Factorization DR to allow for semi-supervised analytical approaches to similar neuronal network dynamics.
- Constructed software wrapper packages to make complex machine learning methods more easily accessible and implementable to end users.
- Collaborated with experimental lab scientists to iteratively adapt and apply machine learning analysis methods to their collected data to answer groundbreaking, novel, and complex neurological questions.
- Designed analysis pipeline for rigorously characterizing neuronal network dynamics under: increasing concentrations of anesthetic sedation, natural and artificial memory recall.

Student Analyst   November 2023 – Present
Office of Technology Development, Boston University, Supervisor: Frances Forrester, PhD

- Carried out comprehensive analyses of academic technologies to assess commercial viability and facilitate commercialization of promising ones.
- Conducted in-depth market landscape research, outlining where a technology might fit within the commercialization pipeline and the industry environment.
- Drafted invention assessments, detailing a foundational understanding of a technology, its field, and commercialization potential.
- Composed one-page promotional marketing briefs, describing the technology and its potential to prospective partners (licensing, sponsored research, etc.).

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Venture Fellow   March 2023 – Present
Breakout Ventures
- Managed early deal-flow, leading initial investment calls, evaluating opportunities (scientific merit, market potential, IP, etc.), and drafting reports with strategic recommendations for the investment team.
- One of a limited number of fellows to have sourced deal-flow move into NDA diligence.
- Refined venture skills and proficiency with Breakout investment team, leveraging case studies to deepen understanding of successful biotech startup investing.
- Served as strategic partner in biotech hub of Boston, evaluating emerging technologies, startups, and entrepreneurs to source potential deals, and connect promising future opportunities with Breakout's resources.

Analytics Consulting   January 2023 – Present
fit foodie living Inc
- Conceptualized, implemented, and maintain a data pipeline for scraping, cleaning, and processing data from an online platform to create and update an accessible customer database, supporting product launches and updates.

Associate Engineer   May 2019 – August 2019
Bio-Vitro Inc, Supervisor: Siddarth Rawal, MD
- Optimized design of previously constructed fluid handling platform for unattended, automated, cell culture and cell signaling analysis under physiological conditions.
- Design was produced and sent to collaborating labs to make organs-on-chips more technically accessible.

Undergraduate Research Assistant   May 2018-August 2018
Research Experience for Undergraduates – Neurological Prosthesis Research Laboratory, Department of Biomedical Engineering, Duke University, Advisor: Warren Grill, PhD
- Modified and completely automated a fully computational, Deep Brain Stimulation, Parkinson's Disease (PD) Neurological model to simulate networks of neurons using experimentally recorded data as inputs.
- Modeled PD brain using experimentally recorded, upstream, neuron firing as inputs to simulate and analyze downstream Thalamus activity, assessing effectiveness of Deep Brain Stimulation as treatment for PD.

Undergraduate Research Assistant   May 2017 – May 2019
Physiomimetic Microsystems Laboratory (PML), Department of Biomedical Engineering, University of Miami
Advisor: Ashutosh Agarwal, PhD
- Developed automated software pipelines for immunohistochemical fluorescent microscope image data acquisition, processing, and analysis for reproducible quantification of organ-on-chip systems.
- Wrote front-end software packages to allow end users to easily and reproducibly process and analyze image data for various platforms (heart, neuro-muscular junction, metastasis).
- Designed, prototyped, and manufactured an integrated and completely automated platform for continuous cell culture and dynamic cell secretion analysis of these organ-on-chip systems.

Student Analyst   January 2017 – May 2017
Department of Continuing International Education, University of Miami, Supervisor: Magaly Abreu
- Created early iteration of real-time, self-updating student database to consolidate information and ease access.
- Wrote financial reports to visualize large volumes of financial information clearly and intuitively.

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AWARDS/HONORS

F31 Ruth L. Kirschstein Predoctoral Individual National Research Service Award	**2023**
NSF Research Traineeship Program Understanding the Brain: Neurophotonics Trainee	2020
NIH Translational Research in Biomaterials Grant Funded Trainee	**2019**
Boston University Biomedical Engineering Distinguished Fellowship	**2019**
University of Miami College of Engineering Senior Design Industry Impact Award	**2019**
Alpha Eta Mu Beta - National biomedical engineering honor society	2019
Omicron Delta Kappa Honor Society - National leadership honor society	2019
Tau Beta Pi Honor Society -National engineering honor society	2018
University of Miami President's Scholarship	2015

SKILLS

Machine Learning and Data Science: Linear Dimensionality Reduction, Matrix Decomposition, Manifold Learning, Clustering, Unsupervised/Semi-Supervised/Supervised Learning, Deep Learning (Artificial Neural-Networks) Time Series Analysis, Image Analysis
Data Science Software: Scikit-Learn, Scipy, Statsmodels, Pandas, Tensorflow, Numba
Programming: Highly Proficient in: Python, MATLAB
Comfortable with: HTML, CSS, R
Familiar with: C++, Java
High Performance Computing: Unix, Linux, Remote Super Computing Clusters, Code Parallelization (Python, MATLAB), GPU Computing, git Version Control
Engineering Design: CAD, SOLIDWORKS, Rapid Prototyping
Software: Arduino IDE, COMSOL Multiphysics, ImageJ
Document Preparation and Graphic Design: Microsoft Office, Adobe Illustrator, Figma
Certifications: Six Sigma Green Belt
Languages: Native in Spanish, fluent in English

LEADERSHIP & MENTORING

Nucleate, Boston Chapter
Director of Communications   **June 2023 – May 2024**
- Directed the Communications team of Boston Nucleate, a student-led organization facilitating venture creation of life science spinouts.
- Overhauled and implemented entirely novel pipeline to standardize communications from Boston chapter to target audiences.
- Served as liaison between Nucleate headquarters, local Nucleate program participants, and the Boston leadership team, solving logistical issues as they presented, or delegating them to the appropriate personnel.
- Wrote all promotional and professional materials advertising Nucleate programming to the Boston biotech community.
- Collaborated with other directors to set weekly communication and agenda and improve current communications workflow.

Vice President of Communications   **November 2022 – May 2023**
- Built automated email pipelines to ensure both chapter leadership, and program participants were up to date on all organizational information.
- Worked with the communications team, and directors of other teams, to write and publish weekly newsletter.

Neuronal Dynamics Lab - 2021-2022 Senior Design Team Advisor   **August 2021 – May 2022**
- Advised and mentored senior design team through development of random forest and support vector machine (SVM) depth of anesthesia classifiers using standard neural recordings.

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JOURNAL PUBLICATIONS

D Carbonero, J Noueihed, MA Kramer, JA White, "Non-Negative Matrix Factorization for Analyzing Neuronal Network Dynamics in Calcium Recordings" ***Scientific Reports***

ED Schlafly, **D Carbonero**, CJ Chu, MA Kramer, "A data augmentation procedure to improve detection of spike ripples in brain voltage recordings" ***Neuroscience Research***

J Noueihed, **D Carbonero**, FR Fernandez, JA White, "Balance of Excitation and Inhibition in the Primary Somatosensory Cortex Layer 2/3 Under Isoflurane Anesthesia" (in preparation)

RR Besser, AC Bowles, A Alassaf, **D Carbonero**, R Maciel, M Saporta, A Agarwal, "A Chemically Defined Media for Culture of C2C12 Skeletal Muscle and Human Induced Pluripotent Stem Cell Derived Spinal Spheroids" ***Cellular and Molecular Bioengineering***, 13 (6), 605-619

RR Besser, AC Bowles, A Alassaf, **D Carbonero**, I Claure, E Jones, J Reda, L Wubker, W Batchelor, N Ziebarth, R Silvera, A Khan, R Maciel, M Saporta, A Agarwal: "Enzymatically Crosslinked Gelatin-Laminin Hydrogels for Applications in Neuromuscular Tissue Engineering", ***Biomaterials Science*** , 8(2), 591-606 HIGHLIGHTED AS COVER ARTICLE

A Alassaf, G Tansik, V Mayo, L Wubker, **D Carbonero**, A Agarwal: "Engineering Anisotropic Cardiac Monolayers on Microelectrode Arrays for Non-invasive Analyses of Electrophysiological Properties" ***Analyst***, 145(1), 139-140 *included in themed collection on bioanalytical tools for enabling precision medicine*

M Ishahak, L Birman, **D Carbonero**, J Hill, A Hernandez, S Rawal, A Agarwal: "Integrated platform for operating and interrogating organs-on-chips", ***Analytical Methods***, 11(43), 5645-5651 *highlighted in the Emerging Investigator Series*

RR Besser, M Ishahak, V Mayo, **D Carbonero**, I Claure, A Agarwal: "Engineered Microenvironments for Maturation of Stem Cell Derived Cardiac Myocytes", ***Theranostics***, 8(1), 124-140

CONFERENCE PRESENTATIONS

D Carbonero, J Noueihed, MA Kramer, JA White, "Non-Negative Matrix Factorization for Analysis of Latent Neuronal Network and Sub-Network Dynamics", Biomedical Engineering Society 2023 Annual Meeting, Seattle WA, October 2023

D Carbonero, J Noueihed, MA Kramer, JA White, "Linear Dimensionality Reduction for Neuronal Network Analysis Under Isoflurane Sedation in Mice", Society for Neuroscience 2022 Annual Meeting, San Diego CA, November 2022

D Carbonero, J Noueihed, MA Kramer, JA White, "Linear Dimensionality Reduction for Analyzing Calcium Recordings", Biomedical Engineering Society 2022 Annual Meeting, San Antonio TX, October 2022 **(Platform Oral Presentation)**

D Carbonero, J Noueihed, JA White, "Principal Component Analysis for Neuronal Network Analysis Under Isoflurane Sedation in Mice", Society for Neuroscientists 2021 Annual Meeting, November 2021

D Carbonero, J Noueihed, JA White, "Principal Component Analysis for Neuronal Network Analysis Under Isoflurane Sedation in Mice", Biomedical Engineering Society 2021 Annual Meeting, Orlando FL, October 2021

R Besser, R Maciel, A Alassaf, **D Carbonero**, M Saporta, A Agarwal, "In Vitro Recapitulation of The Dysfunctional Neuromuscular Junction In Charcot-Marie-Tooth Disease", TERMIS 2019 Annual Conference & Exhibition, Orlando FL, December 2019

R Besser, **D Carbonero**, I Claure, A Alassaf, A Bowles, E Jones, J Reda, W Bachelor, R Rodriquez, A Khan, R Maciel, M Saporta, A Agarwal, "Enzymatically Crosslinked Gelatin-Laminin Hydrogels for Disease on Chip Applications", Society for Biomaterials 2019 Annual Meeting, Seattle WA, April 2019

D Carbonero, K Kumaravelu, W M Grill, "Computational Analysis of Neural Activity Recorded during Subthalamic Nucleus Deep Brain Stimulation in a Rat Model of Parkinson's Disease", Biomedical Engineering Society 2018 Annual Meeting, Atlanta GA, October 2018

R Besser, R Maciel, A Alassaf, **D Carbonero,** M Dvornik, I Claure, M Saporta, A Agarwal, "In Vitro Recapitulation of the dysfunctional neuromuscular junction in Charcot-Marie-Tooth disease", Biomedical Engineering Society 2018 Annual Meeting, Atlanta GA, October 2018

M Ishahak, L Alamda-Sabate, **D Carbonero**, S Rawal, A Agarwal, "Organ-on-Chip Platform with Integrated, Non-Invasive Oxygen Monitoring", Pittcon 2018, Orlando FL, February 2018.

D Carbonero, R Besser, A Agarwal, "TwitchRead: Analyzing Contraction in Engineered Skeletal Muscle Tissue Co-Cultured with Neurospheres", Biomedical Engineering Society 2017 Annual Meeting, Phoenix AZ, October 2017

INVITED TALKS

Boston University Stochastic Processes in Neuroscience Seminar Series   Boston MA, December 2022
Principal Component Analysis as a Change of Basis for Neural Signals
- Seminar series to discuss physical feasibility of stochastic models for neuroscientific data analysis.

Boston University Neurophotonics Center Tech Talk Tutorial Series   Boston MA, September 2022
Linear Dimensionality Reduction for Analyzing Calcium Recordings (a toolbox)
- Seminar series to spread awareness on technologies under development to foster collaboration between labs.

TEACHING EXPERIENCE

Graduate Teaching Fellow   September 2021- December 2021
EK 381 – Probability, Statistics and Data Science for Engineers
Department of Mechanical Engineering, Boston University

Graduate Teaching Fellow   September 2020- December 2020
EK 125 – Introduction to Programming for Engineers
Department of Mechanical Engineering, Boston University