Macy Mora-Antoinette, PhD

✉ mc2699@cornell.edu   in /in/macy-mora-antoinette   🎓 Google Scholar

Relevant Experience

SharkNinja, Shark Beauty   **Jul 2024 – present**
Research and Development Engineer   *Needham, MA*

- Guided development of **class II medical devices** in LED therapy by characterizing IR/red light with spectroscopy and tissue surface profiles, ensuring therapeutic performance targets for anti-aging, pain relief, and muscle recovery.
- Co-designed a pilot dermatology **clinical trial** on LED anti-aging therapy, analyzing patient outcomes and translating results into engineering specs and future product claims for executive decision-making.
- Built **Python-based computer vision pipelines** to analyze skin reflectance and under-eye pigmentation under cross-polarized vs. standard light, enabling objective quantification of therapeutic effects.
- Helped construct an Arduino PID-controlled thermoelectric therapy mask prototype, programming dynamic heating/cooling sequences and validating temperature profiles on users with facial thermocouples.
- Characterized heat generation and circuit efficiency across multiple LED FPC designs, developing thermal management strategies to prevent skin overheating and hyperpigmentation during clinical use.
- Defined KPIs for product efficacy and safety by collaborating with dermatologists and academic experts, synthesizing clinical literature into technical reports that influenced strategic R&D priorities.

Cornell University, Meinig School of Biomedical Engineering   **Aug 2018 – May 2024**
Graduate Research Assistant   *Ithaca, NY*

- Discovered mechanosensitive behavior of cholinergic receptors in bone cells through **multimodal imaging and quantitative analysis**, contributing to 6 publications and 3 podium talks, including the World Congress of Biomechanics (every 4 years)
- Improved measurement fidelity in live physiological imaging by removing motion artifacts through a dual-actuator hardware/software synchronization system, enabling accurate neural-like calcium recordings in bone cells.
- Advanced the understanding of **signal processing for biological signals**, demonstrated by analyzing 225GB of calcium signaling datasets using Fourier/spectral decomposition, feature extraction, and classification pipelines.
- Thoughtfully applied relevant **statistical modeling** (regression models, t-tests with post-hocs) to evaluate physiological data, identifying a 20% reduction in bone strength with disrupted gut microbiomes at ages relevant to bone disease.
- Developed automated workflow for 3D reconstruction of high-resolution X-rays (micro-CT), accelerating geometric analysis of hundreds of bones; revealed obesity leads to larger but not stronger bones.
- Applied **3D image reconstruction** (stitching, denoising, channel shift correction, gamma correction) to large-scale datasets (>300GB) from light-sheet imaging, improving accuracy of semi-automated identification of nerve patterns in bone tissue.
- Determined a 60-90% reduction in bone metabolism when disrupting cholinergic receptors in bone cells, even after physiological stimulation with mechanical loading

Twitter (X)   **Jun – Aug 2022**
Data Science Intern   *New York, NY*

- Mapped software developers' perceptions of work enablement to software tool usage, identifying system bottlenecks that reduced productivity by 20%, by integrating survey, ordinal, and time-series data.
- Quantified 80–340% longer wait times for web client engineers vs. other developers by **merging multi-format data** from relational databases and validating with A/B testing.
- Improved workflow optimization by applying **ensemble models** (random forests + logistic/linear regression) in Python to pinpoint tools most responsible for increasing or decreasing developer wait times.

MIT, Koch Institute for Integrative Cancer Research   **Jun – Aug 2017 and Jun –Aug 2016**
Research Intern   *Cambridge, MA*

- Helped engineer a **sensor-integrated drug delivery system** by connecting a magnetic sensor with Arduino-based hardware, enabling autonomous detection and retrieval of non-biodegradable devices retained in the stomach.
- Designed and validated device performance through mechanical (Instron tensile) and chemical (acid-resistance) testing, ensuring resilience under gastric conditions and achieving successful validation in a large animal model (live pig).
- Contributed to high-impact translational research, earning authorships in Science Translational Medicine and co-inventorship on a U.S. patent; recognized with a return offer for continued innovation.

UC San Diego, Shu Chien-Gene Lay Dept of Bioengineering   **May 2015 – May 2018**

Research Scholar   *La Jolla, CA*
- Used tissue-engineered cardiac platforms that applied cyclic mechanical stretch to mimic heart contractions, improving stem cell differentiation into physiologically relevant beating cardiomyocytes
- Applied time- and frequency-domain **signal processing to electrocardiogram (ECG) data**, demonstrating stronger ECG responses stretched cells correlating to upregulated cardiac biomarkers (qPCR, Western blot).
- Secured competitive research scholarships and presented findings at 3 national conferences and 1 university-wide symposium, showcasing strong communication and knowledge translation skills.

Machine Learning Projects (Georgia Tech)

Ads Recommendation (Practicum with Best Buy)   **Aug – Dec 2022**

Tools: Logistic Regression, Boosted Decision Trees, Collaborative Filtering, Content-Based Filtering
- Reported back to Best Buy an analysis of 2 million customers with 120 product categories (240 millions observations total) to optimize online targeted ads, supporting an operation that drives $14B e-commerce sales annually at the company

Human Motion Prediction   **Jan – May 2021**

Tools: Deep learning, Temporal-Convolutional Network, RNN, Transformer-Encoder Neural Network
- Leveraged the largest Archive of Motion Capture as Surface Shapes to create a robust prediction model across applications in biomechanics, animation, and sports; TC Network achieved 95% reduction to error loss compared to RNN/TE models

Predictive Sports Analytics   **Aug– Dec 2020**

Tools: Support Vector Machine, Random Forest, Logistic Regression, Naive Bayes, KNN, and QDA
- Predicted top 5 ranking soccer teams in the English Premier League based using predictions of game outcomes that analyzed 6,800 previous games across 18 years in soccer

Algorithmic Trading   **Aug – Dec 2020**

Tools: Random Forest, Simulation, Time-Series Forecasting
- Combined three market indicators within a Random Forest model to performs market history analysis on given companies and determine trades; achieved 49% normalized return on investment after backtesting model across a 2 year time span.

Education

Cornell University — PhD, MS Mechanical Engineering   **May 2024**
- *Ford Foundation Predoctoral Fellowship*: awarded $80,000+ from the National Academies of Sciences, Engineering and Medicine; <5% PhD applicants accepted nationwide [Personal Interview]
- *Young Investigator Award*: from the Musculoskeletal Repair and Regeneration Symposium
- *Bouchet Graduate Honor Society*: inducted based on leadership and service; only 10 inductees university-wide

Georgia Institute of Technology — MS, Analytics   **Aug 2023**

University of California, San Diego — BS, Mechanical Engineering   **Jun 2018**
- *Tau Beta Pi Engineering Honor Society*: inducted as a junior as part of top 15% of engineering class
- *Chancellor's Research Excellence Scholarship*

Skills

Programming: Python (OpenCV, PyVista, Scikit-Learn, Numpy, Pandas, Matplotlib), MATLAB, R

Imaging/Signal Processing: stitching, filtering, segmentation, forecasting, classification, feature extraction, Fourier analysis, ImageJ/FIJI, Imaris, microscopy of live rodents and biological specimen, histology

Statistical Analysis & Machine Learning: Regression models, CART/Random Forests, K-Means, KNN, Deep Learning (CNN, RNN), SVM, PCA, Regularization, A/B testing

Publications (3 of 8)

[1] **Science Advances**.2025;11(34). Cholinergic regulation of osteocyte mechanobiology: A paradigm for bone adaptation. DOI: 10.1126/sciadv.ads9720 (first-author)
[2] **Bone Reports**. 2021;14:101065. Alterations to the gut microbiome impair bone tissue strength in aged mice. DOI: 10.1016/j.bonr.2021.101065 (first-author)
[3] **Science Translational Medicine**.2019;11(483). A gastric resident drug delivery system for prolonged gram-level dosing of tuberculosis treatment. DOI: 10.1126/scitranslmed.aau6267 (co-author)