Mali Halac

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Education

Harvard University — Cambridge, MA
Ph.D. in Bioengineering — 2023 - Present
- Advisor: Prof. Shriya Srinivasan
- Biohybrid Organs & Neuroprosthetics (BIONICs) Lab

Drexel University — Philadelphia, PA
B.S. Electrical Engineering — 2019 - 2023
- Concentrations: RF Electronics, Digital Signal Processing, Control Theory
- Specializations: Computational Biology, Neuroengineering

Work Experience

Consultant, Computational Biology — Oct. 2022 - Aug. 2023
Flagship Labs 95, Inc. — *Cambridge, MA*

- Designed computational models and analyzed the human genome and transcriptome to identify remnants of viral elements with potential applications as novel drug delivery mechanisms.

Consultant, Computational Biology — Oct. 2022 - June 2023
Flagship Labs 70, Inc. — *Cambridge, MA*

- Designed computational models for RNA structure analysis, metagenomics, and viral vector based cargo delivery for plant therapeutics.

Computational Biology Co-op — Mar. 2022 - Sept. 2022
Flagship Labs 70, Inc. — *Cambridge, MA*

- Project lead for computational virus discovery.
- Designed metagenomics pipelines for Illumina MiSeq, Nanopore MinION, PacBio, BGISEQ, and Sanger sequencing data.
- Automated quality control for NGS data.
- Designed a taxonomic classifier sensitive at the genus level for RNA viruses.
- Designed a probabilistic model for viral host prediction.
- Automated peak alignment for nucleic acid capillary electrophoresis analysis via dynamic time warping. A critical step for high-throughput RNA structure analysis.
- Automated data transfer from Illumina MiSeq to AWS S3.
- Performed gel electrophoresis and microinjections.

Teaching Assistant, Introductory Programming for Engineers — Sept. 2021 - Mar. 2022
Drexel University — *Philadelphia, PA*

- Designed programming exercises and projects for introductory Python programming.
- Supervised students during the lab sessions.

Research Experience

Senior Thesis Research Sept. 2022 - May 2023
Ecological and Evolutionary Signal Processing & Informatics (EESI) Lab

- Designed a whole brain model to quantify intersubject variation in functional connectivity architecture of attention and working memory.
- Analyzed single nucleotide polymorphisms (SNP), structural variants (SV), and gene expression patterns to determine the genetic origins of intersubject variation in these cognitive functions.

Research Assistant, Machine Learning & Neuromorphic Computing Sept. 2021 - Mar. 2022
Distributed Intelligent Scalable Computing (DISCO) Lab

- Designed a generative model for the enhanced reconstruction of perceived images from human brain activity.
- Worked on the FPGA acceleration of this generative model.

Computational Biology Research Co-op Mar. 2021 - Sept. 2021
Ecological and Evolutionary Signal Processing & Informatics (EESI) Lab

- Designed a semi-supervised continual learning algorithm that
  - analyzes amino acid sequences to infer protein functions (>98% accuracy),
  - reduces the computational cost to update big biological databases (1.65 times less memory usage).
- Taught "Intro to Bash/Unix" at 2021 Biological Data Science Summer Workshop organized by our lab.

VIP Research, Machine Learning & Neuromorphic Computing Sept. 2020 - Mar. 2021
Distributed Intelligent Scalable Computing (DISCO) Lab

- Worked on using machine learning models (VGG19, GAN, DNN) to analyze fMRI scans of human visual cortex with the purpose of reconstructing visual experiences.

Research Assistant, Neuroengineering June. 2020 - Mar. 2021
Neuroengineering & Neuroergonomics Lab

- Worked on the development of a low-cost brain-computer interface (BCI) system for people with Amyotrophic Lateral Sclerosis (ALS).
- Designed the P300 brain wave-based control system that turns brain signals into computer commands for home environment control—turning on/off lights, TV, and A/C.
- Designed the user interface for the BCI.

Journal Publications

1. S. Hirani, P. Vu, **M. Halac**, S. Bohacek, B. Benkli, D. Jevotovsky, J. Vega, A. Hirani, V. Orhurhu, C. Odonkor, J. Ehrenfeld, I. Shadid, A. Azadian, B. Mayrsohn, A. Kwon, Z. Hirani, U. Osuagwu, J. Bird, C. Gilligan, B. Darnall, K. Williams, W. M. Hooten, and S. Srinivasan, "Transforming Pain Medicine: The Power of Collaboration, Entrepreneurship, and Innovation," Pain Medicine, 2025, doi: 10.1093/pm/pnae130.

Peer-Reviewed Conference Publications

1. **M. Halac**, M. Isik, H. Ayaz and A. Das, "Multiscale Voxel Based Decoding For Enhanced Natural Image Reconstruction From Brain Activity," 2022 International Joint Conference on Neural Networks (IJCNN), 2022, pp. 1-7, doi: 10.1109/IJCNN55064.2022.9892430.
2. **M. Halac**, B. Sokhansanj, W. Trimble, T. Coard, N. Sabin, E. Ozdogan, R. Polikar, G. Rosen, "Incremental & Semi-Supervised Learning for Functional Analysis of Protein Sequences," 2021 IEEE Symposium Series on Computational Intelligence (SSCI), 2021, pp. 01-08, doi: 10.1109/SSCI50451.2021.9659958.
3. E. Ozdogan, N. Sabin, T. Gracie, S. Portley, **M. Halac**, T. Coard, W. Trimble, B. Sokhansanj, G. Rosen, R. Polikar, "Incremental and Semi-Supervised Learning of 16S-rRNA Genes For Taxonomic Classification," 2021 IEEE Symposium Series on Computational Intelligence (SSCI), 2021, pp. 1-7, doi: 10.1109/SSCI50451.2021.9660093.
4. M. Sahal, E. Dryden, **M. Halac**, S. Feldmen, T. Heiman-Patterson, H. Ayaz, "Augmented Reality Integrated Brain Computer Interface for Smart Home Control," Advances in Neuroergonomics and Cognitive Engineering (pp. 89–97), 2021, Springer International Publishing.

Peer-Reviewed Abstracts

1. **M. Halac**, A. Madinger, V. Tereshenko, S. Sethuraman, A. Liu, M.C. McCormack, W.G. Austen Jr., L. Gfrerer, S.S. Srinivasan. Nerve Identification and Manipulation Tool enables blind percutaneous nerve localization and intervention. 2025 Annual Meeting of Peripheral Nerve Society (PNS).
2. M. De Lorenzo, **M. Halac**, S. Sivakumar, H. Ayaz, "Deep Neural Network Modeling Using CNN and BiLSTM for Online Passive EEG Brain-Computer Interface to Classify Mental Workload," 2021 Neuroergonomics Conference, 2021.

Preprints

1. E. Moyer, J. Winchell, I. Isozaki, Y. Alparslan, **M. Halac**, E. Kim, "Functional Protein Structure Annotation Using a Deep Convolutional Generative Adversarial Network," 2021, arXiv: 2104.08969.

Patents

1. Endornaviral satellite RNA amplification systems for plants. May 3, 2024. PCT/US2024/027778
2. Partitiviral satellite RNA amplification. May 3, 2024. PCT/US2024/027759

Oral Presentations

1. Percutaneous Nerve Localization and Intervention Device. 2025 Annual Meeting of American Society for Peripheral Nerve (ASPN).

Poster Presentations

1. Genetic Origins of Intersubject Variation in The Functional Connectivity Architecture of Human Brain. Interface Rice 2023.
2. Genetic Origins of Intersubject Variation in The Functional Connectivity Architecture of Human Brain. 2023 Stanford Research Conference.

Awards & Honors

1. 2025 American Society for Peripheral Nerve (ASPN) Travel Grant — Jan. 2025
2. 2024 Mind Brain Behaviour (MBB) Graduate Student Award — Jun. 2024
3. Outstanding Undergraduate Student Award — Jan. 2023
4. Undergraduate Research Mini Grant — Dec. 2022
5. Dean's List — 2019-2022
6. Nomination, BCI Award — 2021
7. Dean's Scholarship — 2019

Hackathons

1. Passive BCI Hackathon—Neuroergonomics Conference 2021.
   Led a team of undergraduate students to design a deep neural network (DNN) for EEG based mental workload classification.

Affiliations

- Student Member, Sigma Xi The Scientific Research Honor Society — 2025 - Present
- Candidate Member, American Society for Peripheral Nerve (ASPN) — 2025 - Present
- Member, Australasian Society for Autonomic Neuroscience — 2025 - Present
- Member, RNA Society — 2024 - Present
- Member, Biomedical Engineering Society (BMES) — 2024 - Present
- Member, American Academy of Pain Medicine (AAPM) — 2024 - Present
- Member, American Society of Pain & Neuroscience (ASPN) — 2024 - Present
- Member, Harvard Biotech Club — 2023 - Present
- President, IEEE-Eta Kappa Nu (HKN) Beta Alpha Chapter — 2022 - 2023
- Member, IEEE-Eta Kappa Nu (HKN) Beta Alpha Chapter — 2021 - 2022
- Member, Bits In Bio — 2022 - Present
- Member, IEEE Computational Intelligence Society (CIS) — 2022 - Present
- Member, IEEE — 2021 - Present
- Member, Drexel Society of Artificial Intelligence — 2020 - 2023
- Member, Drexel Neuroscience Collaborative — 2020 - 2023

Peer Reviewer

- International Journal of Clinical Practice — 2025