Amir H. Daraie

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Education

2022-2027 **Ph.D. in Biomedical Engineering** Johns Hopkins University

Area of research: Developing ML pipelines for large-scale physiological and multimodal data Multimodal AI for clinical imaging and disease staging

2022-2025 **MSc Applied Mathematics and Statistics & Biomedical Engineering** - Johns Hopkins University

Area of focus: Statistics and Statistical Learning

Area of research: Generative AI, Deep Learning, Graph Neural Networks, and LLMs

2018-2022 **BSc in Biomedical Engineering** - Amirkabir University of Technology

GPA: 3.8/4 via 120 credits
Area of research: Digital signal processing, Machine learning for wearbale devices

Works and Experience

June 2025 - Aug 2025 **Dassault Systèmes**, San Diego, California, United States
R&D Intern - Data Science (AI/ML)

- Deep learning CVML models for large-scale image analysis.
- Built and evaluated generative models (VAEs, GANs, and diffusion-based approaches) for image restoration tasks, and trained CNN- and ViT-based architectures on large image datasets.
- Worked on model training, evaluation, and integration with deployment pipelines.

Technologies: · Deep Learning, diffusion models, PyTorch, TensorFlow
Business Impact: Production deployment, cross-functional collaboration, technology validation

July 2021 - Dec 2021 **Donders Institute**, Nijmegen, Netherlands
Software Engineering Intern

Developed open-source sleep monitoring software (Dreamento) enabling academic-industry collaboration and adopted by research labs worldwide. Bridged academic research with practical implementation, demonstrating technology transfer from laboratory to real-world applications. Led end-to-end product development from research concept to deployable software tool.

Technologies: Machine Learning (SVM, LightGBM), Deep Learning (CNN, LSTM), PyQt5, Python
Impact: Multi-institutional adoption, academic-industry collaboration, open-source contribution

Selected Projects

- **Explainable AI for Automated Seizure Detection: 3D Pose-Based CV with Interpretable Movement Proxies**

  - Developed XAI-first deep learning system combining T-Net, PointNet, and RNN architectures to process 33 body landmarks from video data for automated infantile seizure detection with visual interpretability.
  - Implemented Integrated Gradients explainability technique with custom 3D visualization.
  - Demonstrated model autonomously learned to prioritize wrist, elbow, and ankle movements matching clinical seizure semiology.
  Technologies: PyTorch, PointNet, T-Net, RNN, Integrated Gradients XAI

- **Deep Learning-Based Field of View Analysis for CT Medical Images (Dassault Systèmes Internship)**

  - Developed automated quality control system for CT scan analysis using ResNet50 regression model trained on synthetic data generated from thirty million slices across eight thousand patient studies.
  - Implemented generative models (DCGAN, VAE, ViT, Masked Autoencoders) for large-scale image restoration.
  - Integrated pipeline into Pipeline Pilot platform for production deployment.
  - Worked with large-scale 3D medical imaging datasets and clinical imaging constraints
  Technologies: PyTorch, TensorFlow, ResNet50, DCGAN, VAE, ViT, AWS

- **Dreamento: Open-Source Software for Sleep EEG Analysis**

  - Co-developed open-source Python software for real-time sleep EEG monitoring with machine learning-based automatic sleep staging using LightGBM classifier and PyQt5 graphical interface.
  - Implemented real-time signal processing pipeline with automatic detection of sleep microstructures including spindles, slow oscillations, and rapid eye movements using YASA algorithms.
  Technologies: Python, PyQt5, LightGBM, SVM, CNN, LSTM, TensorFlow

Publications

- Sink-index: a network based EEG marker for frontotemporal dementia and Alzheimer disease.
  L. A. Sanchez, Surya Pandiaraju, A. O. Williams, **A. H. Daraie**, C. U. Onyike, and S. V. Sarma,
  Brain Communications, vol. 7, no. 4, Jan. 2025

- Seizure detection and localization using spectral entropy of the intracranial EEG network.
  Daraie, A.H., Charles A. S., Sanchez, L. A., Chandler, A., Hays, M. A., Talley, L., Inati, S. K., Zaghloul, K., Hopp, J. L., Marashly, A., Crone, N. E., Gonzalez-Martinez, J., Kang, J., Sarma, S. V.,
  Under peer review, Brain Journal

- Hypercube-S4GNN: a deep learning based multi-edge graph approach using State Space Models on multivariate EEG for seizure detection.
  Basheer, R., **Daraie A.H.**, Mishra D.
  34th IEEE International Workshop on Machine Learning for Signal Processing (IEEE MLSP 2024)

- Localizing the Seizure Onset Zone with Bayesian Learning During iEEG monitoring.
  Daraie A.H., Charles A. S., Sanchez L. A., Kang J., Sarma S. V.
  46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society

- Scalp EEG Correlates of Anti-Seizure Medications in Adult Epilepsy.
  Charles A. S., **Daraie A.H.**, Myers P., Craley J., Kang J., Sarma S. V.
  46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society

- Network excitability of stimulation-induced spectral responses helps localize the seizure onset zone.
  Hayes, M., **Daraie A H**, ..., Crone, N.
  Journal of Clinical Neurophysiology (In publication, 2023).

- Dreamento Software: an open-source dream engineering toolbox for sleep EEG wearables.
  Esfahani, M. J., **Daraie, A. H.**, Zerr, P., Weber, F. D., Dresler, M.
  SoftwareX - https://doi.org/10.1016/j.softx.2023.101595 (2023).

- Citizen neuroscience: wearable technology and open software to study the human brain in its natural habitat.
  Esfahani, M. J., ..., **Daraie A H**, ..., Dresler, M.
  European Journal of Neuroscience - https://osf.io/preprints/psyarxiv/4mfcd (2023).

Patents

- Method and Apparatus for Detecting Epileptic Seizures in Intracranial EEG Monitoring via Tracking Entropy of Dynamic Network Brain Models Coefficients.
  Daraie, A. H., Sanchez, L. A., Sarma, S. V.
  Provisional Patent (2023).