Mehdi Azabou

www.mehai.dev · mazabou@gatech.edu · +1(404) 933-3204

Bio

I am a third-year Machine Learning Ph.D. student advised by Dr. Eva L. Dyer. My main areas of interest are Deep Learning and Computational Neuroscience. I am actively working on developing methods for self-supervised representation learning for different modalities, and researching new models to learn from neural activity and behavior.

Education

PhD in Machine Learning, Georgia Institute of Technology   Aug 2020 – Expected 2024
  Advisor: Prof. Eva L. Dyer, GPA: 4.0.

Masters in Computer Science, Georgia Institute of Technology   Aug 2018 – Dec 2020
  Specialization: Machine Learning, GPA: 4.0.

Masters in Engineering, CentraleSupélec   Sep 2016 – May 2019
  CentraleSupélec is a top French graduate engineering school of Paris-Saclay University.
  3rd year Specialization: Interactive Systems and Robotics.
  Project: Prediction of Chemical Reaction Outcomes using Graph Neural Networks.

Classes Préparatoires (CPGE), IPEST   Sep 2014 – May 2016
  Intensive training in mathematics, physics and chemistry to prepare for competitive entrance exams.

Research Experience

Georgia Institute of Technology   *Atlanta, GA, United States*
  Research Assistant, NerDS Lab   Aug 2020 – Present
  Working with Dr. Eva L. Dyer on a wide range of problems in machine learning and neuroscience.
  - Developed a self-supervised learning method based on positive neighbor mining. Showed competitive results on image and neural datasets.
  - Revealed the existence of computational fingerprints of transcriptomic cell types, during neuronal activity across diverse contexts. Developed an attention-based model.

  Research Assistant, Smart Cities   Jan 2020 – Jul 2020
  Worked on prediction systems used by Georgia DOT for the inventorying and assessment of road assets including traffic signs and pavements. Developed and deployed real-time object detection pipelines for edge devices, and improved the evaluation procedure used to track performance.

Industry Experience

Parrot Drones   *Paris, France*
  Computer Vision Intern   May 2019 – Nov 2019
  Worked on semantic segmentation tasks for drone aerial imagery. Benchmarked multiple state-of-the-art architectures. Produced software to systematically generate and validate data from simulated off-the-shelf environments, and evaluated domain adaptation methods to address the sim2real gap.

Cleed   *Paris, France*
  Deep Learning Intern   Jun 2018 – Sep 2018
  Led efforts to develop a virtual clothing try-on tool. Designed and implemented a generative model that performs garment swapping. Improved model performance by introducing more modalities like dense human pose estimate and clothing segmentation map. Collected data by scraping retail websites.

Publications

Preprints

- Schneider, A.[+], **Azabou, M.**[+], McDougall-Vigier, L., Parks, D.B., Ensley, S., Bhaskaran-Nair, K., Nowakowski, T.J., Dyer, E.L.[*], and Hengen, K.B.[*] *Transcriptomic cell type structures in vivo neuronal activity across multiple time scales.* bioRxiv 2022.07.10.499487, 2022. Under review at *Neuron*.

Conference and Workshop Papers

- Liu, R., **Azabou, M.**, Dabagia, M., Xiao, J., and Dyer, E. L. *Seeing the forest and the tree: Building representations of both individual and collective dynamics with transformers.* Advances in Neural Information Processing Systems **NeurIPS 2022**

- Quesada, J., Sathidevi, L., Liu, R., Ahad, N., Jackson, J. M., **Azabou, M.**, Xiao, J., Liding, C., Urzay, C., Gray-Roncal, W., Johnson, E. C. and Dyer, E. L. *MTNeuro: A Benchmark for Evaluating Representations of Brain Structure Across Multiple Levels of Abstraction.* In Neural Information Processing Systems **NeurIPS 2022** Datasets and Benchmarks Track.

- **Azabou, M.**, Mendelson, M., Sorokin, M., Thakoor, S., Ahad, N., Urzay, C., and Dyer, E. L. *Learning Behavior Representations Through Multi-Timescale Bootstrapping.* Workshop on Multi-Agent Behavior, **CVPR 2022**, selected for Oral.

- Thakoor, S., Tallec, C., Azar, M.G., **Azabou, M.**, Dyer, E.L., Munos, R., Veličković, P., and Valko, M. *Large-Scale Representation Learning on Graphs via Bootstrapping.* In Proceedings of the International Conference on Learning Representations, **ICLR 2022**.

- Liu, R., **Azabou, M.**, Dabagia, M., Lin, C.H., Gheshlaghi Azar, M., Hengen, K., Valko, M., and Dyer, E. L. *Drop, swap, and generate: A self-supervised approach for generating neural activity.* Advances in Neural Information Processing Systems **NeurIPS 2021**, selected for Oral (1% submissions).

- **Azabou, M.**, Azar, M.G., Liu, R., Lin, C.H., Johnson, E.C., Bhaskaran-Nair, K., Dabagia, M., Avila-Pires, B., Kitchell, L., Hengen, K.B. Gray-Roncal, W., Valko, M., and Dyer, E. L. *Mine your own view: Self-supervised learning through across-sample prediction.* Workshop on Self-supervised Learning: Theory and Practice, **NeurIPS 2021**, selected for Oral.

- **Azabou, M.**[+], Dabagia, M.[+], Liu, R.[+], Lin, C. H., Hengen, K. B., and Dyer, E. L. *Using self-supervision and augmentations to build insights into neural coding.* Workshop on Self-supervised Learning: Theory and Practice, **NeurIPS 2021**.

- Lin, C. H., **Azabou, M.**, and Dyer, E. L. *Making transport more robust and interpretable by moving data through a small number of anchor points.* International Conference on Machine Learning, **ICML 2021**.

Abstracts

- Urzay, C.[+], Ahad, N.[+], **Azabou, M.**, Schneider, A., Atmakuri, G., Hengen, K.B., and Dyer, E. L. *Detecting change points in neural population activity with contrastive metric learning.* To appear at the Cognitive and Computational Neuroscience (CCN) Annual Meeting, San Francisco, CA, August, 2022. (+ co-first authors)

Awards

- Travel award to attend CVPR 2022.

- First place, GT Convergence Innovation Competition, Climate Solutions category, Fall 2018.

- French-Tunisian merit-based Scholarship for Grandes Écoles, 2016-2019 – awarded to 40 students per year.

- Tunisian Excellence Scholarship, 2014-2016 – highest undergraduate scholarship nationally.

Teaching

- Co-Instructor at the Caltech/Chen Institute's Data Science and AI for Neuroscience Summer School, 2022. Developed and led the representation learning hands-on session.
- Content Developer for BMED 6517 Machine Learning in Biosciences at Georgia Tech, 2021.
- Developed and led a Python bootcamp session for DL@MBL: Deep Learning for Microscopy Image Analysis course at the Marine Biological Laboratory, MBL, 2021.
- Teaching Assistant for CS 4261 Mobile applications and Services, Spring 2019. Guided students through the different stages of app creation: ideation, market research, and front-end and back-end development.

Mentorship

- Venkataramana Ganesh, Masters in CS   2022 – 2023
  Project: Designing data augmentations for graph representation learning.
- Michael Mendelson, Undergrad in BME   2021 – 2022
  Project: Using deep learning to decode signatures of exploration and exploitation in human decision making, Received PURA Award for Undergraduate Research at Georgia Tech.
- Carolina Urzay, Undergrad in BME   2021 – 2022
  Project: Detecting change points in neural population activity with contrastive metric learning.
- Zijing Wu, Undergrad in CS/Math   2020 – 2021
  Project: Revealing aging dynamics in C. elegans by modeling behavior dynamics throughout lifespan.

Talks

- "Mine your own view: Self-supervised learning and evaluation for neural data", Summer School on Data Science, AI, and Neuroscience, **California Institute of Technology**, Chen Institute for Neuroscience, Pasadena, CA, July 14, 2022.
- "Learning Behavior Representations Through Multi-Timescale Bootstrapping", Workshop on Multi-Agent Behavior, New Orleans, LA, **CVPR 2022**.
- "Mine your own view: Self-supervised learning through across-sample prediction", Workshop on Self-supervised Learning: Theory and Practice, Virtual, **NeurIPS 2021**.

Reviewing

- Reviewer for *Neural Information Processing Systems (NeurIPS)* 2021, 2022.
- Reviewer for *Cell Patterns*, 2022.
- Reviewer for *Learning on Graphs Conference (LOG)* 2022.
- Sub-reviewer for *Neuron*, 2021.
- Reviewer for *International Conference on Artificial Intelligence and Statistics (AISTATS)* 2021.

Skills **Expert, *Advanced

- **Programming Languages** Python**, Java, C++, Matlab, Mathematica.
- **ML Frameworks** PyTorch**, PyG**, TensorFlow*, Bokeh*, Flask*, scikit-learn*, OpenCV.
- **Misc.** Docker*, gcloud, aws, PostgreSQL, Android, ROS, Adobe Creative Cloud.
- **Languages** Fluent English, French and Arabic. Intermediate Spanish. Beginner Mandarin.