MORGAN N. McCARTY

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Mathematically driven Computer Science student with interdisciplinary research experience in Cybersecurity, Cognition, Neurobiology, and Natural Language Processing. Knowledgeable in the mathematical underpinnings of state-of-the-art Machine Learning models and driven by a strong motivation to lead advancements within the field.

EDUCATION

Northeastern University, Boston, MA   September 2020 - Present
Khoury College of Computer Sciences   Expected graduation: May 2025
Candidate for a Bachelor of Science in Computer Science, minors in Cell and Molecular Biology, Mathematics
- Courses include: Artificial Intelligence, Machine Learning and Data Mining 1, Number Theory, Algorithms and Data, Calculus 3, Cognition, Genetics and Molecular Biology, Neurobiology, Intro to CS Research
- Planeswalkers of Northeastern University - Treasurer (2022 - Present)

Boston Latin School, Boston, MA   September 2014 - June 2020
High School Diploma
- National Honor Society 2019-2020; Varsity Rowing 2015-2020 (Team Captain 2019-2020)
- Senior research project: *Analysis of Genetic Algorithms for their Potential to Optimize Code*

RESEARCH INTERESTS
- Psychological heuristics for biologically plausible large-language models
- Applications of deep neural networks in modeling the human mind
- Biologically inspired artificial intelligence algorithms

RESEARCH EXPERIENCE

Northeastern University, Boston, MA
- *Research Assistant (Artificial Intelligence Algorithms) - **Subjectivity Lab***   September 2024 - Present
  - Applied for and received funding grant through Northeastern University PEAK totalling $3,000
  - Designed research project combining elements from Psychology (Visual Imagery) and Artificial Intelligence (Large-Language Models)
  - Prototyped embedding algorithm incorporating elements of human visual imagery into machine representation
- *Co-op Research Assistant (Psychology and Virtual Reality) - **Subjectivity Lab***   January 2023 - June 2023
  - Constructed library for integrating Virtual Reality with Psychology experiment library Psychopy
  - Utilized library to create experiments to perform on subjects
  - Created tools to help with diagnosis of disorders of consciousness (working with Mass General)
- *Co-op Research Assistant (Autonomous Driving) - **CPI at Northeastern***   January 2022 - August 2022
  - Developed a new framework to allow more realistic testing of OpenPilot in simulation (Carla)
  - Designed virtualization of real-life components to improve simulated cars
  - Analyzed the framework and structure of OpenPilot's code: looking for issues and potential exploits

Harvard Medical School, Boston, MA
- *Co-op Research Assistant (Neural Networks) - **Sabatini Lab***   January 2024 - June 2024
  - Built neural network implementation of mouse neurobiology task using vanilla RNNs in PyTorch
  - Trained models on multiple tasks to improve understanding of real-world learning in mice

TEACHING EXPERIENCE

Northeastern University, Boston, MA
- *Teaching Assistant for Artificial Intelligence (CS 4100)*   September 2022 - December 2022
  - Improved students understanding of content through one-on-one meetings
  - Graded and provided relevant feedback on assignments, examinations, and projects

Boston Latin School Rowing, Boston, MA
- *Head Novice Boys Coach*   September 2021 - December 2022
  - Created training plan and activity regiment to teach skills to beginner athletes
  - Managed boat configurations both physically and through athlete selection
  - Coached Men's Novice Eight to finals at the Spring USRowing Northeast Youth Regional Championship
- *Assistant Novice Girls Coach*   January 2021 - August 2021
  - Helped design training plans with head coach to improve experience and performance of athletes
  - Organized activities both on land and water appropriate for weather conditions or seasons

- *Assistant Novice Land Coach*   September 2020 - December 2020
    - Instructed beginner athletes through bodyweight and core exercises as well as their safe practice
    - Helped organize experiences for athletes during the COVID-19 pandemic safely

PROFESSIONAL EXPERIENCE

lillocards *Store Owner and Operator,* Norfolk, MA   September 2022 - Present
- Built self-owned and self-operated small business with revenue in excess of $10,000 per year
- Created contact network of Magic: the Gathering artists, agents, and other store operators

Arbor Biotechnologies, Inc. *Independent Consultant*, Cambridge, MA   April 2020 - April 2021
- Entered contract information into a database to help organize company records
- Examined contracts for errors and inconsistencies to flag for review by legal team

Southwest Boston CDC Green Team *Member*, Hyde Park, MA   July 2017 - August 2017
- Built sidewalks and maintained trails through sustainable trail-building practices
- Removed invasive plants and insects from urban wilds to help improve environment for local species

VOLUNTEER EXPERIENCE

Head of the Charles Regatta, Cambridge, MA
- *Computer Timer (**Station Lead** 2022, 2023, 2024)*   October 2019, 2021-2024
    - Recorded times for competitors using computer timing and imaging software
    - Directed station team to ensure efficiency of operations within timing station
    - Calibrated high-speed camera for determination of timing down to the thousandth of a second
- *Technology Setup*   October 2022
    - Setup wireless connection for event through signal amplifiers
    - Wired and routed Cat 5e cables throughout critical infrastructure locations
- *Set-up/Clean-up Volunteer*   October 2017, 2018
    - Set up and broke down tents and signs for the regatta

Boston Latin School *Computer Science Tutor*, Boston, MA   December 2019 - June 2020
- Tutored students for AP Computer Science A to improve their understanding of course material
- Reinforced concepts learned in class to help explain content uniquely

Boston Latin School Rowing *Novice Team Volunteer Coach*, Boston, MA   August 2019 - March 2020
- Taught the basics of rowing to novice rowers both on and off the water
- Coxed boats with inexperienced rowers to better help them learn to row
- Led land workouts focusing on building core strength and bodyweight endurance

PRESENTATIONS

McPhee, M., **McCarty, M.**, Young, M., & Morales, J. (2024). The pupil and the mind's eye: Portable pupillometry captures robust responses to imaginary light. *Journal of Vision*, *24*(10), 1499-1499.

McCarty, M., McPhee, M., & Morales, J. (2024). Portable Pupillometry Captures Robust Responses to Imaginary Light. *RISE at Northeastern 2024*.

PUBLICATIONS

Zhou, X., Chen, A., Kouzel, M., Ren, H., **McCarty, M.**, Nita-Rotaru, C., & Alemzadeh, H. (2024). Runtime Stealthy Perception Attacks against DNN-based Adaptive Cruise Control Systems. *arXiv preprint arXiv:2307.08939*. **(Accepted at ACM ASIACCS 2025)**

PROJECTS

2024 Fall Semester - PEAK Summit Project: *Artificial Phantasia: An Encoding Algorithm Integrating Imagery*
2024 Summer II Semester - Directed Study Project: *Tree Detection and Segmentation in Remote Sensing Images*
2024 Summer II Semester - Research Project: *An Analysis of Artificial Intelligence Chat Models on Software Engineering Design Principles*
2023 Fall Semester - Knowledge in a Digital World Final Project: *An Epistemic Evaluation on the Transformer Architecture for Machine Learning*
2023 Summer II Semester - Machine Learning and Data Mining I Final Project: *An Analysis on Biases in Marvel and DC Comics*
2022 Summer II Semester - Directed Study Project: *Air Pollution London: A Pollution Monitoring Platform for Schools*
2021 Fall Semester - Artificial Intelligence Final Project: *Ant Colony Optimization of Shortest Path and Traveling Salesman*

2019-2020 High School Senior Year - Research and Study Skills (Capstone) Project: *Analysis of Genetic Algorithms for their Potential to Optimize Code*

SELECTED AWARDS AND HONORS

2024 Fall Semester Northeastern University PEAK Summit Award ($3000)

2019 United States Naval Academy Summer Seminar Certificate of Completion

2016 Youth CITIES L3 Innovation Challenge "Rising Star Innovator"

TECHNICAL SKILLS

Machine Learning, Artificial Intelligence, and Data Science Skills
- Mathematical and practical implementations of classic algorithms (including the Transformer), Neural Networks, NumPy, Pandas, Scikit-Learn, PyTorch, Amazon EC2, MongoDB

Operating Systems
- Linux (Arch, Ubuntu), MacOS, Windows

Libraries and Software
- Git, transformers (HuggingFace), OpenPilot, Carla, OpenGL (JOGL), ArcGIS, QGIS, Jetbrains IDEs, VS Code

Programming and Markup Languages
- *Proficient:* Java, Python, LaTeX; *Experience*: Assembly, C, C++, C#, HTML, JavaScript, R

OTHER INTERESTS AND HOBBIES

Hiking, Backpacking, Climbing, and Mountaineering
- Have led group hikes in the White Mountains and circumnavigated Andorra in a backpacking trip (65 miles)

Music
- Guitar: Classical, Acoustic, Electric**;** Percussion: Drum Kit, Timpani, Mallet Percussion

Rowing
- Competed in the Head of the Charles Regatta 2017-2019, 2021 and qualified for and competed in the 2019 USRowing Youth National Championships