Jordan Madden

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PROFESSIONAL SUMMARY

Computer Engineering PhD student specializing in trustworthy artificial intelligence and machine learning. Studying Artificial Intelligence (AI) models and systems from an adversarial perspective to uncover their vulnerabilities and build robust defenses. Seeking opportunities to contribute to innovative AI research or engineering roles that push the boundaries of what's possible.

EDUCATION

Binghamton University, Thomas J. Watson College of Engineering and Applied Science   **Binghamton, NY**
Doctor of Philosophy in Computer Engineering   *Expected May 2027*

Binghamton University, Thomas J. Watson College of Engineering and Applied Science   **Binghamton, NY**
Master of Science in Electrical and Computer Engineering   *May 2024*
Thesis: Evaluating the Adversarial Robustness of Perceptual Hashing Algorithms
Cumulative GPA: 3.97/4.00 | **Honors:** Excellence in Electrical and Computer Engineering Research

University of the West Indies, Mona   **Kingston, Jamaica**
Bachelor of Science in Electronics Engineering   *June 2021*
Cumulative GPA: 3.80/4.00 | **Honors:** First Class Honors

TECHNICAL SKILLS

Programming Languages: Python, C/C++, MATLAB, JavaScript, HTML, CSS
Machine Learning: PyTorch, TensorFlow, Scikit-learn, HuggingFace Transformers
Data Processing & Visualization: Pandas, NumPy, Matplotlib, OpenCV
Web Development & Databases: Flask, Streamlit, MongoDB, PostgreSQL
Hardware, Tools & Platforms: Raspberry Pi, Arduino, Linux, Git, Docker

PROFESSIONAL EXPERIENCE

Jamaica Artificial Intelligence Association   **Remote**
Machine Learning Researcher   *May 2024 - Present*
- Developed a method to programmatically generate a novel dataset of 10+ hours of Jamaican Patois audio and its corresponding transcriptions, addressing the language's low-resource challenges
- Used existing speech recognition models to generate an initial, often suboptimal, transcription of some audio then used a Large Language Model (GPT-4o) to correct the transcription and improve the overall data quality
- Used Huggingface Transformers to fine-tune a Whisper neural network model for speech recognition, achieving a Word Error Rate (WER) less than 30 upon final evaluation

Binghamton University, Department of Electrical and Computer Engineering   **Binghamton, NY**
Teaching Assistant   *August 2022 - May 2024*
- Facilitated 2 lab sessions for 90+ undergraduates, covering Electronics and Electrical Circuits, and provided one-on-one support through office hours.
- Evaluated students' lab reports, quizzes, and exams, and provided feedback to enhance students' understanding of the material

Huawei   **Kingston, Jamaica**
Wireless Engineer   *July 2021 - July 2022*
- Spearheaded the optimization, upgrade, and deployment of over 200 microwave and fiber-optic transmission links for telecommunications networks
- Conducted comprehensive post-upgrade monitoring and maintenance of the transmission links to ensure optimal network performance
- Developed web interfaces using HTML, CSS, JavaScript, and Python(Flask), to streamline network analysis and increased the efficiency of the network analysis process by 50%

UWI Mona Robotics   **Kingston, Jamaica**
Software Engineer   *August 2019 - May 2021*
- Developed autonomous navigation code in C++ for a robot, designed to compete in IEEE SoutheastCon 2020
- Integrated data from multiple sensors (LIDAR, Ultrasonic, IR) to enable robot localization and real-time navigation within the competition courses.
- Programmed actuator control systems to autonomously pick up and manipulate various objects, fulfilling competition-specific objectives.

RESEARCH EXPERIENCE

Binghamton University, Li Lab   **Binghamton, NY**
Doctoral Researcher (Evaluating Neural Image Compression)   *August 2024 - Present*
- Studying the adversarial robustness of Neural Image Compression (NIC) models
- Developed attack algorithms that can induce byte-level collisions between 2 semantically different images when they are compressed using NIC Algorithms. Achieved Attack Success Rate of 85%.
- Developing defense methods to protect NIC models from the vulnerabilities that were discovered.

Binghamton University, Li Lab   **Binghamton, NY**
Graduate Researcher (Evaluating the Adversarial Robustness of Perceptual Hashing Algorithms)   *August 2023 - May 2024*
- Studied the robustness of Perceptual Hashing Algorithms (PHAs) under hash evasion and hash inversion attacks
- Developed the Joint Soft-Label Hard-Label Attack (JSHA) algorithm to generate adversarial images that can evade detection by PHAs efficiently, and achieved Attack Success Rate (ASR) >90%
- Trained deep neural networks to synthesize images from their hash values to investigate the feasibility of hash inversion attacks
- Developed a random perturbation defense mechanism for PHAs that successfully reduces the ASR of the aforementioned attacks by >50%
- Accepted for presentation and publication at the 2024 Workshop for New Frontiers in Adversarial Machine Learning at the Conference for Neural Information Processing Systems (NeurIPS) 2024

PUBLICATIONS

Madden, J., Bhavsar, M., Dorje, L. and Li, X. (2024), "Robustness of Practical Perceptual Hashing Algorithms to Hash-Evasion and Hash-Inversion Attacks", *Conference on Neural Information Processing Systems (NeurIPS) 2024 - Workshop on New Frontiers in Adversarial Machine Learning (Accepted)*

Madden, J., Alli, K.S. and Falconer, L.. (2023), "An AI-Based Visual Navigation System for the Blind", *Industrial Engineering and Management Journal, Vol.2, No.1, June/July 2023, pp.4-14*

PROJECTS

Deep Learning and Automatic Differentiation Library
Project Developer
Tech Stack: Python, Numpy, Unix
- Designed and implemented a custom tensor-based autograd engine and neural network library from scratch, mirroring PyTorch's functionality and API
- Implemented common optimization algorithms (SGD, Adam), activation functions (ReLU, Sigmoid, Tanh) and neural network layers (Linear, Conv2d)
- Published this project as a Python Package so that anyone can download and use it free of cost

AI-Based Navigation System for the Blind
Undergraduate Thesis
Tech Stack: Python, C++, Tensorflow, OpenCV, Raspberry Pi, Arduino
- Designed and implemented an AI-enabled device aimed at enhancing mobility for blind/visually impaired people, leveraging machine learning and computer vision technologies.
- Leveraged object detection algorithms - with mAP score of 22 - and depth estimation algorithms - with 99% accuracy - to localize the user within their environment
- Developed a prediction algorithm that uses the localization data to determine the direction in which the user should walk

LEADERSHIP EXPERIENCE

Institute of Electrical and Electronics Engineers   **Kingston, Jamaica**
Student Chapter Vice-Chair   *Sept 2020 - May 2021*
Mona Engineering Society   **Kingston, Jamaica**
Electronics Engineering Student Representative   *Sept 2019 - June 2020*