HAORAN ZHANG

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EDUCATION

UNIVERSITY OF VIRGINIA Charlottesville, VA
Doctoral Candidate, Computer Engineering *May 2024*
Major Courses: *Computer Architecture, AI Hardware, Computer Engineering Pespectives, Human Computer Interaction*

DUKE UNIVERSITY Durham, NC
Master of Science, Computer Science *April 2024*
Overall GPA: 3.95
Major Courses: *Algorithms, Natural Language Processing, Computer Engineering & Artificial Neural Networks, Probabilistic Machine Learning, Data Science, Computer Vision, Graph-Matrix Analysis, and Cryo-EM Image Analysis*

THE GEORGE WASHINGTON UNIVERSITY Washington, DC
Bachelor of Science, Information Systems *May 2022*
Overall GPA: 3.95, Dean's List
Major Courses: *Algorithms and Analysis, Artificial Intelligence, Information Systems Security, Database Design and application, Mobile App Development, Web Applications Development, Web Analytics, Internet of Things Management*

RESEARCH EXPERIENCE

WATSON RESEARCH LAB – Wearable Spectroscopy on Biomarker Detection (lab) Charlottesville, VA
Doctoral Researcher *May 2024 – Present*
- Researched machine learning algorithms for real-time detection of multiple biomarkers (glucose, opioids etc.) from wearable device data, utilizing time-series models such as LSTM, transformers, and RNNs to enhance prediction
- Designed data structures and server architectures to efficiently process and analyze multi-channel wavelength time-series data (e.g., LED-400nm) from customized wearable biosensors, enabling seamless integration and data flow
- Developed *OpenSpectro*, an open-source platform that visualizes and optimizes spectroscopic biomarker profiles using a spectral attention model and curated biomarker database to improve PPG sensor performance

INFANTSEGRL – Fetus Brain MRI Motion Correction (paper) Atlanta, GA
Research Intern *Dec – Jan 2024*
- Authored a comprehensive paper reviewing latest fetal brain MRI motion correction methodologies and challenges
- Reviewed advanced algorithms motion correction, covering CNNs, LSTMs, Transformers, GANs, Diffusion Models
- Provided critical insights into the implications and future advancements in fetal MRI motion correction methods

DUKE CEI LAB - OOD Benchmark Enhancement (OpenOOD v1.5) (repo, paper, page) Durham, NC
Research Assistant *Sept – Mar 2023*
- Unified the OOD detection evaluation, improved full-spectrum OOD compared to *OpenOOD v*1 in terms of scalability and usability, ensured accurate, standardized and user-friendly evaluation of OOD methodologies
- Performed in-depth analysis of experimental results from 100+ recent research papers and conducted large-scale experiments employing nearly 40 methods on *ImageNet-1K* to extract significant and legible insights
- Designed an online leaderboard to track the state-of-the-art OOD works and a lightweight OOD evaluator online
- Contributed to the *OpenOOD v1.5* repo, co-authored the paper and admitted by NeurIPS 2023 – DistShift Workshop

GENERAL ROBOTICS LAB - LLM as Agent Memory Architecture (repo, slides, demo) Durham, NC
Research Assistant *Apr – Sep 2023*
- Innovatively utilized LLMs as memory architecture for agent control, enabling autonomous operation, learning from past, and decision-making in uncharted tasks, validated the agent's ability to self-navigate and acquire knowledge
- Generated 250K tokens from *GPT-3.5-Turbo* to explore a simulated world *MiniGrid*, engineered prompts to induce better decision making, experience summarization, tracked agent position, status and screenshot visually by wandb

- Designed a representation formulation which organically compose environment observations, agent status, past actions and experiences, limited the context length while conserving the information to the greatest extent
- Developed a training and evaluation pipeline for LLM-controlled agent exploration, customized agent class automating and optimizing data-driven decision-making in simulated environments under LLM's control

ECE661 COMP ENG ML - Knowledge Distillation Adversarial Context (repo, paper, poster) Durham, NC
Machine Learning Researcher *Sept – Jan 2023*

- Extensively explored various attack classes that deteriorate the performance of neural networks and scrutinized state-of-the-art adversarial training works including Student-Teacher Distillation, Teacher-Free and Self-Distillation
- Designed and developed an efficient Adversarial Training method employing Knowledge Distillation

CPS521 GRAPH-MATRIX - Digraph Clustering by Marginal Propagation (repo, paper, slides) Durham, NC
Graph Algorithm Researcher *Sept – Jan 2023*

- Proposed a novel Graph Clustering algorithm by Marginal Propagation on Directed Graph Dataset Email-EU Core, viewed the community detection as a semi-supervised learning task, generating clusters from marginal propagation

PUBLICATIONS

- H.Zhang *et al. OpenOOD v1.5: Enhanced Benchmark for Out-of-Distribution Detection*, DistShift - NeurIPS 2023
- H.Zhang, Y.Wang. *A Literature Review on Fetus Brain Motion Correction in MRI.* Draft, December, 2023
- H.Zhang, L.Zhuo, M.Kuo. *Knowledge Distillation in Adversarial Context*. Draft, December 2022
- H.Zhang. *Digraph Clustering by Digraph Clustering by Marginal Propagation*. Draft, Octoboer, 2022
- H.Zhang, A.Bartesaghi. *Atomic Modelling from Cryo-EM Density Maps*. Draft, September 2022

IT PROJECT EXPERIENCE

ECE564 MOBILE APP DEVELOPMENT – BlueDevil Bites: Restaurant Review App Clips (repo) Durham, NC
Mobile App Developer *Sept – Dec 2023*

- Architected and deployed an iOS App to view comments for all cafeterias located at the West Campus of Duke University, hosted on a Vapor server utilizing *AWS EC2* cloud platform and database supported by *SQLite*
- Integrated *MapKit* into the app and utilized Streamer API from Duke for agile data synchronization, guaranteed up-to-the-minute restaurant information, facilitated fast user-engagement via App Clips on either QR Codes or *NFC* Tags
- Adopted data-driven user interfaces by *SwiftUI*, ensured instantaneous update and display of reviews

CPS526 DATA SCIENCE - Strategic Insights From Elite CSGO Play Statistics (repo, slides, video) Durham, NC
Data Scientist *Sept – Dec 2023*

- Conducted a meticulous analysis of 122,411 elite gameplay snapshots from premier *CSGO* tournaments, applied neural network and *PCA*, correlating equipment usage with round outcomes, uncovered game-turning strategies
- Examined prevalent game strategies on the data, synthesized data-driven insights into actionable recommendations

ISTM4210 INFORMATION SYSTEMS CAPSTONE - Alpha Rent Solutions (repo, demo, doc) Washington, DC
Database Engineer *Jan – May 2022*

- Designed and implemented a *MySQL* database, analyzed and performed the data modeling based on business needs, drafted out entity-relationships diagrams, data streams charts, between renters, properties, rents, and various bills
- Blueprinted and coded User-Interface layouts and outlooks via a combination of *HTML*, *JavaScript*, *CSS*, balanced accessibility and aesthetics, reviewed and updated the database promptly when business needs alter or increase
- Implemented Object Oriented *PHP* to streamline the data query, modification, deletion, and status updates, enabled unique token registration links, automatically invoked troubleshooting linked with the *MAMP* server

ISTM4217 INTERNET OF THINGS - Recommend Movie Built on IMDB Reviews (repo, doc) Washington, DC
Data Analyst *Jan – May 2022*

- Executed data analysis on over a billion entries with 10 variables on IMDb Reviews Datasets from 2000 to 2020, built models including collaborative filtering (ALS), Natural Language Processing (*Word2Vec*), and Logistics Regression
- Implemented movie recommendations based on content-based filtering model, provided accurate and relevant Top 10 movie recommendations to each user, logistics classification of 70% accuracy (RMSE 1.15) on rating from 1-10

- Performed *TF-IDF* word frequency on over 2 million none-stop words, constructed similarity model which enabled pattern-matching of movies by keywords and movie similarity ranking by a customized set of movies as inputs

TECHNOLOGY SERVICES - Information Accessibility Research Association (repo, award, page) Shenzhen, China
Accessibility Engineer *Nov – Mar 2021*

- Independently designed and developed a Tritanope Accessibility Algorithm to optimize Web and Application color layout compliant to *WCAG 2.0* standards. Facilitated color-blinded individuals to use the applications efficiently
- Worked as the principal manager of Accessibility Defects by developing a series of data migration and triage scripts to achieve data integration, conducting Barrier-Free Technology Research by using *SQL* server and *SPSS*
- Optimized deficiency testing and regression progress efficiency up to 50% employing *Python* & *VBA* scripts, saving estimated labor costs $1,000 per month and enhancing both the accuracy of detection and error identification
- Awarded Outstanding Interns Award for the year 2020 for significant contributions to data migration and triage

SKILLS

Development Softwares: XCode, IntelliJ, Android Studio, MATLAB, Visual Studio Code, RStudio, SAS
Programming Languages: Swift, Java, Python, PHP, HTML, CSS, JavaScript, SAS, R, SQL
Python Experties: Sklearn, PyTorch, Numpy, Pygame, Gymnasium
Processing Software: 3D Slicer

PRESENTATIONS

- *OpenSpectro: An Open-Source Spectroscopic Profiling Platform*, 47th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Bella Center, Copenhagen, Denmark, May 2025
- *OpenOOD v1.5: Enhanced Benchmark for Out-of-Distribution Detection*, DistShift Workshop, Conference on Neural Information Processing Systems, Ernest N. Morial Convention Center, New Orleans, LA, December 2023

TRAINING

- Algorithms by Princeton University, Coursera
- Linear Algebra, MIT OpenCourseWare
- Internship in Accessibility Research Associaton

HONORS AND AWARDS

- University of Virginia, PhD Provost Fellowship of the Year 2024
- George Washington University, Outstanding Undergraduate Student of the Year 2022
- George Washington University, Beta Gamma Sigma Honor Society Recognition of the Class 2022
- George Washington University, Dean's List of the Year 2020, 2021, 2022
- Information Accessibility Association, Outstanding Intern Award of the Year 2020

REFERENCES

- Prof. Amanda Watson: Assistant Professor of Electrical and Computer Engineering & Computer Science, University of Virginia, Charlottesville, Virginia, United States
  Email: AaWatson@virginia.edu
  Homepage: https://amandawatson.org/

- Prof. Yiran Chen: John Cocke Distinguished Professor of Electrical and Computer Engineering, Duke University, North Carolina, United States
  Email: Yiran.Chen@duke.edu
  Homepage: cei.pratt.duke.edu

- Prof. Maciej A. Mazurowski: Associate Professor of Radiology, Electrical and Computer Engineering, Biostatistics and Bioinformatics, and Computer Science, Duke University, North Carolina, United States
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  Homepage: https://sites.duke.edu/mazurowski/research/

- Prof. Xiaobai Sun: Professor of Computer Science, Duke University, North Carolina, United States
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  Homepage: ieeexplore.ieee.org/author/37308257300

- Prof. Subhasish Dasgupta: Chair of Information Systems & Technology Management, Assocaite Professor of Information Systems and Technology Management, George Washington University,Washington D.C., United States
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  Homepage: business.gwu.edu/subhasish-dasgupta