Yuchen CAO

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EDUCATION

Duke University   Durham, NC
- **M.S.** in Computer Science   **GPA:** 4.00/4.00   May 2024
- **Relevant Coursework:** Algorithm of Machine Learning(A+), Natural Language Processing(A+), Brain-Computer Interface (A+), Data Analysis at Large Scale(A+), Theory of Reinforcement Learning, Generative Model, Robot Learning

University of California, Los Angeles (UCLA)   Los Angeles, CA
- *Scholarship Program of Jiangsu Province*   July 2019 - Aug. 2019
- **Relevant Coursework:** Artificial Intelligence and Machine Learning(A+)

Nanjing University of Posts and Telecommunications (NJUPT)   Nanjing, China
- **B.Eng.** in Computer Science and Technology   **GPA:** 3.86/4.00 (WES)   **Major GPA:** 3.93/4.00 (WES)   June 2021
- **Relevant Coursework:** Compiler Principles(100), Algorithms(99), Database Systems(97), Computer Graphics(97)
- **Online Courses:** Deep Learning.ai, Machine Learning Foundations, Machine Learning Techniques, Linear Algebra

RESEARCH EXPERIENCE

McGurk Effect Research (with MATLAB, Psychtoolbox, Python)   Durham, NC
Research Assistant, Duke University (Supervised by Professor Jennifer Groh)   Jan. 2023 - Present
- Led an individual interdisciplinary research project at the intersection of computer science and brain science, based on the McGurk effect, an illusion showing visual stimuli can alter auditory perception, to probe human multi-modal perception
- Developed video stimuli that can elicit the McGurk effect on subjects with a 100% success rate, exceeding existing stimuli
- Engineered a comprehensive system integrating hardware and software from scratch, including an eye tracker and in-ear microphones, coupled with Psychtoolbox and JACK for efficient data capture in a sound-proof booth
- Executed end-to-end experimental procedures with 15 participants, involving script writing, participant recruitment, and ear-canal sound data collection
- Applying interdisciplinary analytical methods, including sliding window alignment, Mann-Whitney U test, and Fast Fourier Transform (FFT), for precise data analysis and visualization, to figure out what is inputted to the brain for processing

Data-efficient Robust Single-life Reinforcement Learning (with Python, Pytorch)   Durham, NC
Researcher, Duke University (Supervised by Professor Pan Xu)   Oct. 2023 - Present
- Proposed a novel fine-tuning algorithm in Reinforcement Learning, emphasizing robustness against dynamics change and data efficiency, adaptable to real-world single-life environment
- Conducting comprehensive simulation tests to validate the algorithm's efficacy using the OpenAI Gym environment

Energy Efficiency Evaluation and Prediction for Large-scale Cloud Data Centers (with Python)   Nanjing, China
Research Assistant, NJUPT (Supervised by Professor Yun Li, Undergraduate Thesis)   Dec. 2018 - June 2021
- Collaborated with ten people of different levels as the only undergraduate student to develop methods to evaluate and predict the energy efficiency of large-scale cloud data centers
- Conducted energy consumption modeling for servers and Docker containers, built time-series models for CPU-intensive, memory-intensive, and IO-intensive task flows, and analyzed energy usage across memory, CPU, and hard disks
- Implemented OpenStack and Docker systems, simulating cloud data center environments, and collected data on energy usage and hardware specifications
- Specialized in hard disk failure prediction, applying techniques such as undersampling, automated machine learning, and online learning to address proposed issues in this task like data imbalance, conceptual drift, and feature divergence, achieving a prediction accuracy of 90.9% and a Matthews correlation coefficient (MCC) of 80.3%
- Received excellent undergraduate thesis award (Top 5%) for products based on related research results

PROJECT EXPERIENCE

Emotional Response Detection through Brain-Computer Interface (with PyTorch, BCI2000)   Durham, NC
Team Leader, Brain-Computer Interface (BCI) Course design at Duke University   Mar. 2023 - May 2023
- Conducted EEG data collection using non-invasive P300 brain-computer interface and BCI2000 systems, capturing subjects' emotional responses to images from different emotional categories in the Geneva Affective PicturE Database (GAPED)
- Built and optimized deep learning models for wavelet analysis, incorporating GRU and LSTM architectures, achieving an F1 score of 0.72 in differentiating reactions to pleasant and unpleasant stimuli

Mini Amazon (with C++, Python, Django, PostgreSQL, Docker)   Durham, NC
Team Leader, Engineering Robust Server Software course design at Duke University   Mar. 2023 – Apr. 2023
- Led the development of a multi-threaded e-commerce platform simulating Amazon, encompassing both front-end and back-end functionalities, including product browsing, cart management, order placement, and status tracking
- Realized system connection with 2 UPS groups to simulate real-world website, employed Google Protocol Buffer Messages for efficient inter-system communication and materialized features like order dispatch and warehouse management
- Packaged the application using Docker Compose for streamlined deployment, and facilitated external access via Nginx

Common Sense Model Distillation Research (with Pytorch, Python, Numpy, Pandas)   Durham, NC
Team Leader, Natural Language Processing (NLP) course design at Duke University   Oct. 2022 - Dec. 2022
- Distilled 15 student models, including GPT2 and GPT, varying in size and architecture, from a large teacher language model, using corpus expansion and filtering techniques in Symbolic Knowledge Distillation, in order to determine the optimal design of a smaller language model that captures common-sense knowledge and to improve it
- Led a six-person team for manual evaluation of model outputs, and innovatively employed a critic model based on RoBERTa to automate this evaluation process and to enhance beam search performance, achieving a 72% acceptance rate improvement

COMPETITION EXPERIENCE

Design and Optimization of Triangle Counting Algorithm in Large-scale Graph Data (with C++)   Nanjing, China
Lead Developer, Big Data & Computational Intelligence Contest (China Computer Federation)   Sept. 2019 - Dec. 2019
- Developed an efficient algorithm for counting triangles in large-scale graphs (40G), improving computation speed by 95% using CPU (OpenMP) and GPU (CUDA) parallel computing with limited resources (60G memory, 16G graphics card)
- Employed Compressed Sparse Rows format for graph representation, transformed the Triangle Counting Forward Algorithm into a parallel intersection algorithm based on Single Instruction Multiple Data on GPUs and devised slicing and crossing techniques for handling memory limitations
- Optimized GPU resource utilization through node-parallelism, multi-block delay hiding, and shared memory with atomic operations, ensuring both computational speed and accuracy

Rescue Simulator (with Java)   Nanjing, China
Team Member, 2019 RoboCup China Open   Feb. 2019 - April 2019
- Developed rescue robot programs for the simulation of post-earthquake urban environment, focusing on agent behavior, task execution, and communication within varied roles, including firefighter, police, ambulance, etc.
- Created an efficient task allocation strategy for firefighter agents based on distance to fires, employing the Hungarian Algorithm in the central agent to enhance command on those agents, improving firefighting efforts of 10% performance
- Performed extensive code refactoring to align with new competition standards, introduced central agents, and implemented a pre-computation process, resulting in a clearer system architecture and improved computational efficiency

International Collegiate Programming Contest (ACM-ICPC, with C++)   China
Team leader, coached by Professor Zhi Chen at NJUPT   Oct. 2017 – June 2019
- Led a three-person group coding with only one computer to solve problems related to various algorithms and math knowledge within five hours, allocated tasks to optimize problem-solving efficiency during contests
- Coordinated and frequently engaged in rigorous training sessions, mastered diverse algorithmic knowledge in domains including dynamic programming, graph theory, data structures, etc., through practices

SOCIAL WORK ACTIVITIES

Head & Instructor of Algorithm Study Group   Nanjing, China
Science and Technology Association, School of Computer Science, NJUPT   June 2018 - Sept. 2020
- Founded and led an algorithm study group to help students from diverse backgrounds, especially from underrepresented communities, engaged in publicity recruitment, and grew the team to over 50 members
- Conducted weekly programming and algorithmic lessons for the entire school, designed and organized school-level programming competitions fostering academic inclusiveness and a deeper understanding of algorithms among students

Volunteer Lecturer, ICPC (International Collegiate Programming Contest) School Team   Nanjing, China
NJUPT   Feb. 2019 – June 2019
- Organized and managed training sessions, meticulously selecting problem sets and coordinating contest logistics
- Conducted both online and offline lectures and Q&A sessions to support team members' understanding and progress

AWARDS & ACHIEVEMENTS

Excellent Undergraduate Thesis Award (Top 5%), NJUPT	2021
Elite Student (Top 1%), NJUPT	2019&2020
Enterprise Scholarship (Top 2%), NJUPT	2019
Excellent Social Work Award, NJUPT	2018&2020
Top 3%, Big Data & Computational Intelligence Contest	2019
Champion (First Prize), RoboCup China Open	2019
Silver Medal, The ACM-ICPC Asia Regional Contest	2018
Bronze Medal, China Collegiate Programming Contest	2018

CORE COMPETENCIES

Programming Language: C, C++, Python, Java, Lisp, Assembly Language, MATLAB, JavaScript, Go, Ruby, Rust
Tool: Docker, OpenStack, Git, Unix/Linux, Qt, Visual Studio Code, MySQL, Psychtoolbox, BCI2000
Machine Learning: TensorFlow, Scikit-learn, PyTorch, Keras,torch-nlp, OpenCV, pillow, Hugging Face