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# CHENGRU ZOU

400 Dowman Dr, Atlanta, GA 30322 • +1 (404) 954-0423  
eric.zou@emory.edu • GitHub: @EricZou007 • Personal Web: @EZ

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## EDUCATION

### BS in Applied Mathematics and Statistics

Atlanta, GA Aug 2022 – May 2026

Emory University, Emory College of Art and Science

- Cumulative GPA: 3.96/4.0; Honor: Dean's List
- Expected Sum Cum Laude highest honor graduation (May 2026)

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## SKILLS AND INTERESTS

**Research Interests:** Scientific Machine Learning, Inverse Problem, Numerical Optimization

**Skills:** Python, Pytorch, Matlab, R, SQL, Git, Java, C, HTML

**Toolkit:** Docker, SSH, AWS

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## PUBLICATIONS

- **Chengru Zou**, Yuanzhe Xi, Zichao Wendy Di. “Joint Reconstruction of X-ray Ptychography and X-ray Fluorescence” (Preparing submission).
- Erise He, Zhijiang Ye, **Chengru Zou**. “Quantitative Hybrid Structure Analysis of Equipment Wear under Dynamic Pressure based on Digital Intelligent Algorithm.” *Proceedings of the IEEE International Conference on Data Science and Intelligent Systems (ICDSIS)*, 2025, pp. 1–7. DOI: [link].

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## RESEARCH EXPERIENCE

### Student Research Assistant

Atlanta, GA Aug 2024 – Present

Argonne National Laboratory & Emory Math Department

- Designed a physics-informed joint reconstruction framework for X-ray ptychography and fluorescence tomography under the guidance of Dr. Wendy Di and Dr. Yuanzhe Xi.
- Analyzed optimization behavior via loss surface and eigenspectrum to characterize the highly nonconvex objectives of both single and multi-modality reconstructions.
- Implemented (L-BFGS, Truncated Newton–Krylov, NLTGCR) with robust line search and stopping criteria in MATLAB for non-convex optimization.
- Demonstrated up to 50% lower MSE and 10% lower loss versus single-modality baselines on standard benchmarks; validated across overlap settings and noise levels.
- Preparing manuscript for submission to *SIAM Journal on Imaging Sciences*.

### Student Research Assistant

Atlanta, GA July 2024 – Present

MIT-IBM Watson AI Lab

- Developed *Multilevel Block Adapter (MBA)* for parameter-efficient fine-tuning, extending LoRA with multilevel and spectral clustering under the guidance of Dr. Jie Chen.
- Performed algorithmic analysis to derive task-specific learning-rate schedules for MBA.
- Implemented reproducible cloud experiments (SSH/Docker), published on Github with saved checkpoints and scripts.
- Reduced adapter parameters on RoBERTa-base/GPT-2 from 400k to 140k and achieved 2% higher scores on GLUE and E2E datasets.

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## PROJECTS

### AI Chatbot Agent Development

Atlanta, GA June 2024 – Aug 2024

Emory Center for AI Learning, Emory University

- Built a graphical RAG LLM agent for Emory student course selection using Neo4j graphical database and LangChain prompt engineering.
- Improved query accuracy for graphical data, benefiting hundreds of Emory students for course selection.
- Published the report and gave a presentation in the Emory QTM department symposium.

**Atlanta Affordable Housing***Atlanta, GA Sep 2023 – Jan 2024**City of Decatur: Affordable Housing Commission*

- Collaborated with group leader and members to address housing complaints in partnership with the City of Decatur, GA.
- Utilized Geocoding and GIS to model racial and housing rate distributions in Decatur.
- Presented findings using Tableau, aiding over 100 local residents in making informed housing decisions.

**AWARDS AND GRANTS****Mathematical Contest in Modeling (MCM), Meritorious Award***May 2025*

Modeled stair erosion to estimate construction age under the supervision of Dr. Alessandro Veneziani; ranked in the top 5% among 20,000+ participating teams; published an award-winning paper at the *IEEE* conference.

**Emory Pathway Global Internship Grant***May 2024*

Awarded \$4,000 for outstanding summer internship performance

**DataFest Competition, Finalist***April 2024*

Analyzed real-life raw data from CourseKata Company; provided consulting advice that increased study efficiency for over 1,000 students.

**Emory Phi Sigma, Member***May 2023*

Recognition for outstanding academic achievement

**IGEM Gold Medal***May 2021*

Merit for excellent work in medical engineering and business advertisement

**PROFESSIONAL SOCIETY MEMBERSHIP****Atlanta Preconditioning 2024***Student Volunteer*

Helped to hold the academic conference at the Atlanta Area

**Atlanta Mathematics of Data Science Bootcamp***Attendee*

Explored a new algorithm (Lipschitz-regularized  $\chi^2$ -GAN) by combining  $\chi^2$ -GAN and WGAN.

**Atlanta Science Festival – Exploration Exposition***Student Volunteer*

Promoted mathematical knowledge to the public on behalf of the Emory Mathematics Department

**ADDITIONAL**

**Activities:** Emory China Care Club, ECSA

**Hobbies:** Chinese go, Badminton