Yulong Liu

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Research Interests

Computational Mechanics | **Artificial Intelligence** | **Implicit neural representation** | **Poromechanics**

Education

Ph.D. in Geophysics – Cornell University 2024 – Present
B.S. in Mining Engineering – Northeastern University 2024

Research Experience

Ph.D. Student – Dept. of Earth and Atmospheric Sciences, Cornell University Aug. 2024 – Present
Advisor: Chloé Arson *Ithaca, NY*
Project: Computational mechanics, implicit neural representations, and poromechanics for coupled multiphysics problems in Earth science

- Develop computational mechanics models for subsurface systems using the MOOSE finite element framework.
- Build physics-informed neural networks, implicit neural representations, and operator-learning surrogates for geometry-aware, physics-aware prediction in Earth science and mechanics problems.
- Study poromechanics and multiscale transport in porous subsurface media, with growing interests in homogenization theory and surrogate modeling.

Undergraduate Researcher – Northeastern University (CN) Sep. 2020 – Jun. 2024
B.S. in Mining Engineering *Shenyang, China*
Thesis: A Unified Model for Microseismic Signal Classification and Arrival-Time Picking Based on Deep Learning

- Conducted undergraduate research in mining engineering on hydraulic fracturing, triaxial testing, AI-driven microseismic signal processing, and TBMs.
- Developed deep-learning-based approaches for microseismic signal classification and arrival-time picking.
- Received the Outstanding Thesis Award for thesis research, and National Scholarship for overall performance.

Publications

Journal, Conference, and Preprint Papers

- **Yulong Liu**[*,†], Zhenghan Song. *CodeMOOSE: Multi-Agent Collaborative Framework for Multiphysics MOOSE Language*. Under review at NeurIPS 2026.
- **Yulong Liu**, Jonah Botvinick-Greenhouse, Yunan Yang, Chloé Arson. *Operator Learning Surrogate Modeling of Hydraulically Fractured Geothermal Injection-Production Systems: A Cornell Case Study*. ARMA 2026, Tucson.
- **Yulong Liu**, Chloé Arson. *A Physics-Informed Neural Network for Modeling Pressurized Cavities of Arbitrary Smooth Shape Embedded in Heterogeneous Rock*. Research Square preprint, 2026. Currently under review.
- M. Belachew, **Yulong Liu**, J. D. Frost, Chloé Arson. *Numerical Assessment of Plasticity Development and Energy Expenditure of Ant-Like Microtunnelling. Tunnelling and Underground Space Technology*, 172, 107501, 2026.
- **Yulong Liu**, Chloé Arson. *Physics-Informed Neural Network Surrogate Modeling of Pressurized Cavity in Homogeneous and Bilayered Media*. ARMA US Rock Mechanics/Geomechanics Symposium, D022S018R006, 2025.

Thesis

- **Yulong Liu**. *A Unified Model for Microseismic Signal Classification and Arrival-Time Picking Based on Deep Learning*. Undergraduate thesis, Northeastern University, 2024.

[*] Co-first author [†] Corresponding author

Conferences and Presentations

Oral presentation, 60th US Rock Mechanics/Geomechanics Symposium (ARMA) Jun. 2026
American Rock Mechanics Association (ARMA), Tucson, AZ, USA

Poster presentation, Cornell CEE Graduate Research Symposium Apr. 2026
Cornell University, Ithaca, NY, USA

"Physics-Informed Optimization of Heterogeneous Rock Systems" Dec. 2025
Invited seminar – Southwest Petroleum University seminar series, Chengdu, China

Poster presentation, 59th US Rock Mechanics/Geomechanics Symposium (ARMA) Jun. 2025
American Rock Mechanics Association (ARMA), Santa Fe, NM, USA

Fellowships and Awards

Estwing Hammer Award – Outstanding EAS Graduate Student of 2024, Cornell University 2025
Cornell University Travel Grant, Cornell University 2025
Outstanding Thesis, Northeastern University 2024
National Scholarship, Ministry of Education, China 2024
First Class Scholarship, Northeastern University 2023
Autumn Scholarship, Northeastern University 2022
Golden Seed Scholarship, Northeastern University 2022

Academic Service

- Reviewer, *Rock Mechanics and Rock Engineering*
- Reviewer, *Computers and Geotechnics*
- Reviewer, *International Conference on Artificial Neural Networks 2026*

Skills

Programming & Scientific Computing: Python, C++, R, MOOSE finite element framework

Modeling & Simulation: finite element modeling, multiphysics simulation, CAD (e.g., AutoCAD, SolidWorks)

Machine Learning: Machine learning for PDEs, implicit neural representations (INRs), surrogate modeling, data-driven modeling for scientific computing

Experimental Methods: rock mechanics testing (e.g., triaxial compression), laboratory instrumentation

Research Areas: computational mechanics, poromechanics, multiscale transport in porous media

Scientific Writing: LaTeX / Overleaf

Professional Memberships

- Member, American Rock Mechanics Association (ARMA), 2025–Present
- Member, International Society for Rock Mechanics and Rock Engineering (ISRM), 2025–Present
- Member, Chinese Society for Rock Mechanics and Engineering (CSRME), 2024–Present
- Member, Geothermal Rising, 2025–Present