ZIYI "FRANCIS" YIN

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Address: 756 West Peachtree Street NW, CODA S1363C, Atlanta, GA 30308
Current position: PhD candidate at Georgia Institute of Technology

Last update: Dec 2023

EDUCATION

Georgia Institute of Technology — Atlanta, GA
Doctor of Philosophy in Computational Science and Engineering — Aug 2019 - Present
Master of Science in Computational Science and Engineering — May 2023
Advisor: Felix J. Herrmann
Committee members: Edmond Chow, Nisha Chandramoorthy, Zhigang Peng, Olav Møyner

Emory University — Atlanta, GA
Bachelor of Science in Mathematics and Computer Science — May 2019
Advisor: James G. Nagy

RESEARCH INTERESTS

Scientific Machine Learning, High Performance Computing, Inverse Problems, Uncertainty Quantification

WORK EXPERIENCE

Georgia Institute of Technology — Atlanta, GA
Graduate Research Assistant — Aug 2019 - Present

Chevron Corporation — Houston, TX
Research Intern — May 2023 - Aug 2023

Pactera — Dalian, China
AI intern — May 2019 - Aug 2019

Emory University — Atlanta, GA
Research Assistant — May 2018 - May 2019

ACADEMIC EXPERIENCE

Program committee
AAAI 2023 Fall symposium on Artificial Intelligence and Climate

Session chair
International Meeting for Applied Geoscience and Energy 2023 – *MLDA 5 oral session*

Journal reviewer
Geophysics
Geophysical Prospecting
Geoscientific Model Development
IEEE Transactions on Geoscience and Remote Sensing
Journal of Applied Geophysics
Journal of Geophysics and Engineering
Journal of Geophysical Research: Solid Earth
Journal of Open Research Software
Journal of Open Source Software
Pure and Applied Geophysics

Conference proceeding reviewer
International Meeting for Applied Geoscience and Energy 2023
AAAI 2023 Fall symposium on Artificial Intelligence and Climate
SciMLCon 2022

Award reviewer
Georgia Tech President's Undergraduate Research Award 2022, 2023

LEADERSHIP EXPERIENCE

Georgia Institute of Technology Geophysical Society — Atlanta, GA
President — Oct 2020 - Sep 2022
Secretary — Nov 2019 - Oct 2020

Office of Undergraduate Studies, Emory University — Atlanta, GA
Academic Fellow — Aug 2018 - May 2019

TEACHING EXPERIENCE

Georgia Institute of Technology — Atlanta, GA
Teaching Assistant, Seismic Monitoring CO_2 Storage — Spring 2022
Head Teaching Assistant, Computational Data Analysis — Fall 2021
Teaching Assistant, Exploration Seismology — Spring 2021
Teaching Assistant, Iterative Methods for Systems of Equations — Fall 2020

Emory University — Atlanta, GA
Teaching Assistant, Probability and Statistics I & II — Fall 2018, Spring 2019
Teaching Assistant, Foundation of Mathematics — Summer & Fall 2018, Spring 2019

HONORS AND AWARDS

2022 IMAGE's Student Oral Paper Honorable Mention — Apr 2023
SEG Technical Program Registration grant — Aug 2021
SEG/Chevron Student Leadership Symposium travel grant — Jun 2020
Graduate with Highest Honors (*summa cum laude*), Emory University — May 2019
Phi Beta Kappa Honor Society Membership — Apr 2019
Dean's List, Emory University — Aug 2017 - May 2019

GRANTS

SEG Field Camp grant ($1000) — 2022
Studying 1886 Earthquake at Summerville, South Carolina – Seismic Nodal Deployment in the Field

SKILLS

Languages: Julia, Python, MATLAB, Java, C/C++, Bash, SQL, PHP, R, MPI
Machine Learning Libraries: PyTorch, Tensorflow, JAX, Flux.jl
Cluster/Cloud Service Platforms: Slurm, Amazon Web Services (AWS), Microsoft Azure
Document Preparation Systems: Markdown, LaTeX, html

PREPRINT

- **Ziyi Yin***, Rafael Orozco*, Mathias Louboutin, and Felix J. Herrmann. "WISE: full-Waveform variational Inference via Subsurface Extensions". Dec 2023.

* denotes equal contribution.

JOURNAL PUBLICATIONS

- **Ziyi Yin**, Rafael Orozco, Mathias Louboutin, and Felix J. Herrmann. "Solving multiphysics-based inverse problems with learned surrogates and constraints". Oct 2023. In: *Advanced Modeling and Simulation in Engineering Sciences*. DOI: 10.1186/s40323-023-00252-0.
- Mathias Louboutin*, **Ziyi Yin***, Rafael Orozco, Thomas J. Grady II, Ali Siahkoohi, Gabrio Rizzuti, Philipp A. Witte, Olav Møyner, Gerard J. Gorman, and Felix J. Herrmann. "Learned multiphysics inversion with differentiable programming and machine learning". Jul 2023. In: *The Leading Edge*. DOI: 10.1190/tle42070474.1.
- Thomas J. Grady II, Rishi Khan, Mathias Louboutin, **Ziyi Yin**, Philipp A. Witte, Ranveer Chandra, Russell J. Hewett, and Felix J. Herrmann. "Model-Parallel Fourier Neural Operators as Learned Surrogates for Large-Scale Parametric PDEs". Jun 2023. In: *Computers & Geosciences*. DOI: 10.1016/j.cageo.2023.105402.
- Yijun Zhang, **Ziyi Yin**, Oscar Lopez, Ali Siahkoohi, Mathias Louboutin, Rajiv Kumar, and Felix J. Herrmann. "Optimized time-lapse acquisition design via spectral gap ratio minimization". Apr 2023. In: *GEOPHYSICS*. DOI: 10.1190/geo2023-0024.1.
- **Ziyi Yin**, Huseyin Tuna Erdinc, Abhinav Prakash Gahlot, Mathias Louboutin, and Felix J. Herrmann. "Derisking geologic carbon storage from high-resolution time-lapse seismic to explainable leakage detection". Jan 2023. In: *The Leading Edge*. DOI: 10.1190/tle42010069.1.

CONFERENCE PROCEEDINGS

- Abhinav Prakash Gahlot, Huseyin Tuna Erdinc, Rafael Orozco, **Ziyi Yin**, Felix J. Herrmann. "Inference of CO2 flow patterns – a feasibility study". Oct 2023. In: *NeurIPS 2023 Workshop - Tackling Climate Change with Machine Learning*. DOI: 10.48550/arXiv.2311.00290. Spotlight.
- Yijun Zhang*, **Ziyi Yin***, Oscar Lopez, Ali Siahkoohi, Mathias Louboutin, and Felix J. Herrmann. "3D seismic survey design by maximizing the spectral gap". Aug 2023. In: *Third International Meeting for Applied Geoscience & Energy Expanded Abstracts*. DOI: 10.1190/image2023-3895546.1.
- Huseyin Tuna Erdinc*, Abhinav Prakash Gahlot*, **Ziyi Yin**, Mathias Louboutin, and Felix J. Herrmann. "De-risking Carbon Capture and Sequestration with Explainable CO2 Leakage Detection in Time-lapse Seismic Monitoring Images". Nov 2022. In: *AAAI 2022 Fall Symposium - The Role of AI in Responding to Climate Challenges*. DOI: 10.48550/arXiv.2212.08596.
- **Ziyi Yin**, Ali Siahkoohi, Mathias Louboutin, and Felix J. Herrmann. "Learned coupled inversion for carbon sequestration monitoring and forecasting with Fourier neural operators". Aug 2022. In: *Second International Meeting for Applied Geoscience & Energy Expanded Abstracts*. DOI: 10.1190/image2022-3722848.1. Student oral paper honorable mention.
- Mathias Louboutin, Philipp A. Witte, Ali Siahkoohi, Gabrio Rizzuti, **Ziyi Yin**, Rafael Orozco, and Felix J. Herrmann. "Accelerating innovation with software abstractions for scalable computational geophysics". Aug 2022. In: *Second International Meeting for Applied Geoscience & Energy Expanded Abstracts*. DOI: 10.1190/image2022-3750561.1.
- Yijun Zhang, Mathias Louboutin, Ali Siahkoohi, **Ziyi Yin**, Rajiv Kumar and Felix J. Herrmann. "A simulation-free seismic survey design by maximizing the spectral gap". Aug 2022. In: *Second International Meeting for Applied Geoscience & Energy Expanded Abstracts*. DOI: 10.1190/image2022-3751690.1.
- **Ziyi Yin**, Mathias Louboutin, Felix J. Herrmann. "Compressive time-lapse seismic monitoring of carbon storage and sequestration with the joint recovery model". Sep 2021. In: *First International Meeting for Applied Geoscience & Energy Expanded Abstracts*. DOI: 10.1190/segam2021-3569087.1.

- **Ziyi Yin**, Rafael Orozco, Philipp A. Witte, Mathias Louboutin, Gabrio Rizzuti, and Felix J. Herrmann. "Extended source imaging, a unifying framework for seismic & medical imaging". Sep 2020. In: *SEG Technical Program Expanded Abstracts 2020*. DOI: 10.1190/segam2020-3426999.1.

CONFERENCE PRESENTATIONS

- **Ziyi Yin**, Mathias Louboutin, Olav Møyner, and Felix J. Herrmann. "Coupled physics inversion for geological carbon storage monitoring". Aug 2023. In: *Third International Meeting for Applied Geoscience & Energy*.
- Ting-ying Yu, Abhinav Prakash Gahlot, Rafael Orozco, **Ziyi Yin**, Mathias Louboutin, and Felix J. Herrmann. "Monitoring subsurface CO2 plumes with sequential Bayesian inference". Aug 2023. In: *Third International Meeting for Applied Geoscience & Energy*.
- **Ziyi Yin**, Rafael Orozco, Mathias Louboutin, Ali Siahkoohi, and Felix J. Herrmann. "Uncertainty-aware time-lapse monitoring of geological carbon storage with learned surrogates". Jun 2023.
- Huseyin Tuna Erdinc, Abhinav Prakash Gahlot, **Ziyi Yin**, Mathias Louboutin, and Felix J. Herrmann. "Derisking geological storage with simulation-based seismic monitoring design and machine learning". Apr 2023.
- Felix J. Herrmann, Mathias Louboutin, Thomas J. Grady II, **Ziyi Yin**, and Rishi Khan. "The Next Step: Interoperable Domain-Specific Programming". Feb 2023.
- Mathias Louboutin, Ali Siahkoohi, **Ziyi Yin**, Rafael Orozco, Thomas J. Grady II, Yijun Zhang, Philipp A. Witte, Gabrio Rizzuti, and Felix J. Herrmann. "Abstractions for at-scale seismic inversion". Mar 2022.
- Yuxiao Ren, Philipp A. Witte, Ali Siahkoohi, Mathias Louboutin, **Ziyi Yin**, and Felix J. Herrmann. "Seismic velocity inversion and uncertainty quantification using conditional normalizing flows". Dec 2021.
- Felix J. Herrmann, Mathias Louboutin, **Ziyi Yin**, and Philipp A. Witte. "Low-cost time-lapse seismic imaging of CCS with the joint recovery model". Oct 2021.
- Mathias Louboutin, **Ziyi Yin**, Yijun Zhang, and Felix J. Herrmann. "Sparsity promoting least-squares migration for long offset sparse OBN". Oct 2020.

THESIS

- **Ziyi Yin**. "Edge Detection and Enriched Subspaces". May 2019. In: *Undergraduate honors thesis for Bachelor of Sciences with Highest Honors at Emory University*. URL: https://etd.library.emory.edu/concern/etds/7w62f916x?locale=en.

PRESENTATIONS

- "WISE: Full-waveform Inference with Subsurface Extensions". Nov 2023. In: *ML4Seismic Partners Meeting 2023*.
- "End-to-end permeability inversion from prestack time-lapse seismic data: a case study on Compass model". Nov 2023. In: *ML4Seismic Partners Meeting 2023*.
- "Monitoring subsurface CO2 plumes with learned sequential Bayesian inference" (*contributed*). Nov 2023.
- "Large-scale parametric PDE approximations with model-parallel Fourier neural operators" (*contributed*). Nov 2023.
- "Time-lapse seismic monitoring of geological carbon storage with the nonlinear joint recovery model" (*contributed*). Nov 2023. In: *ML4Seismic Partners Meeting 2023*.

- "Maximizing CO2 injectivity within fracture pressure" (*contributed*). Nov 2023. In: *ML4Seismic Partners Meeting 2023*.
- "Solving PDE-based inverse problems with learned surrogates and constraints". Nov 2023. In: *HOTCSE Seminar*.
- "Introduction to Seismic Laboratory for Imaging and Modeling". Nov 2023. In: *CSE Student Recruiting Event 2023*.
- "Uncertainty-aware time-lapse CO2 monitoring with learned end-to-end inversion". Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Simulation-based framework for geological carbon storage monitoring". Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Amortized velocity continuation with Fourier neural operators". Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Time-lapse seismic survey design by maximizing the spectral gap" (*contributed*). Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Effective scaling of numerical surrogates via domain-decomposed Fourier neural operators" (*contributed*). Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "ML4Seismic open-source software: updates and developments" (*contributed*). Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "De-risking GCS projects with explainable CO2 leakage detection in time-lapse seismic images" (*contributed*). Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Monitoring with sequential Bayesian inference" (*contributed*). Nov 2022. In: *ML4Seismic Partners Meeting 2022*.
- "Julia for Geoscience". Apr 2022. In: *Transform 2022*.
- "Improved seismic monitoring of CO2 sequestration with the weighted joint recovery model". In: *ML4Seismic Partners Meeting 2021*. Nov 2021.
- "Low-cost & robust seismic monitoring of carbon storage and sequestration with the joint recovery model". In: *Georgia Tech Geophysics Seminar*. Sep 2021.
- "Edge Detection and Enriched Subspaces". In: *Undergraduate honors thesis defense*. April 2019.