

# ZIYI “FRANCIS” YIN

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Current position: PhD candidate at Georgia Institute of Technology

## EDUCATION

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### 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

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

## WORK EXPERIENCE

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### 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

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### 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

The Open Rheumatology Journal

## Conference proceeding reviewer

ICLR 2024 workshop on AI4DifferentialEquations

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

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### Georgia Institute of Technology Geophysical Society

*President*

*Secretary*

Atlanta, GA

Oct 2020 - Sep 2022

Nov 2019 - Oct 2020

### Office of Undergraduate Studies, Emory University

*Academic Fellow*

Atlanta, GA

Aug 2018 - May 2019

## TEACHING EXPERIENCE

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### Georgia Institute of Technology

*Teaching Assistant*, Seismic Monitoring CO<sub>2</sub> Storage

*Head Teaching Assistant*, Computational Data Analysis

*Teaching Assistant*, Exploration Seismology

*Teaching Assistant*, Iterative Methods for Systems of Equations

Atlanta, GA

Spring 2022

Fall 2021

Spring 2021

Fall 2020

### Emory University

*Teaching Assistant*, Probability and Statistics I & II

*Teaching Assistant*, Foundation of Mathematics

Atlanta, GA

Fall 2018, Spring 2019

Summer & Fall 2018, Spring 2019

## HONORS AND AWARDS

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2022 IMAGE's Student Oral Paper Honorable Mention

SEG Technical Program Registration grant

SEG/Chevron Student Leadership Symposium travel grant

Graduate with Highest Honors (*summa cum laude*), Emory University

Phi Beta Kappa Honor Society Membership

Dean's List, Emory University

Apr 2023

Aug 2021

Jun 2020

May 2019

Apr 2019

Aug 2017 - May 2019

## GRANTS

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SEG Field Camp grant (\$1000)

*Studying 1886 Earthquake at Summerville, South Carolina – Seismic Nodal Deployment in the Field*

2022

## SKILLS

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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, L<sup>A</sup>T<sub>E</sub>X, html

## PREPRINT

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

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\* denotes equal contribution.

## JOURNAL PUBLICATIONS

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- **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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1190/tle42010069.1).

## CONFERENCE PROCEEDINGS

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- 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1190/segam2020-3426999.1).

## CONFERENCE PRESENTATIONS

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- **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 CO<sub>2</sub> 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

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- **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

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- “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 CO<sub>2</sub> 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.