

# SHREYAS SUNIL GAIKWAD

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## EDUCATION

### University of Texas at Austin

*Ph.D. in Computational Science, Engineering, and Mathematics, GPA: 4.0/4.0*

*M.S. in Computational Science, Engineering, and Mathematics, GPA: 4.0/4.0*

**Austin, Texas**

*2020-2025*

*2019-2021*

### Indian Institute of Technology (IIT) Bombay

*B.Tech with Honors in Mechanical Engineering (Minor in Computer Science), GPA: 9.32/10.0*

**Mumbai, India**

*2015-2019*

## EXPERIENCE

- **Graduate Research Assistant, UT Austin** *2020-Present*
  - Developed a Bayesian inversion framework for the ice sheet model SICOPOLIS by leveraging open-source **Automatic Differentiation** tools to perform back-propagation in a Fortran-based numerical model. [\[I\]](#)[\[1\]](#)
  - Developing a novel feature importance method for Artificial Neural Networks using **XAI** method Layerwise Relevance Propagation using **Keras** to validate insights from deep learning against robust physical mechanisms.
  - Developing deep learning emulators using **Keras** to efficiently simulate seaice dynamics in ocean models.
- **Graduate Teaching Assistant, UT Austin** *Fall 2022*
  - Responsible for grading assignments, conducting office hours, and full lectures in the absence of the instructor.
- **Visiting Scholar, Argonne National Laboratory** *Summer 2022*
  - Interfaced **Automatic Differentiation** and MPI-based parallelism for a mountain glacier simulation in Julia.
  - Developed **first-ever open-source** Bayesian inversion framework for ocean circulation model MITgcm, establishing an **alternative to proprietary software that costs ~\$14,000** per year per individual [\[II\]](#)

## RESEARCH PROJECTS

- **Machine Learning Applications in Geophysics** *Spring 2021*
  - Developed CNNs in **Keras** for earthquake detection using data from stations, with **96% validation accuracy**.
  - Developed U-Nets in **Keras** for automatic seismic faults detection, with **97% test accuracy**.
  - Leveraged Autoencoders in **Keras** to aid clustering through dimensional reduction into the latent space.
  - Built pipeline to pick mudrocks from real wireline logs using ML algorithms, with **87% test accuracy**.
- **Physics-Informed Machine Learning** *Spring 2021*
  - Trained a Deep Neural Network in **PyTorch** to emulate a partial differential equation (PDE) based glacier model by leveraging **higher-order derivatives of the PyTorch computational graph**.
  - Enriched the framework using an expanded computational graph to infer unknown PDE parameters.
- **Laplacian 2D Finite Difference (FD) Solver Application** *Fall 2020*
  - Features: OOP (C++), Solver (gauss, jacobi, PETSc), tests (bats, Travis CI, docker), 98% code coverage (lcov), 0% memory errors (valgrind), build (autotools), HPC env (SLURM), parser & logger (GRVY).

## OPEN-SOURCE CONTRIBUTIONS

- I [SICOPOLIS-AD v2](#), open-source data assimilation framework for the ice sheet model SICOPOLIS.  
II [MITgcm-AD](#), open-source data assimilation framework for the general ocean circulation model MITgcm.  
III [ARGOVIS](#), OOP-style Python tools for community use in interactive plotting and binning of Argo data.

## TECHNICAL SKILLS

Languages	Python (Keras, PyTorch), Julia, C/C++, Fortran-77/90, MATLAB
HPC toolkit	OpenMP, MPI, CUDA, SLURM, git, docker, shell scripts, CI, autotools, valgrind, lcov, GRVY

## HONORS AND AWARDS

- President and Vice President, Austin Chapter of Society of Industrial & Applied Mathematics (SIAM). *2021-2023*
- Recipient of Peter O'Donnell Graduate **fellowship worth \$24,000**. *2019*
- Ranked 509/1,500,000 (**99.97 percentile**) in nationwide university entrance exams, India. *2015*

## SELECT COURSEWORK

Data Science	Machine Learning, ML applications in Geophysics, Engineering Data Mining
Algorithms	Differential Equations, Linear Algebra, HPC, Functional Analysis, Data Structures & Algorithms
Modeling	Uncertainty Quantification in Modeling, Mathematical Modeling, Quantum & Statistical Mechanics

## CONFERENCE PROCEEDINGS AND PRESENTATIONS

- **SS Gaikwad et. al** “Computational Science to enable Digital Twins of the Oceans”, *6th SIAM Texas-Louisiana Sectional Meeting (SIAM TX-LA) 2023*.
- **SS Gaikwad et. al** “MITgcm-AD: Open Source Inverse Modeling Framework for the oceans”, *WCRP Workshop MIT 2023, 14th Joint Laboratory for Extreme Scale Computing (JLESC) Workshop 2022*.

## JOURNAL ARTICLES

1. **SS Gaikwad et. al** “SICOPOLIS-AD v2: tangent linear and adjoint modeling framework for ice sheet modeling enabled by Automatic Differentiation tool Tapenade.” *Journal of Open Source Software* 8, no. 83 (2023): 4679.