SHREYAS SUNIL GAIKWAD

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EDUCATION

University of Texas at Austin — **Austin, Texas**
Ph.D. in Computational Science, Engineering, and Mathematics, GPA: 4.0/4.0 — *2020-2025*
M.S. in Computational Science, Engineering, and Mathematics, GPA: 4.0/4.0 — *2019-2021*

Indian Institute of Technology (IIT) Bombay — **Mumbai, India**
B.Tech with Honors in Mechanical Engineering (Minor in Computer Science), GPA: 9.32/10.0 — *2015-2019*

EXPERIENCE

- **Graduate Research Assistant, UT Austin** — *2020-Present*
  - Developed the adjoint and tangent linear models (equivalent to fast PDE-constrained backpropagation) for the ice sheet model SICOPOLIS by leveraging open-source **Automatic Differentiation** tools. [I][2]
  - Developing a computational framework for **PDE-constrained Bayesian inversion** for ice-sheet models. [I]
  - Developing a **CUDA-parallelized** ice sheet model in Julia for fast and efficient 2D data assimilation.
  - Examining the similarities between adjoint models and **Explainable-AI techniques** (XAI) for deep learning emulators such as **Layerwise Relevance Propagation** (LRP) in the earth system context. [1]
- **Visiting Scholar, Scripps Institution of Oceanography** — *Fall 2023*
  - Developing **deep learning emulators** to efficiently simulate seaice dynamics in ocean general circulation models.
- **Visiting Scholar, Argonne National Laboratory** — *Summer 2022*
  - Interfaced **Enzyme** and **MPI** for a mountain glacier simulation in Julia.
  - Developed **first-ever open-source** data assimilation framework for ocean circulation model MITgcm, establishing an **alternative to proprietary software that costs** ∼**$20,000** per year per individual [II]

RESEARCH PROJECTS

- **Machine Learning Applications in Geophysics** — *Spring 2021*
  - Tested utility of **supervised and unsupervised deep learning** in real geophysical applications.
  - Developed pipeline to pick mudrocks from real wireline logs using ML algorithms, with **87% test accuracy**.
- **Physics-Informed Machine Learning** — *Spring 2021*
  - Developed **fast neural network emulator** and data assimilator for a highly non-linear, diffusive glacier model.
- **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, 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 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

- Gaikwad, Shreyas Sunil et. al "SICOPOLIS-AD v2: Inverse modeling framework for ice sheet modeling", (*AGU Fall Meeting 2022, SCAR-OSC 2022, ML for Polar Regions 2022, 24th EuroAD Workshop 2021*).
- Gaikwad, Shreyas Sunil 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 "Examining parallels between adjoint models and Explainable AI (XAI) methods in an oceanic and glaciological context", *In Preparation.*
2. **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.*