Shreyas **Gaikwad**

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Education

The University of Texas at Austin — *Austin, TX*

PH.D. IN COMPUTATIONAL ENGINEERING AND SCIENCES — *August 2019 - May 2024*

MS IN COMPUTATIONAL ENGINEERING AND SCIENCES - CGPA: **4.0/4.0** — *August 2019 - May 2021*

Indian Institute of Technology (IIT) Bombay — *Mumbai, India*

B.TECH (HONORS) IN MECHANICAL ENGINEERING, MINOR IN COMPUTER SCIENCE - CGPA: **9.32/10**, DEPARTMENT RANK - **4/150** — *July 2015 - May 2019*

Professional Experience

Graduate Research Assistant, Optimization and Inverse Methods in Glaciology — *September 2020 - Present*

- Optimized uncertain model parameters, leveraging second order inexact Newton Conjugate Gradient method
- Leveraging **Deep Learning** to reduce the computational cost of simulating sea ice in the general ocean circulation model, MITgcm

Visiting Scholar, Argonne National Laboratory — *June 2022 - August 2022*

- Open source software development for ocean models in Julia, a programming language as fast as C and as easy as Python
- Exponential speed up in computing gradients, using open source **Automatic Differentiation** tools with MITgcm general circulation model

ITC Limited, India's Largest FMCG Conglomerate — *May 2018 - July 2018*

- **50% Automation Increase** in Primary Packing, **60% Downtime Reduction** in Secondary Packing; Cost savings worth **$165,000**

Research Projects

Machine Learning Applications in Geophysics — *January 2021 - May 2021*

- Developed pipeline to pick mudrocks from wireline logs using **Machine Learning** algorithms on real dataset, with **87% test accuracy**
- First (known) attempt to utilize this for pore pressure prediction, an important geological application

Physics Informed Neural Networks for Mountain Glaciers — *January 2021 - May 2021*

- Trained a **Deep Neural Network** to emulate the solution and optimize the parameters of highly non-linear and diffusive PDE model for a glacier

Laplacian 2D Finite Difference (FD) solver application — *August 2020 - December 2020*

- **Features** - Solver (Gauss, Jacobi, PETSc), tests (bats, Travis CI, Docker), **98%** code coverage (lcov), **0%** memory errors (Valgrind), build (Autotools), HPC env (SLURM), Storage (HDF5), parser and logger (GRVY), code verification (MASA), version control (github), OOP (C++)

Partial Differential Equations-constrained optimization using FEniCS — *August 2021 - December 2021*

- Leveraged **FEniCS, autograd** and infinite dimensional gradients and hessians to perform optimization subject to PDE constraints
- **Applications** - Image denoising & preserving sharp edges, frequency domain inverse wave propagation, inversion of Burger's & ADR equations

Analysis of Parallel Computing Techniques on Generalized-α method — *January 2018 - May 2018*

- Achieved upto **7x speedup** using MPI and upto **5x speedup** using CUDA for fluid structure interactions modeled by Generalized-α method

Bayesian Inference of uncertain model parameters — *January 2020 - May 2020*

- **Applications** - Energy Balance Model model calibrated to surface temperature data, Stokes drag calibrated with laboratory measurement data
- Applied Markov Chain Monte Carlo (**MCMC**) methods in order to sample high-dimensional parameter spaces and derive posterior distributions

Publications and International Talks

Gaikwad et. al (2022), "SICOPOLIS-AD v2: linearized forward and adjoint modeling framework for ice sheet modeling enabled by automatic differentiation tool Tapenade", *Journal for Open Source Software*, In preparation

24th EuroAD Workshop, 2021, "SICOPOLIS-AD v2: An open-source adjoint modeling framework for ice-sheet models" — *Virtual*

Skills

Languages **Python** (scikit-learn, Keras, PyTorch, FENICS, numpy, xarray, autograd, Pandas), **C++** (GRVY, MASA, HDF5, PETSc), **FORTRAN-90**

Tools Github, Docker, Shell scripting, Travis-CI, Autotools, OpenMP, MPI, CUDA, SLURM, MATLAB, LaTeX, Valgrind, HTML, Jekyll, lcov, gcov

Honors & Awards

2019 **Peter O'Donnell Fellowship**, **$24,000** by the Oden Institute for Computational Engineering & Sciences — *Austin, TX*

2015 **KVPY Fellowship**, conferred by Govt. of India for demonstrating aptitude for research, **Rank - 27/50,000** — *Nashik, India*

Mentorship & Leadership Experience

2021-22 **Vice President**, University of Texas Chapter of SIAM — *Austin, TX*

2021-22 **Mentor**, SIAM-UT Applied Math Mentorship Program — *Austin, TX*

2018-19 **Mentor**, Department Academic Mentorship & Academic Rehabilitation Program, IIT Bombay — *Mumbai, India*