

Dhruv Patel

Curriculum Vitae

Stanford University, CA
✉ dvpatel@stanford.edu
📁 [dhruvpatel108.github.io](https://github.com/dhruvpatel108)
🐙 [dhruvpatel108](https://github.com/dhruvpatel108)

I am currently the **Stephen Timoshenko Distinguished Postdoctoral Fellow** at *Stanford University* working at the intersection of Deep Learning and Computational Sciences.

Research Interests

Scientific Machine Learning, Deep Generative Modeling, Bayesian Inference, Uncertainty quantification, Computer Vision, Computational Mechanics, Medical Imaging.

Academic History

Postdoctoral Fellow,
Stanford University, Stanford, USA.
Mechanics and Computation Group

PhD, Computational Mechanics,
University of Southern California (USC), Los Angeles, USA.
Thesis: Physics-based data-driven inference.
Advisor: Prof. Assad Oberai

MTech, Applied Mechanics,
Indian Institute of Technology - Delhi, New Delhi, India.
Thesis: Modeling of a supercoiled DNA using elastic rod model employing self-contact phenomena.

BE, Mechanical Engineering,
L. D. College of Engineering (LDCE), Ahmedabad, India.

Selected Honours & Awards

- 2022 **Best Dissertation Award**, Department of Mechanical Engineering, USC.
- 2022 Runner up of the **William F. Ballhaus Jr. Award for Best Dissertation** in Viterbi School of Engineering, USC.
- 2021 **Stephen Timoshenko Distinguished Postdoctoral Fellowship**, Stanford University
- 2019 The Honourable Mention of **2019 Karel Urbanek Award** for Best Student Paper, SPIE Advanced Lithography, San Jose, CA (2nd place).
- 2018 Finalist of the Best Student Poster competition, 13th World Congress on Computational Mechanics, New York City, NY.
- 2018 9th Gene Golub SIAM summer school on inverse problems and uncertainty quantification scholarship, Breckenridge, CO.
- 2016 **Prof. Karunes Memorial Award** for *Best Master's Thesis* - Applied Mechanics department, IIT Delhi.
- 2015 Ministry of Human Resource and Development, Government of India fellowship - M.Tech., IIT Delhi.
- 2009 – Ministry of Human Resource and Development, Government of India, national merit scholarship, B.E., LDCE.
- 2013 B.E., LDCE.

Publications

Journal Articles

- [1] **D. Patel**, R. Tibrewala, A. Vega, L. Dong, N. Hugenberg, A. Oberai "Circumventing the solution of inverse problems in mechanics through deep learning: Application to elasticity imaging", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)
 - Selected media highlights: [1](#), [2](#), [3](#), [4](#), [5](#)
- [2] **D. Patel**, R. Bonam, A. Oberai "Deep learning-based detection, classification, and localization of defects in semiconductor processes", *Journal of Micro/nanolithography, MEMS, and MOEMS*. [\[Link\]](#)
 - Selected media highlights: [1](#), [2](#)
- [3] **D. Patel**, V. Kher, B. Desai, L. Xiaomeng, S. Cen, N. Nanda, A. Gholamrezanezhad, V. Duddalwar, B. Varghese, A. Oberai "Machine learning-based predictors for COVID-19 disease severity", *Scientific Reports*. [\[Link\]](#)
- [4] **D. Patel**, A. Oberai "GAN-based priors for quantifying uncertainty in supervised learning" *SIAM/ASA Journal of Uncertainty Quantification*. [\[Link\]](#)
- [5] **D. Patel**, D. Ray, A. Oberai, "Solution of Bayesian inverse problems and model order reduction using deep generative modeling", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)
- [6] R. Raad, **D. Patel**, C. Hsu, D. Ray, B. Varghese, S. Cen, D. Hwang, I. Gill, V. Duddalwar, A. Oberai "Probabilistic medical image imputation via deep adversarial learning ", *Journal of Engineering with Computers*. [\[Link\]](#)
- [7] D. Ray, H. Ramaswamy, **D. Patel**, A. Oberai "The efficacy and generalizability of conditional GANs for posterior inference in physics-based inverse problems", *Numerical Algebra Control and Optimization special issue on Inverse problems*. [\[Link\]](#)
- [8] G. Cacciamani, Y. Xue, U. Durairaj, S. Roberts, **D. Patel**, R. Raad, G. Miranda, S. Sadeghi, A. Hung, I. Gill, M. Desai, P. Kuhn, A. Oberai "Machine learning framework-based prognostic classifier for predicting recurrence-free survival for patients undergoing radical cystectomy for urothelial bladder cancer", *Journal of Clinical Oncology*. [\[Link\]](#)
- [9] **D. Patel**, D. Ray, M. Abdelmalik, T. Hughes, A. Oberai "Variationally mimetic operator networks" (in review). [\[Link\]](#)
- [10] **D. Patel**, J. Lee, M. Farthing, T. Hesser, P. Kitanidis, E. Darve "Multi-fidelity Hamiltonian Monte Carlo" .

Peer-reviewed Conference and Workshop Articles

- [1] A. Dasgupta, **D. Patel**, D. Ray, A. Oberai "GAN-Flow: A dimension-reduced variational framework for physics-based inverse problems", *Machine Learning and the Physical sciences workshop, 36th conference on Neural Information Processing System (NeurIPS)*, 2022. [\[Link\]](#)
- [1] **D. Patel**, J. Lee, M. Forghani, M. Farthing, T. Hesser, P. Kitanidis, E. Darve "Multi-Fidelity Hamiltonian Monte Carlo Method with Deep Learning-based Surrogate", *Second symposium on science-guided AI, AAAI Fall Symposium Series, virtual*, 2021. [\[Link\]](#)
- [2] D. Ray, **D. Patel**, H. Ramaswamy, A. Oberai "Efficient posterior inference and generalization in physics-based Bayesian inference with conditional GANs", *Deep inverse workshop, 35th conference on Neural Information Processing System (NeurIPS), virtual*, 2021. [\[Link\]](#)
- [3] **D. Patel**, C. Hsu, B. Varghese, S. Cen, D. Hwang, I. Gill, V. Duddalwar, A. Oberai "Probabilistic recovery of missing phase images in contrast-enhanced CT", *Medical imaging workshop, 34th conference on Neural Information Processing System (NeurIPS), virtual*, 2020. [\[Link\]](#)

- [4] **D. Patel**, D. Ray, H. Ramaswamy, A. Oberai "Bayesian inference in physics-driven problems with adversarial priors", *Deep inverse workshop, 34th conference on Neural Information Processing System (NeurIPS)*, virtual, 2020. [[Link](#)]
- [5] **D. Patel**, A. Oberai "Generative Adversarial Network priors for Bayesian inference", *Deep inverse workshop, 33rd conference on Neural Information Processing System (NeurIPS)*, Vancouver, BC, 2019. [[Link](#)]
- [6] **D. Patel**, R. Bonam, A. Oberai "Engineering neural networks for improved defect detection and classification", *Proc. SPIE 10959, Metrology, Inspection, and Process Control for Microlithography XXXIII, SPIE Advanced Lithography*, San Jose, CA, 2020. [[Link](#)]

Selected talks

- [1] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Multi-fidelity Hamiltonian Monte Carlo", *SIAM conference on Mathematics of Data Science (MDS)*, San Diego, CA, 2022 (**Invited talk**)
- [2] **D. Patel** "Physics meets Machine Learning", *Institute of Computational and Mathematical Engineering (ICME), Stanford, Xpo Research Symposium*, Stanford, CA, 2022 (**Invited talk**)
- [3] **D. Patel** "Efficient Bayesian Inference using Deep Generative Priors and Multi-fidelity Modeling", *Energy Resources Engineering (ERE) graduate seminar series*, Stanford, CA, 2021 - virtual (**Invited talk**). [[Link](#)]
- [4] **D. Patel**, A. Oberai "Efficient Bayesian inference using deep generative modeling", *Mechanics and Computation group*, Stanford, CA, 2020 - virtual (**Invited talk**).
- [5] **D. Patel**, A. Oberai "Solution of Bayesian inverse problems and uncertainty quantification in deep learning using deep generative modeling", *Combustion Research Facility, Sandia National Lab*, Livermore, CA, 2020 - virtual (**Invited talk**).
- [6] **D. Patel**, A. Oberai "Solution of Bayesian inverse problems and uncertainty quantification in deep learning using deep generative modeling", *Mechanics of materials department, Sandia National Lab*, Livermore, CA, 2020 - virtual (**Invited talk**).
- [7] **D. Patel**, A. Oberai "Physics-based data-driven deep generative models for efficient Bayesian inference", *Climate Modeling Alliance (CliMA)*, Caltech, Pasadena, CA, 2020 (**Invited talk**).
- [8] **D. Patel**, A. Oberai "To know what we don't know: quantifying uncertainty using sample-based priors", *Mechanics seminar series, Department of Aerospace and Mechanical Engineering*, USC, Los Angeles, CA, 2020.
- [9] **D. Patel**, R. Bonam, A. Oberai "Engineering neural networks for improved defect detection, classification, and localization", *SPIE Advanced Lithography*, San Jose, CA, 2019.
- [10] **D. Patel**, R. Tibrewala, A. Vega, L. Dong, N. Hugenberg, A. Oberai "Circumventing the solution of inverse problems in mechanics through deep learning", *13th World Congress on Computational Mechanics (WCCM)*, NYC, NY, 2018.

Research Advising

PhD. candidates

- Summer 2021 *Jason Liang (Stanford)*
 - Present Learning disentangled representation of physical data using progressive variational autoencoders.
- Spring 2022 – *Elliot Epstein (Stanford)*
 - Present Stochastic inference of ignition parameters for cryogenic rocket engines.

MS candidates

- Fall 2019 – *Chiao-Chih Hsu (USC)*
- Fall 2020 Implementing learning-based models to infer missing phase image of renal lesions from partially visible Contrast-Enhanced Computed Tomography (CECT) data.

- Fall 2018 – *Vijay Kothapalli (USC)*
- Summer 2019 Designed and developed deep learning-based models for time series data with application to Contrast-Enhanced Ultrasound (CEUS) imaging.
Undergraduate candidates
- Summer 2020 *Vikram Kher (USC)*
– Fall 2020 Developing ML-based tools for prediction of clinical prognosis and disease severity in COVID-19 patients. **Winner:** Best USC Viterbi summer undergraduate research project.
- Summer 2019 *Eeshan Gupta (USC)*
Developed software tools for solving physics-driven Bayesian inverse problems using GAN priors.
- Summer 2017 *Adriana Vega, Raghav Tibrewala (RPI)*
Developed deep learning-based elasticity imaging workflow to classify breast tumors based on its mechanical properties.
High-school student
- Summer 2018 *Jacqueline Wang (USC)*
Developed data processing and visualization pipeline for the tumor classification project.

Teaching Experience

- Winter 2023 **CME 599: Machine Learning for Computational Engineering**, Stanford.
 - Designing new course material and instructing this graduate level course.
- Fall 2020 **AME 599: Machine Learning and Computational Physics**, USC.
 - Assisted my advisor in preparing course material for the first offering of this graduate level course.
 - Conducted office hours and graded assignments.
- Spring 2017 **ENGR 2050: Introduction to Engineering Design**, RPI.
 - Conducted studio sessions and assisted students in conceptual and detailed design of the project for the project-based undergraduate course.
- Fall 2016 **ENGR 1200: Engineering graphics and CAD**, RPI.
 - Conducted lab sessions as a lead TA for the undergraduate course with 250+ students.
 - Conducted office hours, graded assignments, and assisted 50+ students with final CAD project.
- Spring 2016 **Advanced Solid Mechanics**, IIT-D.
 - Conducted office hours and tutorials and graded assignments.

Professional Membership and Service

- Organizer**, *Mini-symposium on ML-driven model order reduction and inverse problems, SIAM Mathematics of Data Science (MDS), San Diego, CA, Sept. 2022; Mini-symposium on Operator Networks, U.S. National Congress on Computational Mechanics, Albuquerque, NM, July 2023.*
- Reviewer**, *International Conference on Learning Representation (ICLR); AAAI conference on Artificial Intelligence; Journal of Computational Physics (JCP); Journal of Computer Methods in Applied Mechanics and Engineering (CMAME); International Journal for Numerical Methods in Engineering (IJNME); Journal of Geosciences; Journal of Numerical Algebra, Control, and Optimization (NACO); Journal of Hydrology.*
- Central team placement coordinator, *IIT Delhi.*

Computer Skills

- Programming Languages Python, C, C++, MATLAB, Fortran, Bash scripting
- Scientific tools and libraries TensorFlow, PyTorch, TensorFlow Probability, FEniCS, MPI, OpenMP, data analysis packages in python (Scikit-learn, pandas, Scipy), ParaView, Ansys, NX, Creo, L^AT_EX, version control with GitHub