Abhinav Gupta

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Industry professional interested in developing ML/AI methods for solving complex real-world problems.

Education

Massachusetts Institute of Technology — Cambridge, MA
PhD in Mechanical Engineering and Computation (GPA: 4.9/5) — *Jan 2017 – July 2022*

- Thesis: Scientific Machine Learning for Ocean Applications | Minor: Technology and Policy
- Wunsch Foundation Silent Hoist and Crane Award for Outstanding Graduate Student

Indian Institute of Technology Kanpur — Kanpur, India
Master's (GPA: 10/10) & Bachelor's (GPA: 9.9/10) in Mechanical Engineering — *Jul 2011 – Jun 2016*

- Department Rank - 1 | General Proficiency Medal; Banco Foundation Award; OP Bajaj Memorial Award
- Master's Thesis: Bayesian Inference of Obstacle Systems and Coupled Biogeochemical-Physical Model

Experience

Large Molecule Research, Sanofi — Cambridge, MA
Senior Machine learning Scientist, Next Generation Biologics Design — *Aug 2022 – Present*

Research Profile:

- Developing state-of-the-art ML/AI technologies to solve challenges in real-world drug discovery
- Protein design and engineering using large language models, structure prediction, generative AI, and more
- Filed one provisional patent, 3 internal research presentations, and conducted one conference workshop

Allied Contributions:

- Managed one co-op and leading a collaborative team for development of new deep learning models
- Contributed to evaluations and negotiations leading to a multi-million dollar strategic collaboration

Multidisciplinary Simulation, Estimation, Assimilation Systems (MSEAS) Lab, MIT — Cambridge, MA
Research Assistant — *Jan 2017 – Jul 2022*
Undergraduate Visiting Student (S.N. Bose Scholar) — *Summer 2014 & 15*

Research Profile:

- Advanced algorithms on the intersection of uncertainty quantification, Bayesian modeling and inference, deep learning, and computational physics for high-dimensional and multidisciplinary problems – Scientific Machine Learning (SciML)
- Developed a delay-differential-equations-based deep learning framework to learn missing parts of dynamical system models; applications include refining coarse models, simplification of complex real-world models, and more
- Developed a partial-differential-equations-based Bayesian machine learning framework for model discovery; has applications in learning ocean ecosystem models, sustainable fisheries management, brain tumor modeling and more
- Published 3 first author and 9 co-author papers in peer-reviewed literature | Journal cover-image feature
- 19 Research presentations: Including AGU (Dec'19; Feb'18); IEEE Oceans (Oct'19); IISc Bangalore (Jul'19, Aug'21); Indian Space Res. Org. (Jul'19); SIAM (Mar'19; May'21); Caltech (Jul'21) | *SIAM Student Travel Award* | *MIT-CCSE'21 Best Poster*

Allied Contributions:

- Developed collaboration protocols to facilitate a multi-university-research project across 5 universities
- Mentored 3 undergraduate and 3 high-school interns on research projects
- Helped generate ideas and contributed to the writing of in-total 5 research grants

Tech Stack: Python, PyTorch, Lightning, MATLAB

Fellowships

MathWorks Mechanical Engineering Fellowship — *2020 – 21*

- Awarded to 3 out of 500 graduate students for exceptional academic performance

MIT-Tata Center for Technology & Design Fellow — *2018 – 20*

- Studied interplay of technology, entrepreneurship, and policy; and deepened perspectives on severely resource-constrained communities by interviewing Indian fishermen, non-profits, and government institutions

Leadership

Graduate Student Council Representative (2019-20) - Represented interests of Mechanical Engineering graduate students at institute-wide graduate student council

Cultural Chair, Sangam (2017-18) – Served the Indian community by organizing cultural events; led 8-member team to conduct 3-day orientation for incoming Indian students

Social Chair, Graduate Association of Mechanical Engineers, MIT (2019-20) • Hall Councilor, SP Grad Housing (2018-20) • Secretary, Aeromodelling Club, IIT Kanpur (2012-13) • Student Guide, Counselling Service, IIT Kanpur (2012-13)

Hobbies

Hosting traditional Indian cuisine dinner nights • Exploring history and culture of different countries by collecting coins

Publications

Gupta, A., Lermusiaux, P.F., 2023. Generalized neural closure models with interpretability. *Nature Scientific Reports 13,* 10634.

Gupta, A. and Lermusiaux, P.F., 2023. Bayesian learning of coupled biogeochemical-physical models. *Progress in Oceanography*, p.103050.

Gupta, A. and Lermusiaux, P.F., 2021. Neural closure models for dynamical systems. *Proceedings of the Royal Society A*, *477*(2252), p.20201004.

Gupta, A., Haley, P.J., Subramani, D.N. and Lermusiaux, P.F., 2019. Fish modeling and Bayesian learning for the Lakshadweep Islands. In *Oceans 2019 MTS/IEEE Seattle* (pp. 1-10). IEEE.

Gupta, A. and Saha, A.K., 2019. Suppression of vortex shedding in flow around a square cylinder using control cylinder. *European Journal of Mechanics-B/Fluids*, *76*, pp.276-291.

Kulkarni, C.S., **Gupta, A**. and Lermusiaux, P.F., 2020. Sparse regression and adaptive feature generation for the discovery of dynamical systems. In *Dynamic Data Driven Applications Systems: Third International Conference, DDDAS 2020, Boston, MA, USA, October 2-4, 2020, Proceedings 3* (pp. 208-216). Springer International Publishing.

Haley, P.J., **Gupta, A.**, Mirabito, C. and Lermusiaux, P.F., 2020. Towards Bayesian ocean physical-biogeochemical-acidification prediction and learning systems for Massachusetts Bay. In *Global Oceans 2020: Singapore–US Gulf Coast* (pp. 1-9). IEEE.

Lermusiaux, P.F., Mirabito, C., Haley, P.J., Ali, W.H., **Gupta, A.**, et al., 2020. Real-time probabilistic coupled ocean physics-acoustics forecasting and data assimilation for underwater GPS. In *Global Oceans 2020: Singapore–US Gulf Coast* (pp. 1-9). IEEE.

Ali, W.H., Mirhi, M.H., **Gupta, A.**, Kulkarni, C.S., Foucart, C., Doshi, M.M., Subramani, D.N., Mirabito, C., Haley Jr, P.J. and Lermusiaux, P.F., 2019, October. Seavizkit: Interactive maps for ocean visualization. In *Oceans 2019 MTS/IEEE Seattle* (pp. 1-10). IEEE.

Doshi, M., Kulkarni, C.S., Ali, W.H., **Gupta, A.,** Lermusiaux, P.F., Zhan, P., Hoteit, I. and Knio, O., 2019. Flow maps and coherent sets for characterizing residence times and connectivity in Lagoons and coral reefs: The case of the Red Sea. In *Oceans 2019 MTS/IEEE Seattle* (pp. 1-8). IEEE.

Lermusiaux, P.F., Doshi, M., Kulkarni, C.S., **Gupta, A**., Haley, P.J., Mirabito, C., et al., 2019. Plastic pollution in the coastal oceans: Characterization and modeling. In *Oceans 2019 MTS/IEEE Seattle* (pp. 1-10). IEEE.

Kulkarni, C.S., Haley, P.J., Lermusiaux, P.F., Dutt, A., **Gupta, A**., Mirabito, C., et al., 2018. Real-time sediment plume modeling in the Southern California Bight. In *Oceans 2018 MTS/IEEE Charleston* (pp. 1-10). IEEE.

Lermusiaux, P.F., Subramani, D.N., Lin, J., Kulkarni, C.S., **Gupta, A.,** Dutt, A., Lolla, T., Haley, P.J., Ali, W.H., Mirabito, C. and Jana, S., 2017. A future for intelligent autonomous ocean observing systems. *Journal of Marine Research*, *75*(6), pp.765-813.

Lermusiaux, P.F., Haley Jr, P.J., Jana, S., **Gupta, A.,** Kulkarni, C.S., Mirabito, C., Ali, W.H., Subramani, D.N., Dutt, A., Lin, J. and Shcherbina, A.Y., 2017. Optimal planning and sampling predictions for autonomous and Lagrangian platforms and sensors in the northern Arabian Sea. *Oceanography*, *30*(2), pp.172-185.