Saurabh Deshpande

PhD in Machine Learning: Linkedin

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About Me

Machine learning engineer with strong expertise in deep learning, backed by 5.5 years of combined research and industry experience. PhD research under a prestigious Marie Sklodowska-Curie fellowship, working directly with one of the world's most cited researchers, earned the Excellent Thesis Award. Fast learner with a proven track record in developing deterministic and probabilistic ML models using Python, TensorFlow, and PyTorch. Looking for opportunities to leverage my expertise in AI and data-driven modeling to solve complex engineering challenges.

Professional Experience

Computer Vision Engineer
Perception-AI (founding team), Circu Li-ion GmbH, Karlsruhe. *09/2024 - 12/2024*

- Developed specialized **Python packages** and API endpoints, to automate robotic disassembly processes for electric vehicle batteries, **saving 10x process time** and eliminating manual efforts.
- Developed and **deployed** novel method integrating 2D image registration with 3D point cloud registration to compute battery displacement relative to reference positions in **production environments**, achieving **1mm accuracy**..
- Evaluated object detection frameworks (MMDetection, Detectron2, YOLO) with GPU accelerated training on proprietary datasets, driving critical business decisions.

Python | Deep Learning | Algorithms | Software Development | Computer Vision | Deployment

Postdoctoral Researcher: ML for Scientific Simulations and Computer Vision
University of Luxembourg with Prof. Stéphane Bordas *08/2023 - 07/2024*

- Developed fast and accurate probabilistic ML models achieving a **100x speedup** over traditional methods for simulating real world engineering problems (such as soft body deformations) (GitHub).
- Generated high-quality datasets using numerical techniques (finite element method) to train **autoencoder**-based neural networks integrated with **Gaussian Processes**, on **HPC** platform.
- Developed a deep learning-based nucleus detection system for microscopic images of human tissues, achieving 95% mean Average Precision (mAP) across diverse samples.

Probabilistic Machine Learning | Neural Networks | Gaussian Processes | HPC | Python | Git

Electro-Mechanical Design Engineer
Indian Space Research Organisation (ISRO), India *07/2017 - 05/2019*

- Developed **India's first** high-accuracy (1') telescope pointing mechanism, utilized in the GSAT-29 satellite mission. Led mechanical development as a project manager alongside technical work.
- Work involved satellite payload realization right from the concept ideation, mechanical design (CAD), and simulations (FEA), to assembly-integration for the leading space missions of the country.

Mathematical Modeling | Team Work | Analytical Skills | Problem Solving | Mechanical design

Education

University of Luxembourg: Doctoral Program in Computational Sciences
Machine Learning PhD with the prestigious Marie Skłodowska-Curie fellowship,
Recipient of the Excellent Thesis Award (source). *08/2019 - 09/2023*

Indian Institute of Technology, Madras (IIT Madras, India)
B.Tech (Mechanical) & M.Tech (Product Design). *Minor:* Industrial Engineering,
IIT Madras is constantly top ranked engineering institute in India. *07/2012 - 05/2017*

Technical University of Munich (TUM, Germany)
Semester abroad with the travel grant: Mechanical Engineering *04/2016 - 07/2016*

Selected Publications

Google scholar

S. Deshpande, et al. "*MAgNET: A Graph U-Net Architecture for Mesh-Based Simulations*" (2024). Engineering Applications of Artificial Intelligence (Impact Factor(IF) = 8.0).

S. Deshpande, et al. "*Probabilistic Deep Learning for Real-Time Large Deformation Simulations*" (2022). Computer Methods in Applied Mechanics and Engineering (IF=7.2).

S. Deshpande, et al. "*Convolution, aggregation & attention based deep neural networks to accelerate simulations in mechanics*" (2022). Frontiers in Materials (IF=3.2).

Skills

Programming Languages: Python (NumPy, Pandas, Scipy, WandB, FastAPI), SQL
ML/DL Libraries: TensorFlow, TensorFlow Probability, PyTorch, Keras, Scikit-learn
Computational Tools: Matlab, Mathematica
Business: Product development, Presentation, Analytical thinking, Problem Solving Skills
Languages: English (proficient), Luxembourgish, German (beginner)
Other: git, docker, HPC, DVC, Markdown, [z|ba]sh, LaTeX

PhD Research

(thesis source)
(github)

Deep learning based data-driven frameworks for scientific simulations
Supervisor: Prof. Stéphane Bordas (a highly cited researcher) *08/2019 - 09/2023*

- Collaborated within ITN RAINBOW, a prestigious Marie-Sklodowska Curie Actions network, focusing on data driven, patient-specific biomechanical simulation models.
- Developed advanced deep learning frameworks, achieving $\sim$ **400x speedup** over traditional numerical methods, such as non-linear finite element method, enabling real-time biomechanical simulations.
- Research earned **Excellent Thesis Award**, yielding **4 journal** and **6 conference** publications.

MAgNET: A novel Graph U-Net architecture *article*

- **Developed new graph DL layers**: Multichannel Aggregation (MAg) and graph pooling layers.
- Implemented in batch format in TensorFlow, ensuring seamless integration with existing DL layers.
- These layers form a novel Graph U-Net architecture capable of learning on high dimensional inputs.
- MAgNET achieved **40x speedup** compared to traditional non-linear FEM simulations. (GitHub)

Bayesian convolutional neural networks for soft body deformation simulations *article*

- Developed a **Bayesian U-Net framework**, which accurately predicted **probability distributions** of soft body deformations, along with the associated aleatoric and epistemic uncertainties.

Attention based deep neural networks for simulating mechanics of solids *article*

- Engineered a real-time soft body physics simulator using Perceiver IO transformer architecture, achieving a **410x speedup** over traditional numerical methods.

Bayesian & Graph Deep Learning | CNNs & Transformers | Algorithm Development | HPC

Selected Awards

- **Excellent Doctoral Thesis Award** at the University of Luxembourg (**10 out of 120**). *2023*
- **Marie Skłodowska-Curie Actions** fellowship for pursuing the PhD ($\sim$ 240k Euro). *2019-22*
- **Best Presentation Award** at the ML School, University of Bern (500 Euro). *2022*
- Chosen as one of 15 students across the university to receive coaching from **Stanford Business School** faculty on presentation skills. *2022*
- State Bank of India scholarship covering **95% tuition fees** at IIT Madras ($\sim$ 3k Euro). *2012-17*
- Secured a place among the top **0.5%** of **0.5 million** IIT-JEE aspirants, hence unlocking doors to IIT Madras, one of the best engineering institutes in India. *2012*
- Recipient of the KVPY fellowship from the Government of India (**top 0.5%**), offering **full financial support** to pursue a bachelor's degree in pure sciences. *2012*

Leadership

Student representative positions (elected by students) *06/2021 - 12/2022*

- For **600 PhDs** in the Doctoral School of Science and Engineering, University of Luxembourg.
- For 15 PhDs in the Marie Skłodowska-Curie ITN Rainbow network.

Excellent Communication | Teamwork | Presentation