SABYASACHI SAHOO

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Ph.D. candidate with industry experience working on ML model generalization, robustness & efficiency.

EDUCATION

Mila, Inria, Université Laval Aug 2021 - Present
Ph.D. in Machine Learning. Advisors: Christian Gagné & Frédéric Precioso. (GPA: 4/4) (Expected: Aug 2026)
Keywords: *generalization*, *robustness*, *finetuning*, *test-time compute*, *foundation models*.

Indian Institute of Science (IISc) - Bangalore 2014 - 2016
Masters in Computational and Data Science. Advisor: Sathish Vadhiyar. (Top 5 in class)

National Institute of Technology (NIT) - Surat 2010 - 2014
Bachelors in Mechanical Engineering.

WORK EXPERIENCE

NVIDIA - System Engineer II Aug 2016 - May 2018

- **Self-Driving Car Display**: Implemented new features, reducing bugs (60%) and improving user experience.
- **Resource Management**: Designed modular device tree framework, cutting cross-team development time (30%).
- **Xavier Chip's Launch**: Implemented critical modules for successful launch & performance boost (25%).

Donut Research Labs - Deep Learning Engineer May 2018 - Feb 2019

- **Text Generation**: Improved Walmart's brand name extraction accuracy (40%) using a Seq2Seq model, pre-trained on product descriptions, fine-tuned on noisy annotations, and top-k sampling with beam search.
- **Extreme Text Classification**: Class-imbalance-aware LSTM improved accuracy (25%) & sped inference (10%).
- **Product Specs Extraction/OCR**: Single Shot Detector based information extraction, improving perf (35%).
- **Dataset Building**: for text generation & OCR projects (collection, annotation, cleaning).

ML Lab, IISc Bangalore - Research Associate Feb 2019 - Aug 2021

- **2D & 3D Image Generation** [8, 16, 24]: Enhanced LiDAR generation using an adversarial autoencoder, improved high-resolution image generation using Discrete Cosine Transform based Variational Autoencoders (VAEs), and made scene flow prediction adaptive by fusing learning-based and geometry-based approaches.
- **Explainable AI** [13, 14, 25]: Aligned concept extraction with human understanding, improved it using non-negative matrix factorization, and exposed adversarial vulnerabilities in popular explainability methods.
- **Healthcare AI** [4, 23]: Improved domain adaptation and explainability for smartphone-transmitted X-rays using Multi-Task Learning and deployed it as a text-based reporting tool during the COVID-19 pandemic.
- **Robotics** [5, 7, 26]: Differentiable SLAM framework for LiDAR & cost-effective driver assistance system (ADAS).

ACADEMIC EXPERIENCE

Mila/Inria - Graduate Research Assistant Aug 2021 - Present

- **Unsupervised Finetuning** [1, 10]: Enhanced adaptation to distribution shifts using optimal layer selection for test-time adaptation and self-distillation of CLIP for zero-shot image classification.
- **Domain Generalization** [6, 12]: Improved generalization to distribution shifts using out-of-distribution methods and denoising incorrect predictions using diffusion models.
- **Continual Learning** [3, 22]: Reduced forgetting in continual learning through hessian-aware low-rank approximation and showed that simple ensembling (bagging/dropout) can outperform complex strategies.
- **Adversarial Robustness** [2, 11]: Enhanced adversarial defense by using softmax predictions to detect vulnerable samples cheaply and using test-time adaptation.
- **Out-of-Distribution (OOD)** [9, 15]: Improved OOD detection using gradients from OOD prototype and optimized microservice partitioning by reformulating it into a reinforcement learning (RL) problem.

Computational and Data Science, IISc Bangalore - Graduate Research Assistant Aug 2015 - Aug 2016

- **Visual Semantic Search** [17]: Extracted hierarchical relationships between visually similar classes in CNNs.
- **Parallel Computing** [18, 20]: Scaled molecular dynamics on dragonfly supercomputer using a hierarchical graph partitioning and improved Traveling Salesman Problem using a hybrid CPU-GPU/CUDA implementation.

ONGOING WORKS

- S. Sahoo *et al.* **Data Selection Strategies for Out-of-Distribution Generalization**.
- S. Sahoo *et al.* **Scaling Test-Time Compute for Abstract LLM Reasoning**.
- J. Ngnawe, S. Sahoo *et al.* **Model Stitching for Adversarial Robust Finetuning**.
- S. Menon, S. Sahoo *et al.* **Learnable Layer Selection for Test-Time Adaptation**.
- M. Guerrier, S. Sahoo *et al.* **Test-Time Adaptation for Safe Robot Navigation**.
- K. Mani, S. Sahoo *et al.* **Test-Time Policy Adaptation of RL Agents**.

SELECTED PUBLICATIONS

[1] S. Sahoo, M. ElAraby, J. Ngnawe, Y. Pequignot, F. Precioso, and C. Gagné. **A Layer Selection Approach to Test Time Adaptation**. In: Association for the Advancement of Artificial Intelligence Conference. [link]. *AAAI. 2025*.

[2] J. Ngnawe, S. Sahoo, Y. Pequignot, F. Precioso, and C. Gagné. **Detecting Brittle Decisions for Free: Leveraging Margin Consistency in Deep Robust Classifiers**. In: Advances in Neural Information Processing Systems. [link]. *NeurIPS. 2024*.

[3] J. Li, R. Wang, Y. Lai, C. Shui, S. Sahoo, C. X. Ling, S. Yang, B. Wang, C. Gagné, and F. Zhou. **Hessian Aware Low-Rank Weight Perturbation for Continual Learning**. In: Transactions on Knowledge and Data Engineering Journal. [link]. *TKDE. 2023*.

[4] M. Antony, S. T. Kakileti, R. Shah, S. Sahoo, C. Bhattacharyya, and G. Manjunath. **Challenges of AI driven diagnosis of chest X-rays transmitted through smart phones: a case study in COVID-19**. In: Scientific Reports Journal. [link]. *Nature. 2023*.

[5] P. Kumar, D. Vattikonda, V. B. S. Nadkarni, E. Dong, and S. Sahoo. **Differentiable SLAM Helps Deep Learning-based LiDAR Perception Tasks**. In: British Machine Vision Conference. [link]. *BMVC. 2023*.

[6] S. Sahoo, F. Zhou, Y. Pequignot, J. Ngnawe, F. Precioso, and C. Gagné. **Domain Generalization by Minimizing Out-of-Distribution Detection**. In: Montreal AI Symposium. [link]. *MAIS. 2022*.

[7] F. Aryan, D. Vattikonda, E. Dong, and S. Sahoo. **Grad-lidar-SLAM: Fully differentiable global SLAM for lidar with pose-graph optimization**. In: IROS Workshop on Probabilistic Robotics in the Age of Deep Learning. [link]. *IROS Workshop. 2022*.

[8] S. Sahoo, P. Kumar, V. Shah, V. Kondameedi, A. Jain, A. Verma, C. Bhattacharyya, and V. Vishwanath. **Dynamic to static lidar scan reconstruction using adversarially trained auto encoder**. In: Association for the Advancement of Artificial Intelligence Conference. [link]. *AAAI. 2021*.

[9] M. ElAraby, S. Sahoo, Y. Pequignot, P. Novello, and L. Paull. **GROOD: GRadient-aware Out-Of-Distribution detection in interpolated manifolds**. In: *Under review*. [link]. 2025.

[10] M. Sandhu, Y. Pequignot, S. Nashed, S. Sahoo, and L. Paull. **CLIP-Enhance: Improving CLIP Zero-Shot Classification via von Mises-Fisher Clustering**. In: *Under review*. [link]. 2025.

PREPRINTS

[11] K. Samanta, S. Sahoo, and C. Gagné. **Test Time Adaptation as an Adversarial Defense Strategy**. Internship Report. [link]. 2023.

[12] A. Verma, S. Sahoo, and C. Gagné. **Diffusion based Pseudolabeling under Distribution Shifts**. Internship Report. [link]. 2023.

[13] D. Tiwari, R. Shah, S. Sahoo, and C. Bhattacharyya. **Enhancing Explainability in Medical Images using Global Methods**. Masters Thesis. [link]. 2022.

[14] G. Parashar, S. Sahoo, and C. Bhattacharyya. **Adversarial Robustness for Local Interpretable Methods**. Masters Thesis. [link]. 2021.

[15] S. Sahoo and K. Sellami. **Automated Microservice Extraction using Reinforcement Learning**. [link]. 2021.

[16] D. Shanbag, S. Sahoo, C. Bhattacharyya, and V. V. **An Approach For Accurate Sceneflow Prediction for LiDAR-based Sensors**. Masters Thesis. [link]. 2020.

[17] S. Sahoo and V. Kondameedi. **Establishing Semantic relationships among Object Classes using Deep Networks for Image Classification**. [link]. 2015.

[18] S. Sahoo and V. Kondameedi. **Hybrid Execution of Travelling Salesman Problem**. [link]. 2015.

THESES

[19] S. Sahoo, F. Precioso, and C. Gagné. "**Test-time Out-of-Distribution Generalization**". PhD Proposal. [link]. Mila/Université Laval, 2022.

[20] S. Sahoo and S. S. Vadhiyar. "**Hierarchical Task Mapping on Dragonfly topology for Scaling Molecular Dynamics**". Masters Thesis. [link]. IISc Bangalore, 2016.

[21] S. Sahoo, M. N. Yadav, V. Savalia, R. Soni, R. Agarwal, N. Lomash, and H. B. Naik. "**Thermoacoustic Energy Conversion Using Piezoelectric Diaphragm/Bi-Morph**". Bachelors Thesis. [link]. SVNIT Surat, 2014.

PROJECTS

[22] S. Sahoo, S. Karami, A. Safarnejadian, and A. Tupper. **Deep Ensemble Methods for Vehicle Classification**. [link]. Université Laval. 2021.

[23] S. Sahoo, R. Shah, S. T. Kakileti, C. Bhattacharyya, and G. Manjunath. **A new AI-driven platform will facilitate early-COVID interventions over Whatsapp**. [link]. Department of Science and Technology, Government of India. 2021.

[24] T. Varshney, S. Sahoo, V. Kondameedi, and C. Bhattacharyya. **DCT-VAE: Capturing Low-level and High-level Features for Image Generation**. [link]. IISc Bangalore. 2021.

[25] S. Sahoo, A. Jain, R. Shah, and C. Bhattacharyya. **Improving Automatic Concept Extraction for Global Model Explainability**. [link]. Niramai Health Analytix. 2021.

[26] V. Kondameedi, S. Shet, A. Verma, S. Sahoo, P. Kumar, C. Bhattacharyya, and S. Biswas. **Frugal Advanced Driver Assistance System (ADAS) for Indian Roads**. [link]. TATA Motors. 2020.

[27] S. Sahoo, P. Kumar, C. Bhattacharyya, and V. V. **Proximal Pose Search for Adapting SLAM in Dynamic Environments on Slow Moving UGVs**. [link]. Ati Motors. 2019.

TEACHING AND LEADERSHIP ROLES

- **Teaching Assistant**, Machine Learning course, Université Laval (2022/2023/2024): Involved with designing and grading quizzes/homeworks, and conducting tutorial sessions.
- **Student Mentor**, SHARE Research Labs (2020-21): Teaching and mentoring students for working towards a research paper for top-tier conferences.
- **Organizer** of various reading groups on topics like Machine Learning (2022-23), Out-of-Distribution (2022-25), and Autonomous Navigation (2019-20).
- **Placement Coordinator**, IISc (2015-16): Invited, organized, and coordinated on-campus placement for numerous industries and startups.

HONORS AND AWARDS

- Awarded IID Excellence scholarship 2022.
- Secured research funding from DEEL (2021-Present).
- Secured research funding from Ati Motors (2019-21), and ARTPARK (2021).
- Awarded distinction for my master's thesis.
- Won various competitions: 1st place in NeurIPS 2017 Challenge, top finalist in NVIDIA Reinforcement Learning Competition 2018, 3rd place in SO1 Product Recommendation Competition 2018.