

SABYASACHI SAHOO

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Ph.D. researcher with industry experience (Nvidia) interested in building robust models for real-world deployment.

EDUCATION

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|---|---------------------|
| Mila/Inria/Université Laval Ph.D. in Machine Learning. Advisors: Christian Gagné & Frédéric Precioso . (GPA: 3.9/4) | Sep 2021 - Present |
| Indian Institute of Science (IISc), Bangalore Masters in Computational and Data Science. Advisor: Sathish Vadhiyar . (Top 5 in class) | Aug 2014 - Jul 2016 |
| Sardar Vallabhbhai National Institute of Technology (NIT), Surat Bachelors in Mechanical Engineering. | Aug 2010 - Jul 2014 |

RESEARCH EXPERIENCE

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|---|---------------------|
| Mila/Université Laval - Graduate Research Assistant Work on understanding and improving model robustness and generalization across various domains. <ul style="list-style-type: none">• Test-Time Adaptation (TTA) & Continual Learning: Online early stopping to learn new features during TTA without forgetting pretrained features [1], and low-rank approximation for continual learning improves robustness to task order and forgetting[2].• Out-of-Distribution (OOD) & Adversarial Robustness: Mixup improves OOD detection in gradient space [3], output logits to cheaply detect samples vulnerable to adversarial attacks [4], and improved adversarial robustness using test time adaptation (TTA) [5].• Domain Generalization: Improved generalization by minimizing out-of-distribution detection [6], or denoising classifier predictions using diffusion model [7].• Reinforcement Learning (RL) & Ensembles: Reformulate the microservice partitioning problem as an RL problem [8], and simple ensemble approaches can outperform complex ensembling strategies [9].• Robotics: Differentiable SLAM framework for LiDAR [10], to improve learning based robotics perception [11]. | Sep 2021 - Present |
| ML Lab, IISc Bangalore - Research Assistant Worked on improving model performance and explainability in healthcare and robotics applications. Advisor: Chiranjib Bhattacharyya <ul style="list-style-type: none">• Multi-task learning: for improved disease diagnosis from compressed chest X-ray images [13], which was deployed as an automatic report generation tool during the pandemic [14].• Explainability: Non-negative matrix factorization for expert-aligned concept extraction [15, 16], and exposed vulnerability of popular saliency-based explanation methods to input perturbations [17].• Lidar generation: Adversarial autoencoder-based model for self-driving cars [18], and improved scene flow prediction by adaptively fusing learning-based and geometry-based approaches [19].• ADAS & Image generation: Cost-effective ADAS system optimized for adverse conditions on Indian roads [21], and Discrete Cosine Transform improves high-resolution image generation in Variational Autoencoders [22]. | Feb 2019 - Aug 2021 |
| Computational and Data Science, IISc Bangalore - Graduate Research Assistant Worked on analyzing deep learning models and optimizing computational performance. <ul style="list-style-type: none">• Deep Learning: Extracted semantic relationships between visually similar classes using pretrained CNNs [23].• High-performance computing: Multi-CPU hierarchical graph partitioning algorithm for scaling molecular dynamics [24] and efficient hybrid CPU-GPU implementation for Traveling Salesman Problem [25]. | Aug 2015 - Jul 2016 |

ONGOING WORKS

- Sabyasachi Sahoo, Mostafa ElAraby, Jonas Ngnawe, Yann Pequignot, Frédéric Precioso, and Christian Gagné. **A Mechanistic Interpretation and Improvement of Finetuning for Foundation Models.**
- Mahtab Sandhu, Sabyasachi Sahoo, Yann Pequignot, Samer Nashed, and Liam Paull. **Improving Zero-shot Image Classification of CLIP.**
- Mostafa ElAraby, Sabyasachi Sahoo, and Liam Paull. **Improving OOD detection via Pruning.**
- Jonas Ngnawe, Sabyasachi Sahoo, Yann Pequignot, Frédéric Precioso, and Christian Gagné. **Exploring Adversarially Vulnerable Fraction around Input Hyperspheres in Pretrained Models.**

INDUSTRY EXPERIENCE

Nvidia - Software Engineer II

Aug 2016 - May 2018

Led display team responsible for all self-driving platforms.

- Enhanced **display functionality** by designing and implementing new features while ensuring bug-free operation.
- Designed and modularized the **device tree module**, making it reusable across self-driving platforms.
- Led the implementation of these modules for the new **Jetson Xavier chip** to ensure a successful launch.

Donut Research Labs - Deep Learning Engineer

May 2018 - Feb 2019

Led NLP and computer vision projects for e-commerce applications.

- **Text Normalization:** Improved Walmart's brand name extraction accuracy (35%) using a Seq2Seq model, pretrained on product descriptions, fine-tuned on noisy annotations, and top-k sampling with beam search.
- **Long Tail Text Classification:** Class imbalance aware LSTM sped inference (10%) & improved accuracy (5%).
- **Object Detection:** Built info extraction module from scratch by fine-tuning SSD model on product images.
- **Dataset Building:** for text normalization & object detection projects (collection, annotation, cleaning).

PREPRINTS (UNDER REVIEW)

- [1] [Sabyasachi Sahoo](#), Mostafa ElAraby, Jonas Ngnawe, Yann Pequignot, Frédéric Precioso, and Christian Gagné. **Layerwise Early Stopping for Test Time Adaptation**. In: *arxiv. Under review* (2024). [\[link\]](#).
- [3] Mostafa ElAraby, [Sabyasachi Sahoo](#), Yann Pequignot, Paul Novello, and Liam Paull. **GROOD: GRAdient-aware Out-Of-Distribution detection in interpolated manifolds**. In: *arxiv. Under review* (2024). [\[link\]](#).
- [4] Jonas Ngnawe, [Sabyasachi Sahoo](#), Yann Pequignot, Frédéric Precioso, and Christian Gagné. **Detecting Brittle Decisions for Free: Leveraging Margin Consistency in Deep Robust Classifiers**. In: *arxiv. Under review* (2024). [\[link\]](#).

PUBLICATIONS

- [2] Jiaqi Li, Rui Wang, Yuanhao Lai, Changjian Shui, [Sabyasachi Sahoo](#), Charles X Ling, Shichun Yang, Boyu Wang, Christian Gagné, and Fan Zhou. **Hessian Aware Low-Rank Weight Perturbation for Continual Learning**. In: *Transactions on Knowledge and Data Engineering (TKDE) Journal*. [\[link\]](#). 2023.
- [6] [Sabyasachi Sahoo](#), Fan Zhou, Yann Pequignot, Jonas Ngnawe, Frédéric Precioso, and Christian Gagné. **Domain Generalization by Minimizing Out-of-Distribution Detection**. In: *Proceedings of the Montreal AI Symposium (MAIS)*. [\[link\]](#). 2022.
- [10] FNU Aryan, Dheeraj Vattikonda, Erqun Dong, and [Sabyasachi 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*. [\[link\]](#). 2022.
- [11] Prashant Kumar, Dheeraj Vattikonda, Vedang Bhupesh Shenvi Nadkarni, Erqun Dong, and [Sabyasachi Sahoo](#). **Differentiable SLAM Helps Deep Learning-based LiDAR Perception Tasks**. In: *Proceedings of the British Machine Vision Conference (BMVC)*. [\[link\]](#). 2023.
- [13] Mariamma Antony, Siva Teja Kakileti, Rachit Shah, [Sabyasachi Sahoo](#), Chiranjib Bhattacharyya, and Geetha Manjunath. **Challenges of AI driven diagnosis of chest X-rays transmitted through smart phones: a case study in COVID-19**. In: *Scientific Reports Journal, Nature*. [\[link\]](#). 2023.
- [18] [Sabyasachi Sahoo](#), Prashant Kumar, Vanshil Shah, Vineetha Kondameedi, Abhinav Jain, Akshaj Verma, Chiranjib Bhattacharyya, and Vinay Vishwanath. **Dynamic to static lidar scan reconstruction using adversarially trained auto encoder**. In: *Proceedings of the Association for the Advancement of Artificial Intelligence (AAAI) Conference*. [\[link\]](#). 2021.

OTHER WORKS

- [5] Kunal Samanta, [Sabyasachi Sahoo](#), and Christian Gagné. **Test Time Adaptation as an Adversarial Defense Strategy**. Internship Report. [\[link\]](#). Université Laval, 2023.
- [7] Apoorva Verma, [Sabyasachi Sahoo](#), and Christian Gagné. **Diffusion based Pseudolabeling under Distribution Shifts**. Internship Report. [\[link\]](#). Université Laval, 2023.
- [8] [Sabyasachi Sahoo](#) and Khaled Sellami. **Automated Microservice Extraction using Reinforcement Learning**. [\[link\]](#). Université Laval, 2021.

- [12] [Sabyasachi Sahoo](#), Frédéric Precioso, and Christian Gagné. **Test-time Out-of-Distribution Generalization**. PhD Proposal. [\[link\]](#). Université Laval, 2022.
- [15] Darshika Tiwari, Rachit Shah, Sabyasachi Sahoo, and Chiranjib Bhattacharyya. **Enhancing Explainability in Medical Images using Global Methods**. Masters Thesis. [\[link\]](#). IISc Bangalore, 2022.
- [17] Gaurav Parashar, [Sabyasachi Sahoo](#), and Chiranjib Bhattacharyya. **Adversarial Robustness for Local Interpretable Methods**. Masters Thesis. [\[link\]](#). IISc Bangalore, 2021.
- [19] Dhiraj Shanbag, Sabyasachi Sahoo, Chiranjib Bhattacharyya, and Vinay V. **An Approach For Accurate SceneFlow Prediction for LiDAR-based Sensors**. Masters Thesis. [\[link\]](#). IISc Bangalore, 2020.
- [23] [Sabyasachi Sahoo](#) and Vineetha Kondameedi. **Establishing Semantic relationships among Object Classes using Deep Networks for Image Classification**. [\[link\]](#). IISc Bangalore, 2015.
- [24] [Sabyasachi Sahoo](#) and Sathish S. Vadhiyar. **Hierarchical Task Mapping on Dragonfly topology for Scaling Molecular Dynamics**. Masters Thesis. [\[link\]](#). IISc Bangalore, 2016.
- [25] [Sabyasachi Sahoo](#) and Vineetha Kondameedi. **Hybrid Execution of Travelling Salesman Problem**. [\[link\]](#). IISc Bangalore, 2015.

PROJECTS

- [9] [Sabyasachi Sahoo](#), Sara Karami, Arman Safarnejadian, and Adam Tupper. **Deep Ensemble Methods for Vehicle Classification**. [\[link\]](#). Université Laval. 2021.
- [14] [Sabyasachi Sahoo](#), Rachit Shah, Siva Teja Kakileti, Chiranjib Bhattacharyya, and Geetha Manjunath. **A new AI-driven platform will facilitate early-COVID interventions over Whatsapp**. [\[link\]](#). Department of Science and Technology, Government of India. 2021.
- [16] [Sabyasachi Sahoo](#), Abhinav Jain, Rachit Shah, and Chiranjib Bhattacharyya. **Improving Automatic Concept Extraction for Global Model Explainability**. [\[link\]](#). Niramai Health Analytix. 2021.
- [20] [Sabyasachi Sahoo](#), Prashant Kumar, Chiranjib Bhattacharyya, and Vinay V. **Proximal Pose Search for Adapting SLAM in Dynamic Environments on Slow Moving UGVs**. [\[link\]](#). Ati Motors. 2019.
- [21] Vineetha Kondameedi, Santosh Shet, Akshaj Verma, [Sabyasachi Sahoo](#), Prashant Kumar, Chiranjib Bhattacharyya, and Soma Biswas. **Frugal Advanced Driver Assistance System (ADAS) for Indian Roads**. [\[link\]](#). TATA Motors. 2020.
- [22] Tezuesh Varshney, [Sabyasachi Sahoo](#), and Chiranjib Bhattacharyya. **DCT-VAE: Capturing Low-level and High-level Features for Image Generation**. [\[link\]](#). IISc Bangalore. 2021.

TEACHING AND LEADERSHIP ROLES

- **Teaching Assistant** of Machine Learning course at Université Laval (fall 2022/2023): Conducted weekly tutorial sessions and graded homework/exams.
- **Student Mentor**, [SHARE Research Labs](#) (2020-21): Teaching and mentoring students on the platform for working towards a research paper for top-tier conferences.
- **Organizer**, various reading groups on topics like Machine Learning (2022-23), Out-of-Distribution (2022-24), 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](#).