

Sudarshan Rajagopalan

✉ sambasa2@jhu.edu 📞 +1-410-493-8843 🌐 sudraj2002.github.io 🔗 LinkedIn 🐙 GitHub

Research Interests

I work on generative models for vision, with an emphasis on adapting and leveraging them for real-world image and video restoration and enhancement. My research spans diffusion and autoregressive models, as well as generative transport methods such as Schrödinger bridges. I am broadly interested in large-scale image and video generation, multimodal and omni-modal models, and post-training of generative models.

Experience and Education

Google May 2026 – Present

- Research intern at Google, Mountain View, CA, working on generative models for synthetic data generation using unpaired data.

Dolby Laboratories Sep 2025 – Dec 2025

- Research intern at Dolby Laboratories, Sunnyvale, CA, where I worked on large generative video models for enhancement tasks.

Johns Hopkins University 2023 – Present

- PhD in Electrical and Computer Engineering, advised by Prof. Vishal M. Patel; *GPA: 3.94 / 4.0*
- Coursework: Machine Learning for Signal Processing, Machine Perception, Machine Intelligence
- Anticipated Graduation Date: 12/26

Madras Institute of Technology, Anna University, Chennai, India 2019 – 2023

- Bachelor's in Electronics and Communication Engineering; *CGPA: 9.62/10*
- Coursework: Digital Signal Processing, Image Processing, Artificial Intelligence and Machine Learning

Publications

1. **Your Pre-trained Diffusion Model Secretly Knows Restoration** Mar 2026
Sudarshan Rajagopalan, Vishal M. Patel
Under Review at NeurIPS-2026
2. **SymKL: A Unified Representation-Space Measure of Signal Degradation** Feb 2026
Dhananjaya Jayasundara, Sudarshan Rajagopalan, Vishal M. Patel
Under Review at AAAI-2027
3. **RestoreVAR: Visual Autoregressive Generation for All-in-One Image Restoration** Jan 2026
Sudarshan Rajagopalan, Kartik Narayan, Vishal M. Patel
The Fourteenth International Conference on Learning Representations (ICLR-26)
4. **Human-in-the-loop RGB semantic segmentation for intuitive teaching of novel grasping tasks via few-shot adaptation of lightweight neural networks** Jan 2026
Furkan Kaynar, Sudarshan Rajagopalan, Mahmoud Krichene, Eckehard Steinbach
Computer Vision and Image Understanding (CVIU)
5. **GenDeg: Diffusion-Based Degradation Synthesis for Generalizable All-in-One Image Restoration** Nov 2024
Sudarshan Rajagopalan, Nithin Gopalakrishnan Nair, Jay N. Paranjape, Vishal M. Patel
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR-25)
6. **SINR: Sparsity Driven Compressed Implicit Neural Representations** Nov 2024
Dhananjaya Jayasundara, Sudarshan Rajagopalan, Don Yasiru Lakshan Ranasinghe, Trac Tran, Vishal M. Patel
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR-25)

7. **Low-rank Adaptation-based All-Weather Removal for Autonomous Navigation** Sep 2024
Sudarshan Rajagopalan, Vishal M. Patel
International Conference on Robotics and Automation (ICRA-2025)
8. **AWRaCLE: All-Weather Image Restoration using Visual In-Context Learning** Aug 2024
Sudarshan Rajagopalan, Vishal M. Patel
AAAI Conference on Artificial Intelligence (AAAI-25)
9. **Remote Task-oriented Grasp Area Teaching By Non-Experts through Interactive Segmentation and Few-Shot Learning** Feb 2023
Furkan Kaynar*, Sudarshan Rajagopalan*, Shaobo Zhou, Eckehard Steinbach
AAAI Workshop on Artificial Intelligence for User-Centric Assistance for at Home Tasks, 2023
10. **Spectrum-inspired Low-light Image Translation for Saliency Detection** Dec 2022
Kitty Varghese, Sudarshan Rajagopalan, Mohit Lamba, Kaushik Mitra
The Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), 2022

Research experience

- Synthetic data generation using generative models trained on unpaired data** 2026
- At Google Research, I am working on simulating realistic degradations such as noise, blur, and low-quality artifacts using generative models trained on real-world unpaired degraded data.
 - I developed a scalable *diffusion Schrödinger bridge* approach that learns to generate realistic degradations while preserving the underlying image content, entirely from unpaired data.
- Unlocking Restoration from Pre-trained Diffusion Models** 2026
- Revealed that pre-trained diffusion models possess image restoration capabilities that can be elicited through their *native conditioning pathway*.
 - This behavior is unlocked by learning a conditioning prompt in a *diffusion bridge* framework, enabling pre-trained diffusion models such as FLUX and Wan to achieve effective restoration.
- Large video diffusion models for video enhancement** 2025
- At Dolby Laboratories, I proposed a *latent-space conditioning network* for extracting clean features from degraded video latents. The extracted features were then injected into an *expert-based diffusion* model backbone, Wan 2.2, using 2D *spatial-only cross-attention*.
 - The model was trained using paired LR-HR data and achieved strong generalization to unseen artifacts.
- Visual autoregressive generation for image restoration** 2025
- Proposed RestoreVAR, a *visual autoregressive model* (VAR)-based approach for image restoration.
 - RestoreVAR outperforms generative latent diffusion-based restoration approaches while being over $10\times$ faster during inference.
- Diffusion-based Degradation Synthesis** 2024
- Proposed GenDeg, a novel *Stable Diffusion*-based model that generates diverse degradations on any input image for synthetic data generation. GenDeg conditions on the input image, a text prompt, and the degradation level.
 - Demonstrated that incorporating these synthesized degradations significantly enhances the generalization capabilities of *all-in-one* image restoration models.
- Image Restoration using In-Context Learning** 2024
- Developed AWRaCLE, a state-of-the-art *all-weather image restoration network* that utilizes *visual in-context learning* for enhancing restoration performance.
 - AWRaCLE extracts degradation-specific visual context from a clean-degraded image pair for restoration guidance.
- LoRA for image restoration** 2024
- Proposed leveraging LoRA for efficiently adapting pre-trained all-weather restoration networks to novel tasks. Additionally, introduced an SVD-based alignment technique, LoRA-Align, to mitigate forgetting caused by LoRA.
 - Showed that all-weather models adapted using LoRA and LoRA-Align perform well for autonomous navigation tasks such as depth estimation and semantic segmentation.

Compressed implicit neural representations

2024

- Worked on the problem of compressing the model size of *implicit neural representations (INR)*.
- Used *orthogonal matching pursuit* and *entropy coding* to obtain compressed INR.

Research Grant: Walk-through Rendering from Images of Varying Altitude (WRIVA), advised by Prof. Vishal Patel

2023 - Present

- Working on mitigating image artifacts to enhance 3D scene renderings from images containing artifacts.
- Working on mitigating image artifacts such as over-exposure, under-exposure, JPEG compression, etc. to enhance 3D scene renderings from images containing those artifacts.

Internship at TU Munich advised by Prof. Eckehard Steinbach

July 2022 – Oct 2022

- Developed a *few-shot* robotic grasp-area learning framework to segment an area of an object for grasping tasks.
- Used the Reptile *meta-learning* algorithm to train a U-Net for segmenting graspable regions.

Computational Imaging Lab, IIT Madras advised by Prof. Kaushik Mitra

May 2021 – Nov 2022

- Worked on a Fourier-transform based *image translation* method to transform well-lit images into low-light images. Our method used carefully designed band-pass filtering with 2D windowing to suppress ringing artifacts.
- Explored *Neural Architecture Search* for low-light restoration and achieved comparable results to that of state-of-the-art methods.

Final Year Project, Madras Institute of Technology, advised by Prof. Mala John

Jan 2023 - May 2023

- Developed a sketch-to-face generation method for aiding fugitive recognition.
- Utilized a conditional generative adversarial network (GAN) with edge-guidance loss to produce sharp and accurate face images from sketches.

Technical Skills

Coding: Python, C++, MATLAB

Deep Learning: PyTorch, JAX, Flax, TensorFlow

Teaching Experience

Teaching Assistant for *Perception for Embodied AI*

Spring 2026

- Grading and weekly office hours.

Teaching Assistant for *Introduction to Digital Signal Processing*

Fall 2024

- Grading and weekly office hours.

Scholastic Achievements

- Awarded the DAAD WISE scholarship 2022 for a fully funded research internship at TU Munich, Germany.
- Ranked in the top 3% of my batch of 164 students in my undergraduate studies.
- Qualified in the Joint Entrance Examination Advanced (JEE Advanced) 2019, among 1,50,000+ candidates.

Academic Service

- Reviewer: *CVPR, ECCV, ICLR, NeurIPS, AAAI, TIP, TPAMI*