

# Rhitvik Sinha

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## EDUCATION

### Courant Institute of Mathematical Sciences, New York University

New York, NY

*Master of Science in Computer Science*

2022 - 2024

**Courses:** *Computer Vision, Machine Learning, Reinforcement Learning, Large Language & Vision Models, DL Systems*

### Indian Institute of Technology, Kharagpur

Kharagpur, India

*Bachelor of Technology (Honours) in Electrical Engineering*

2018 - 2022

**Courses:** *Deep Learning, Data Analytics, Transform Calculus, Probability & Stochastic Processes*

## TECHNICAL SKILLS

**Languages:** *Python, C/C++, CUDA, MATLAB, R, JavaScript, Scala, Java*

**Python Tools:** *PyTorch, TensorFlow 2.x, OpenCV, Gym/Gymnasium/PettingZoo, multiprocessing, Z3*

**Developer Tools:** *Git, Docker, AWS, GCP, LaTeX, VS Code, Unity (ML-Agents)*

## EXPERIENCE

### Systems and Applications Engineering Intern

Summer 2023

*Cirrus360 Corp., Richardson, TX*

*Supervisor: Dr. Alan Gatherer*

- Directly assisted the team of Co-Founders in the development, optimization & release of an experimental Domain Specific Language with applications in the setup of private wireless networks.
- Used Python's multiprocessing tool to enable parallel execution of a Z3-based Constraint Solver resulting in a logarithmic speedup as the number of CPU cores is increased.
- Developed a Flask-hosted Automatic Speech Recognition (ASR) tool using OpenAI's Whisper API & TorchAudio to transcribe audio files, as a sample web-app deployed on this experimental network to demonstrate its feasibility.

**Skills:** *Domain Specific Languages • Python: multiprocessing, Z3, Flask, Whisper, TorchAudio • JavaScript: MediaRecorder*

### Graduate Employee Adjunct

Fall 2023

*Courant Institute of Mathematical Sciences, New York University*

*Supervisor: Prof. Eyal Lubetzky*

- Lead recitations for 4 sections of *MATH-UA.121: Calculus 1*. Hold office hours, proctor midterms & finals.
- Help students understand and practice the material taught during lecture.
- Communicate and coordinate with instructor to prepare and grade materials such as quizzes and worksheets.

**Skills:** *Teaching • Grading • Tutoring*

## PROJECTS

### Image Encoding Schemes for Vision Transformers | [Paper](#)

Fall 2023

*Course Project (CSCI-GA 3033 Special Topics: Large Language & Vision Models), NYU*

*Guide: Prof. Saining Xie*

- Reviewed literature on image tokenization methods in a Vision Transformer. Extensively studied the techniques 'Convolutions before Tokenization', 'Vector Quantization' & 'Mixed-Resolution Tokenization'.
- Working with the CIFAR10 & CIFAR100 datasets, observed the following: 'Convolutions before Tokenization' improves performances, but adds a substantial training cost; 'Vector Quantization' does not improve performance; 'Mixed-Resolution Tokenization' improves performance at a marginal training cost.

**Skills:** *Vision Transformers • Python: PyTorch • Image Tokenization*

### Adaptive SphereFormer: Dynamic Radial Windows for Better Sparse Learning | [Paper](#)

Fall 2023

*Course Project (CSCI-GA 2271 Computer Vision), NYU*

*Guide: Prof. Rob Fergus*

- Reviewed literature on state of the art LiDAR segmentation techniques, with particular emphasis on the SphereFormer (Lai et al. 2023). Reproduced results of the baseline SphereFormer and observed the memory limitations encountered.
- Proposed a modified solution which we call, 'Adaptive SphereFormer' that improves the state of the art LiDAR 3D Segmentation accuracy, by a Mean Intersection over Union (mIoU) of 1%.

**Skills:** *Transformer Models • Python: PyTorch • LiDAR 3D Segmentation*

### Optimizing Diffusion Models for Image De-Noising | [Paper](#)

Fall 2022

*Course Project (CSCI-GA 2565 Machine Learning), NYU*

*Guide: Prof. Rajesh Ranganath*

- Reviewed literature on generative models (VAEs, GANs etc), with special emphasis on diffusion models.
- Reproduced benchmarks of Denoising Diffusion Probabilistic Model (DDPM) to set a baseline.
- Modified & trained diffusion models to accept noisy images as input, and reported effect of input noise level, diffusion input step and diffusion cycles on the de-noising output of DDPM. Also implemented & trained a class-conditioned diffusion model.
- Trained a diffusion model to re-generate images with missing pixels, essentially behaving as a Masked Auto-Encoder.

**Skills:** *Diffusion Models • Python: PyTorch • Image Denoising • Masked Image Generation*