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

Indian Institute of Technology, Kharagpur — Kharagpur, India
Bachelor of Technology (Honours) in Electrical Engineering — *2018 - 2022*
Courses: *Transform Calculus, Probability & Stochastic Processes, Deep Learning, Data Analytics*

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*
- Hold 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

Optimizing Diffusion Models for Image De-Noising — 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: *Generative AI • Diffusion Models • Python: PyTorch • Image Denoising • Masked Image Generation*

Multi-Agent RL with Unity (SoccerTwos) — Spring 2023
Course Project (DS-GA 3001 Special Topics: Reinforcement Learning), NYU — *Guide: Prof. Jeremy Curuksu*
- Used Unity's ML-Agents PettingZoo Wrapper to train and compare policies on the SoccerTwos environment (2v2 soccer).
- Used Self-Play to train agent against a former copy of this agent. Experimented with PPO (Proximal Policy Optimization), SAC (Soft Actor Critic) and POCA (Posthumous Credit Assignment) policies.
- Observed that POCA trained agent learned collaborative 'attack' and 'defence' strategies unaided by human feedback.

Skills: *Game-Playing AI • Reinforcement Learning • Python: ML-Agents, Gym, PettingZoo*

Deep Learning for Extreme Weather Forecasting — Spring, Fall 2021
Undergraduate Research, IIT Kharagpur — *Guide: Prof. Adway Mitra*
- Performed literature review, with specific focus on Capsule Neural Networks and Analog Weather Forecasting.
- Used surface temperature (T2m) and geopotential height at 500 mbar (Z500) (from the NCAR CESM-LENS datatset) to make analogous predictions of the onset of heat/cold waves over North America, 1-5 days ahead.
- Observed that CapsNets outperformed CNNs and logistic regression; confirmed trends observed in the paper 'Analog Forecasting of Extreme-Causing Weather Patterns Using Deep Learning' (2020, Chattopadhyay et al.)

Skills: *Predictive AI • Capsule Neural Nets • Python: TensorFlow, GeoPandas • Extreme Weather Forecasting*

Technical Skills

Languages: *Python, C++, 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)*