

SAMYAK JAIN

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[LinkedIn](#) ◊ [Github](#) ◊ [Webpage](#) ◊ [Google Scholar](#) ◊ [Twitter](#)

EDUCATION

Indian Institute of Technology (BHU) Varanasi

August 2018 - May 2023

Integrated Dual Degree (B.Tech + M.Tech) in Computer Science - CGPA : 9.55/10.0

[Master's Thesis](#)

AREAS OF INTEREST

Research topics: AI safety, AI alignment, Science of deep learning, Interpretability, Learning dynamics

Sub-topics: Adversarial robustness, Red teaming, Safety fine-tuning, Compositional generalization, Phase transitions, Mode connectivity, Domain generalization, Reward hacking, Cooperative alignment, Lottery ticket hypothesis.

EXPERIENCE

Microsoft Research India

July 2024 - Present

Research Fellow

Mentor [Navin Goyal](#)

Project: Developing a better understanding on why lottery tickets exist using tools from interpretability.

Five AI and Torr Vision Group, University of Oxford

October 2023 - June-2024

Research Intern

Mentor [Puneet Dokania](#)

Project: Demonstrated the mechanisms involved behind the success of jailbreaking attacks.

Krueger AI Safety Lab, University of Cambridge

May 2023 - October-2023

Research Intern

Mentor [David Krueger](#)

Project: Showed that fine-tuning learns minimal transformations of a pretrained model's capabilities, like a "wrapper".

Vision and AI Lab, Indian Institute of Science, Bangalore

May 2020 - May-2023

Research Intern

Mentor [Venkatesh Babu](#)

Project: Built more effective and efficient adversarial training methods, achieving SOTA performance on leaderboards.

Theoretical Foundations of AI Lab, Technical University of Munich

May 2021 - August-2021

Research Intern

Mentor [Debarghya Ghoshdastidar](#)

Project: Worked on understanding the learning dynamics of linear autoencoders.

PUBLICATIONS

- **What Makes Safety Fine-tuning Methods Safe? A Mechanistic Study**
Samyak Jain, Ekdeep Singh, Kemal Oksuz, Tom Joy, Phil Torr, Amartya Sanyal, Puneet Dokania
ICML workshop on Mechanistic Interpretability, 2024 ([Spotlight](#))
NeurIPS 2024 [main code](#)
- **Mechanistically analyzing the effects of fine-tuning on procedurally defined tasks**
Samyak Jain*, Robert Kirk*, Ekdeep Singh*, Hidenori Tanaka, Robert Dick, Tim Rocktaschel, Edward Grefenstette, David Krueger
ICLR 2024 [main code](#)
- **Towards Understanding and Improving Adversarial Robustness of Vision Transformers**
Samyak Jain, Tanima Dutta
CVPR 2024 [main](#)
- **DART: Diversify-Aggregate-Repeat Training Improves Generalization of Neural Networks**
Samyak Jain*, Sravanti Addepalli*, Pawan Sahu, Priyam Dey, RV. Babu
CVPR-2023 [main code](#)
- **Efficient and Effective Augmentation Strategy for Adversarial Training**
Sravanti Addepalli*, [Samyak Jain*](#), RV. Babu
NeurIPS 2022 [main code](#)
- **Scaling Adversarial Training to Large Perturbation Bounds**
Sravanti Addepalli*, [Samyak Jain*](#), Gaurang Sriramanan, RV. Babu
ECCV 2022 [main code](#)
- **Boosting Adversarial Robustness using Feature Level Stochastic Smoothing**
Sravanti Addepalli*, [Samyak Jain*](#), Gaurang Sriramanan*, RV. Babu
SAIAD Workshop CVPR 2021 [main code](#)

FEATURED ACADEMIC PROJECTS AND COLLABORATIONS

Understanding the lottery ticket hypothesis [Navin Goyal](#)

- Found that neurons forming lottery tickets have a high projection with the final model at initialization.
- High projection leads to exponential rise in norm, thereby enforcing faster convergence of such neurons.

Mechanistic understanding of safety fine-tuning and jailbreaking attacks [Puneet Dokania](#), [Ekdeep Singh](#), [Amartya Sanyal](#), [Phil Torr](#)

- Safety fine-tuning projects unsafe samples into model's (low rank) null space, resulting in safety.
- Safety fine-tuned model is unable to project jailbreaks into it's null space, thus circumventing safety.
- [Gemma Scope](#) highlighted the safety value of using sparse autoencoders based on insights in this work.

Mechanistic understanding of fine-tuning [Robert Kirk](#), [Ekdeep Singh](#), [David Krueger](#), [Hidenori Tanaka](#), [Tim Rocktschel](#), [Edward Grefenstette](#)

- Demonstrated that fine-tuning is unable to alter the model mechanistically, giving pretense of change.
- Reverse fine-tuning proposed in this work has become the staple method for evaluating unlearning.
- [Follow-up](#) works have used key insights from our work to counter use of safety fine-tuning as an assurance protocol.

Exploring loss basin to find generalized solutions [RV. Babu](#), [Sravanti Addepalli](#)

- Analytically showed that weight averaging of diverse models in training increases time to learn spurious features.
- Proposed method DART demonstrated improvements on both in-domain and out of domain settings.

Using data augmentations effectively in adversarial training [RV. Babu](#), [Sravanti Addepalli](#)

- Showed for the first time that it is possible to use augmentations effectively in adversarial training.
- Demonstrated that weight space smoothing can help in preventing catastrophic overfitting.

Aligning adversarial training with Ideal training objectives [RV. Babu](#), [Sravanti Addepalli](#)

- Observed that standard AT cannot generalize to larger perturbation bounds due to conflict in training.
- Proposed a method, which aims to align the model's predictions with the oracle labels of adversarial images.

Understanding gradient masking in vision transformers [Tanima Dutta](#)

- Past works have demonstrated gradient masking in vision transformers, but failed to analyze the cause.
- Demonstrated that softmax in attention causes floating point errors leading to gradient masking in VITs.

SCHOLASTIC ACHIEVEMENTS

- Recipient of **DAAD-WISE**, a research oriented scholarship program by German Government.
- Fellow of Berkeley Existential Risk Initiative (**BERI**), which supported my research at Cambridge.
- Recipient of Summer Research Fellowship 2020 (**SRFP**), a research program by Indian Government.
- All India rank 922 in JEE Advanced 2018 and 346 in JEE Mains 2018 out of 1 million+ candidates.
- Selected for the KVPY 2018 Fellowship (IISc, Bangalore) by the Govt. of India.
- Ranked amongst **Top 300** students in India for Maths, Physics and Astronomy Olympiads at national level – INMO, INPhO, INAO 2018. City topper in National Talent Search Exam (NTSE) 2016.
- Member of [Future of Life-Existential AI Safety Community](#).

INVITED TALKS AND PRESENTATIONS

Mechanistic understanding of safety fine-tuning and jailbreaks ICML mechanistic interpretability workshop	July 2024
Pitfalls in safety fine-tuning for robust alignment ETH Zurich AI Center.	February 2024
Mechanistic understanding of fine-tuning Krueger AI safety lab and Five AI.	November 2023

FEATURED POSITIONS AND RELEVANT COURSES

Reviewer: NeurIPS 2024, ICLR 2024, ICML 2023, NeurIPS 2023, CVPR 2023, CVPR 2022, ICLR 2022, NeurIPS 2022.

Outstanding / Highlighted reviewer award: NeurIPS 2024, CVPR 2023, CVPR 2022, ICLR 2022

Teaching Assistant: Introduction to Database Management and Introduction to Machine Learning

- Conducted lab classes of undergraduate students with a batch size of over eighty.
- Worked alongside the professor to make and evaluate lab assignments and final course assessments.

Relevant Courses: Computer Vision (**A**), Applications of Deep-Learning (**A**), Theory of computation (**A-**), Artificial Intelligence (**A**), Probability and Statistics (**A**), Stochastic processes (**A**), Linear Algebra (**A**), Data Mining (**A**), Computer Graphics (**A***), Mathematical Methods (**A**), Number Theory (**A-**), Data Structures (**A-**) and Algorithms (**A***), Information Security (**A***), Theory of Rings and Modules (**A**), Probabilistic Graphical Models, Optimization.