Arpit Bansal

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Research Interests

My research primarily revolves around empirical analysis and optimization of Deep Neural Network architectures, focusing on enhancing their training and inference mechanisms. I have a pronounced interest in image synthesis, specifically in text-to-image generation models, involving methodologies to streamline image generation processes and an in-depth exploration of diffusion model mechanisms. Additionally, I have ventured into algorithmic synthesis via neural networks and developed robust watermarking techniques for neural networks. A complementary aspect of my research includes investigating the inherent behaviors and characteristics of neural networks in various scenarios.

Education

University of Maryland, College Park — *College Park*
PhD in Computer Science ($3.925/4.0$) — *Jan 2021 - present*
- Advisor: Prof. Tom Goldstein
- Dean's Fellowship

Indian Institute of Technology, Kharagpur — *Kharagpur, India*
Bachelors + Masters in Electrical Engineering — *Aug 2014 - May 2019*
- Minor in Computer Science
- Advisor: Prof. Rajiv Ranjan Sahay

Industry Experience

June 2023 - Aug 2023
Amazon AWS AI labs
Applied Science Intern
Examined the challenges of existing Text-to-Image Diffusion models' low fidelity and devised a novel approach to produce high-fidelity images conditioned on text.

July 2019 - Dec 2020
Visa Incorporated, India
Software Developer
Designed an NLP engine for intuitive English queries and an impactful Recommendation System, earning a Visa Trade Secret. Introduced a Merchant Rating system based on transaction nature, recognized with another Trade Secret for its Research and Development.

May 2018 - July 2018
Visa Incorporated, India
Software Developer Intern
Developed a robust algorithm to discern relationships among thousands of database columns by analyzing their English-named titles and the frequency of their combined queries.

May 2017 - July 2017
Fission Labs, India
Machine Learning Intern
Solved a real-world problem using Deep Learning (CNN), to enable Instant Appraiser Estimation in Automobile Trading Industry.

Selected Publications

Universal guidance for diffusion models
A. Bansal*, H. Chu*, A. Schwarzschild, S. Sengupta, M. Goldblum, J. Geiping, T. Goldstein
Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops 2023

Cold diffusion: Inverting arbitrary image transforms without noise
A. Bansal, E. Borgnia, H. Chu, J Li, H. Kazemi, F. Huang, M. Goldblum, J. Geiping, T. Goldstein
arXiv preprint arXiv:2208.09392

End-to-end Algorithm Synthesis with Recurrent Networks: Logical Extrapolation Without Overthinking
A. Bansal*, A. Schwarzchild*, E. Borgnia, Z. Emam, F. Huang, M. Goldblum, T. Goldstein
Conference on Neural Information Processing Systems (Neurips) 2022

Certified Neural Network Watermarks with Randomized Smoothing
A. Bansal*, P. Yeh Chiang*, M. Curry, R. Jain, C. Wigington, V. Manjunatha, J. P Dickerson, T. Goldstein
International Conference on Machine Learning (ICML - Spotlight) 2022

Can You Learn the Same Model Twice? Investigating Reproducibility and Double Descent from the Decision Boundary Perspective
G. Somepalli, L. Fowl, **A. Bansal**, P. Yeh Chiang, Y. Dar, R. Baraniuk, M.GoldBlum, T. Goldstein
Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR - Oral) 2022

Transfer Learning with Deep Tabular Models
R. Levin*, V. Cherepanova*, A. Schwarzschild†, **A. Bansal**†, C Bayan Bruss, T. Goldstein, A. G. Wilson, M. Goldblum
International Conference on Learning Representations (ICLR) 2023

Canary in a Coalmine: Better Membership Inference with Ensembled Adversarial Queries
Y. Wen, **A. Bansal**, H. Kazemi, E. Borgnia, M. Goldblum, J. Geiping, T. Goldstein
International Conference on Learning Representations (ICLR - Spotlight) 2023

Gradient-based optimization is not necessary for generalization in neural networks
P. Yeh Chiang, R. Ni, D. Yu Miller, **A. Bansal**, J. Geiping, M. Goldblum, T. Goldstein
International Conference on Learning Representations (ICLR - Spotlight) 2023

Teaching Experience

Fall 2021 **Control Systems**, Teaching Assistant — *University of Maryland, College Park*
Spring 2021 **Operating Systems**, Teaching Assistant — *University of Maryland, College Park*

Relevant Course-work

Machine Learning Information Retrieval (IIT), Machine Learning (IIT), Speech and NLP (IIT), Deep Learning (UMD), Algorithms in Machine Learning (UMD)

Signal Processing Digital Signal Processing (IIT), Statistical Signal Processing (IIT), Probability and Stochastic Processes (IIT), Random Processes (UMD), Information Theory (UMD), Numerical Analysis I (UMD), Advanced Numerical Optimization (UMD)