Gautham Govind Anil

Pre-Doctoral Researcher, Google DeepMind
gauthamga.gga@gmail.com
Website Github LinkedIn

Education

Indian Institute of Technology Madras 2019 - 2024
Dual Degree - B.Tech. in Electrical Engineering + M.Tech. in Data Science **Department Rank: 1, 9.72/10**

Publications & Preprints

Fine-Tuning Diffusion Models via Intermediate Distribution Shaping **[In Submission]**
GG Anil, *SU Haque, N Kannen, D Nagaraj, S Shakkottai, K Shanmugam* **Presented @ PUT Workshop, ICML 2025**

Interleaved Gibbs Diffusion for Constrained Generation **[In Submission]**
GG Anil, *S Yadav, D Nagaraj, K Shanmugam, P Jain* **Presented @ DeLTA Workshop, ICLR 2025**

Infinite Width Limits of Self Supervised Neural Networks
M Fleissner, ***GG Anil***, *D Ghoshdastidar* **[AISTATS 2025]**

When Can We Approximate Wide Contrastive Models with NTKs and PCA?
GG Anil, *P Esser, D Ghoshdastidar* **[AAAI 2025]**

QuGAP: Generating Universal Adversarial Perturbations for Quantum Classifiers
G Anil*, *V Vinod*, A Narayan* **[AAAI 2024]**

Research Experience

Pre-Doctoral Researcher, Google DeepMind Aug '24 - Present
Advisors: **Dr. Dheeraj Nagraj**, **Dr. Karthikeyan Shanmugam**, **Dr. Prateek Jain**

Fine-Tuning Diffusion Models via Intermediate Distribution Shaping
- Marginal KL intractable for diffusion models; policy gradient methods rely on relaxations of marginal KL.
- Proposed GRAFT for exact implicit marginal KL regularization; P-GRAFT to further improve sample efficiency.
- Developed Inverse Noise Correction for reversible flow models to fine-tune even without explicit rewards.
- An 8.81% improvement in VQAScore for Text-to-Image generation was obtained using proposed methods.

Interleaved Gibbs Diffusion for Constrained Generation
- Existing discrete-continuous diffusion frameworks assume factorizability across elements during reversal.
- They do not capture constraints well; demonstrated 7% improvement in 3-SAT by forgoing factorizability.
- Introduced a novel discrete-continuous diffusion framework achieving exact reversal with ideal denoisers.
- SOTA performance across layout, molecule and tabular generation without domain-specific architectures.

Visiting Student Researcher, Technical University of Munich Oct '23 - Mar '24
Advisor: **Prof. Debarghya Ghoshdastidar**

Infinite Width Limits of Self-Supervised Neural Networks
- Prior works implicitly assume convergence to NTK for wide neural nets trained using non-contrastive losses.
- Rigorously established NTK constancy for one hidden layer wide neural nets trained with Barlow Twins loss.
- New proof technique to account for Barlow Twins' training dynamics; leveraged Grönwall's inequality.
- Derived generalization error bounds for Kernel Barlow Twins; connected to finite neural nets through NTK.

Approximating Wide Contrastive Models with NTKs and PCA
- Equivalences between optimization objectives of (kernel) contrastive learning and PCA are known.
- First to analyze training dynamics for contrastive losses; proved NTK constancy for cosine-similarity losses.
- NTK does not lead to a closed-form solution; imposed orthogonality constraints to derive explicit solution.
- Established closeness between PCA and Grassmannian gradient descent for cosine-similarity losses.

*Equal Contribution

Research Intern, The University of British Columbia Jun '22 - Aug '23
Advisor: **Prof. Apurva Narayan**

Generating Universal Adversarial Perturbations for Quantum Classifiers
- UAPs are well established for classical machine learning models; notion ill-defined for Quantum Classifiers.
- Conceptualized and theoretically proved existence of additive UAPs; proposed QuGAP-A for generation.
- Introduced QuGAP-U for generation of unitary UAPs; leveraged a novel fidelity-based loss for high fidelity.
- QuGAP-U achieved full misclassification at over 20% higher quantum state fidelity compared to prior SOTA.

Other Major Projects

Audio-Visual Segmentation under **Prof. AN Rajagopalan** Jan '23 - May '23
- Utilized disjoint image and audio datasets for AV segmentation; on par performance with curated datasets.
- Proposed and evaluated a modular AV segmentation pipeline using audio labels; improved mIoU by 15%.

Reinforcement Learning Methods under **Prof. Balaraman Ravindran** Jan '23 - May '23
- Implemented DQN and Actor-Critic methods on OpenAI gymnasium (Acrobot, Cart Pole, Mountain Car).
- Empirically compared and contrasted SARSA and Q-Learning as well as SMDP and Intra-option Q-Learning.

Combinatorial Optimization using Quantum Annealing under **Prof. Anil Prabhakar** Jan '22 - May '22
- Formulated QUBOs for solving combinatorial optimization problems such as Vehicle Routing and Clustering.
- Empirically demonstrated improved time complexity for the proposed quantum annealing algorithm.

Multi-Robot Coverage Planning under **Prof. Balaji Srinivasan** Oct '21 - Dec '21
- Developed a multi-agent coverage path planner inspired by Boustrophedon Cellular Decomposition.
- Trained semantic segmentation modules for trash detection; first position in Inter-IIT Robotics challenge.

Remote Sensing using SAR with **GalaxEye Space Solutions Pvt. Ltd.** Jun '21 - Aug '21
- Proposed a novel method for Range Cell Migration Correction by modifying Range Doppler Algorithm.
- Implemented the algorithm for FMCW SAR; lowered ADC sampling rate and achieved 50% speed boost.

Key Coursework

Pattern Recognition & Machine Learning, Reinforcement Learning, Modern Computer Vision, Mathematical Foundations of Data Science, Estimation Theory, Control Theory, Probability, Statistics & Stochastic Processes, Linear Algebra, Multivariate Calculus, Data Structures & Algorithms, Big Data Lab, Introduction to Data Analytics, Quantum Computation & Quantum Information, Digital Signal Processing, Computer Organization.

Achievements

2024 Selected for 2-year pre-doctoral researcher program at Google DeepMind India.
2024 Received American Express Leadership Award for Excellence in Data Science.
2023 Selected for 6-month research internship at Technical University of Munich through DAAD-KOSPIE.
2022 Selected for 12-week research internship at The University of British Columbia through MITACS-Globalink.
2022 Selected as an Undergraduate Young Research Fellow at IIT Madras from over 200 candidates.
2019 Secured All India Rank 187 (top 0.02%) among 1.1 million candidates in JEE (Main).
2019 Secured All India Rank 415 (top 0.2%) among 0.2 million candidates in JEE (Advanced).

Talks & Presentations

2025 Poster @ PUT Workshop, ICML 2025, Vancouver Convention Centre, Canada
2024 Talk @ TFAI, Technical University of Munich, Germany
2024 Poster @ AAAI 2024, Vancouver Convention Centre, Canada
2022 Poster @ Young Research Fellow Showcase Event, Indian Institute of Technology Madras

Volunteering

2024 Volunteer @ AAAI 2024, Vancouver: Coordinated workshop sessions.
2022 Coordinator @ Jobs & Internships Cell, IIT Madras: Handled logistics for on-campus job fairs.
2021 Audiobook Narrator @ NSS, IIT Madras: Audiobooks for enabling individuals with visual impairment.
2020 Mentor @ Avanti Fellows, IIT Madras: Mentored over 60 underprivileged high school students.
2020 Content Writer @ NSS, IIT Madras: Wrote high school level articles on Physics & Chemistry.