Prakhar Ganesh

COMPUTER SCIENCE · PHD STUDENT

Université de Montréal (UdeM) | Quebec AI Institute (Mila)

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Research Interests : I am attracted to the challenges that arise in machine learning when moving from the sandbox to the real world, primarily at the intersection of various pillars in trustworthy machine learning, including fairness, privacy, adversarial robustness, model compression, etc., focusing on uncovering the learning dynamics of neural networks.

Education

Université de Montréal (UdeM) | Quebec AI Institute (Mila)
COMPUTER SCIENCE, DOCTORATE | ADVISOR: PROF GOLNOOSH FARNADI   *Sep 2023 - Present*

National University of Singapore (NUS)
MASTER OF COMPUTING (AI SPECIALISATION) | ADVISOR: PROF REZA SHOKRI   *Aug 2021 - Mar 2023*

Indian Institute of Technology Delhi (IITD)
BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING   *Aug 2015 - May 2019*

Work Experience

NATIONAL UNIVERSITY OF SINGAPORE (NUS) | RESEARCH INTERN   *Jan 2023 - Apr 2023*

ALVISUAL | AI ENGINEER (INTERN)   *Jan 2022 - Mar 2022*

ADVANCED DIGITAL SCIENCES CENTER (ADSC) | RESEARCH ENGINEER   *Jun 2019 - July 2021*

KRIDA.AI | ENGINEER (INTERN)   *Jan 2019 - May 2019*

WEALTHNET ADVISORS | ANALYST (INTERN)   *May 2018 - July 2018*

Publications

On The Impact of Machine Learning Randomness on Group Fairness
[BEST PAPER AWARD] ACM CONFERENCE ON FAIRNESS, ACCOUNTABILITY AND TRANSPARENCY (FACCT), 2023
Prakhar Ganesh, Hongyan Chang, Martin Strobel, Reza Shokri

YOLO-ReT: Towards High Accuracy Real-time Object Detection on Edge GPUs
IEEE/CVF WINTER CONFERENCE ON APPLICATIONS OF COMPUTER VISION (WACV), 2022
Prakhar Ganesh, Yao Chen, Yin Yang, Deming Chen, Marianne Winslett

HiKonv: High Throughput Quantized Convolution With Novel Bit-wise Management and Computation
ASIA AND SOUTH PACIFIC DESIGN AUTOMATION CONFERENCE (ASP-DAC), 2022
Yao Chen, Xinheng Liu, **Prakhar Ganesh**, Junhao Pan, Jinjun Xiong, Deming Chen

Compressing Large-Scale Transformer-Based Models: A Case Study on BERT
TRANSACTIONS OF THE ASSOCIATION FOR COMPUTATIONAL LINGUISTICS (TACL), 2021
Prakhar Ganesh, Yao Chen, Xin Lou, Mohd. Ali Khan, Yin Yang, Hassan Sajjad, Preslav Nakov, Deming Chen, Marianne Winslett

Learning-based Detection and Characterization of Time Delay Attack in Cyber-Physical Systems
IEEE TRANSACTIONS ON SMART GRID (TSG), 2021
Prakhar Ganesh, Xin Lou, Yao Chen, Rui Tan, David K.Y. Yau, Deming Chen, Marianne Winslett

Assessing and Mitigating the Impact of Time Delay Attack: Case studies for Power Grid Controls
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS (JSAC), 2020
Xin Lou, Cuong Tran, Rui Tan, David K.Y. Yau, Zbigniew T. Kalbarczyk, Ambarish Kumar Banerjee, **Prakhar Ganesh**

Competitions and Awards

2023   **Best Paper Award**, ACM Conference on Fairness, Accountability and Transparency (FAccT)
2022   **Winner**, 8-Bit Bias Bounty Competition - Supervised Learning Track
2021   **Top 3 Teams**, ASP-DAC System Design Contest

Selected Projects

Training Non-Determinism and Group Fairness
OCT 2021 - DEC 2022 | NATIONAL UNIVERSITY OF SINGAPORE (NUS)
- Investigated the impact of various sources of randomness in training neural networks on group fairness measures.
- Identified the high variance in group fairness measures as a result of the volatility of the learning process specifically for underrepresented groups and analyzed the dominant source of randomness as the stochasticity of data order during training.
- Developed an approach to manipulate group-level accuracy (and model fairness) by creating custom data orders for training.

Lightweight Object Detection on Edge Devices
Aug 2020 - May 2021 | Advanced Digital Sciences Center (ADSC)
- Designed a lightweight detection model that runs real-time (>30 FPS) on Jetson Nano. Featured on NVIDIA Jetson Forum.
- Scrutinized the practise of complete backbone transfer learning with empirical results, and proposed novel architectural components by exploiting multi-scale feature interaction to simiultaneously improve accuracy and execution speed.
- Assisted with the design of a novel algorithm capable of executing parallelized low-bit convolutions in full-bitwidth multipliers.

Compressing Large-Scale Transformer-Based Models
Jan 2020 - Jun 2020 | Advanced Digital Sciences Center (ADSC)
- Summarized the existing body of research on compressing Transformers, with a specific focus on the widely used BERT, providing an overview of the current state-of-the-art methods and techniques.
- Analyzed and categorized different compression methods, shedding light on their effectiveness and providing insights into their underlying mechanisms, and even clarified several best practices for compressing large-scale Transformer models.

Protection against Time Delay Attacks
Jun 2019 - Jan 2020 | Advanced Digital Sciences Center (ADSC)
- Proposed a hierarchical LSTM capable of online processing to provide timely warnings in cyber-physical systems.
- Improved upon existing postmortem data-driven approaches by providing quicker predictions followed by gradual improvements with time for accurate and simultaneous detection and characterization of time delay attacks.
- Achieved ∼70% decrease in prediction error against baselines with only $1/3^{rd}$ reaction latency and real-time protection.

Deep Learning in High Frequency Trading
May 2018 - July 2018 | WealthNet Advisors
- Proposed a hybrid LSTM with multi-context features to incorporate both short-term and long-term signals together in HFTs.
- Achieved ∼4% boost in F-score against existing techniques, and integrated the pipeline into the company's trading module.

Restructuring Conversations for Zero-shot Abstractive Dialogue Summarization
Feb 2018 – May 2018 | IIT Delhi
- Proposed a zero-shot abstractive dialogue summarization that uses discourse relations to provide structure to conversations.
- State-of-the-art performance, with open-ended improvement possibilities as the underlying document summarizers get better.

Preprints/Manuscripts

Free Lunch for Co-Saliency Detection: Context Adjustment
ArXiv Preprint arXiv:2108.02093
Lingdong Kong, **Prakhar Ganesh**, Tan Wang, Junhao Liu, Le Zhang, Yao Chen

Restructuring Conversations using Discourse Relations for Zero-shot Abstractive Dialogue Summarization
ArXiv Preprint arXiv:1902.01615
Prakhar Ganesh, Saket Dingliwal

VLSTM: Very Long Short-Term Memory Networks for High-Frequency Trading
ArXiv Preprint arXiv:1809.01506
Prakhar Ganesh, Puneet Rakheja

Nucl2Vec: Local alignment of DNA sequences using Distributed Vector Representation
bioRxiv Preprint doi:10.1101/401851
Prakhar Ganesh, Gaurav Gupta, Shubhi Saini, Kolin Paul

Professional Service

2024	**Peer Reviewer,**	Winter Conference on Application of Computer Vision (WACV)
2023	**Ethics Reviewer,**	Neural Information Processing Systems (NeurIPS)
2023	**Peer Reviewer,**	AI Communications
2022	**Peer Reviewer,**	Winter Conference on Application of Computer Vision (WACV)
2021	**Peer Reviewer,**	AAAI Conference on Artificial Intelligence (AAAI)
2021	**Peer Reviewer,**	Winter Conference on Application of Computer Vision (WACV)
2020	**Peer Reviewer,**	Computer Speech and Language
2020	**Peer Reviewer,**	Signal, Image and Video Processing