Mingyang Deng

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Research Interest

Advance the intelligence of generative foundation models, including diffusion models and large language models.

Education

Massachusetts Institute of Technology, (GPA : 5.00/5.00) Sep 2020 – Present
Undergraduate student in Mathematics/Electrical Engineering and Computer Science *Cambridge, MA*

HS Affiliated to Renmin University of China, Sep 2015 – Jul 2021
High school student *Beijing, China*

Awards

Gold medal ***(1st place)***, 45th Annual ICPC World Finals Nov 2022
Putnam Fellows, 83rd William Lowell Putnam Competition Dec 2022
Gold medal ***(1st place)***, 33rd International Olympiad in Informatics Jun 2021
Gold medal, 60th International Mathematical Olympiad Jul 2019
1st place, Codechef Snackdown Final 2021 Jan 2022
4th place, Google Code Jam Final 2021 Aug 2021
2nd place, HackMIT 2021 Sep 2021

Publications

- Restart Sampling for Improving Generative Process. NeurIPS 2023.
  Yilun Xu*, Mingyang Deng*, Xiang Cheng*, Yonglong Tian, Ziming Liu, Tommi Jaakkola
  https://arxiv.org/pdf/2306.14878.pdf
- Measuring Feature Sparsity in Language Models. NeurIPS 2023 SoLAR workshop Spotlight.
  Mingyang Deng*, Lucas Tao*, Joe Benton
  https://arxiv.org/pdf/2310.07837.pdf
- Uniform sets with few progressions via colorings. Submitted to Mathematical Proceedings of the Cambridge Philosophical Society.
  Mingyang Deng*, Jonathan Tidor*, Yufei Zhao*
  https://arxiv.org/abs/2307.06914
- On Problems Related to Unbounded SubsetSum: A Unified Combinatorial Approach. SODA 2023.
  Mingyang Deng*, Xiao Mao*, Ziqian Zhong*
  https://epubs.siam.org/doi/abs/10.1137/1.9781611977554.ch114
- Approximating Knapsack and Partition via Dense Subset Sums. SODA 2023.
  Mingyang Deng*, Ce Jin*, Xiao Mao*
  https://epubs.siam.org/doi/abs/10.1137/1.9781611977554.ch113
- New additive approximations for shortest paths and cycles. ICALP 2022.
  Mingyang Deng*, Yael Kirkpatrick*, Victor Rong*, Virginia Vassilevska Williams*, Ziqian Zhong*
  https://doi.org/10.4230/LIPIcs.ICALP.2022.50
- New Lower Bounds and Upper Bounds for Listing Avoidable Vertices. MFCS 2022.
  Mingyang Deng*, Virginia Vassilevska Williams*, Ziqian Zhong*
  https://drops.dagstuhl.de/entities/document/10.4230/LIPIcs.MFCS.2022.41

Experience

Undergraduate Research in Diffusion models Mar 2023 – Present
MIT; Supervised by Prof. Tommi Jaakkola

- Researched diffusion model samplers; identified advantages of SDE over ODE samplers (Mar-May 2023). Proposed restart sampling for diffusion models, accepted at NeurIPS 2023 and integrated into StableDiffusion WebUI.
- Currently developing entropy-based samplers, a new generative process that facilitates unsupervised planning and encompasses diffusion and autoregressive generation as special cases (work in progress).

Undergraduate Research in Language models Sep 2023 – Present
MIT; Supervised by Prof. Jacob Andreas

- Focusing on mechanistic interpretability; studying erasure neuron effects in residual networks for an ICML submission.

- Decomposing residual stream activations and operations using sparse dictionaries (ongoing project).

Undergraduate Research in Algorithms Sep 2021 – Apr 2022
MIT; Supervised by Prof. Virginia Vassilevska Williams
- Designed near-linear time solutions for the CoinChange problem; accepted by SODA 2023.
- Developed state-of-the-art approximation for the Knapsack problem; accepted by SODA 2023.
- Advanced all pairs shortest paths problem with bounded-difference max-plus product; paper accepted by ICALP 2022.

Undergraduate Research in Combinatorics May 2022 – Sep 2022
MIT; Supervised by Prof. Yufei Zhao
- Explored Ruzsa's conjecture; improved bounds and established new links to arithmetic Ramsey problems. Paper under review at MPCPS.

Supervised Program for Alignment Research Mar 2023 – Aug 2023
Berkeley AI Safety; Supervised by Joe Benton
- Employed sparse coding for language model activations; confirmed representation sparsity. Paper accepted for NeurIPS 2023 SoLaR Workshop.

Undergraduate TA Sep 2022 – Dec 2022
MIT; Supervised by Prof. Michael Sipser
- Conducted recitations and office hours for MIT's Theory of Computation course (18.404).

Research Internship on Video Generation Oct 2023 – Dec 2023
Mellis lab
- Addressed challenges in video generation, including camera motion, context length extension, and data scraping.

Internship in Quantitative Finance Jun 2023 – Aug 2023
Citadel Securities
- Conducted alpha research on options and secured a return offer.

China National Olympiad in Informatics Winter Camp Jan 2022 – Jan 2022
Remote from MIT
- Delivered a lecture on algorithms, with a focus on dynamic programming and construction; mentored younger students in problem-solving paradigms.

Projects

Contribute to stable-diffusion-webui | *Python* Jun 2023 – Jul 2023
- Link to project: https://github.com/AUTOMATIC1111/stable-diffusion-webui/pull/11850
- Integrated the restart sampling to Stable Diffusion Webui. It's merged into the main branch and is used by people.

Mosaic Detective (Weblab 2022 2nd place) | *React, MongoDB, Node.js, Socket.io* Feb 2021 – Feb 2021
- Link to project: https://mosaic-detective.com
- Use react to implement a website game where client can guess a blurred image by revealing pieces. Use socket.io to communicate between client and server. Some cryptography are applied to fulfill the security and speed requirements of the game.

Dovic The game (HackMIT 2021 2nd place) | *Node.js, Socket.io* Sep 2021 – Sep 2021
- An educational game similar to Among us encourages students to keep social distance and do contact tracing. Consists of 3000 lines of code, but was completed within a single day by a group of four.

Heuristic algorithm of Hamiltonian paths | *C++* Jul 2020 – Feb 2021
- Link to project: https://codeforces.ml/blog/entry/90513
- Implement a solver to find Hamiltonian paths and cycles on directed and undirected graphs, which outperforms most APIs. Use Link/Cut Tree to maintain paths with random iterating. Has great performance on most random graphs in practical. Can even find a path within seconds on graphs with hundreds of thousands of vertices and not so many Hamiltonian paths.

Technical Skills

Languages: English, Chinese
Programming Languages: C++, Python, Javascript