Mingyang Deng

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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

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

Experience

Undergraduate research in algorithms Sep 2021 – Apr 2022
MIT

- Design algorithms to solve the CoinChange problem in almost linear time. Accepted by SODA 2023.
- Use random partition to obtain the state of the art approximating scheme of the Knapsack problem. Accepted by SODA 2023.
- Use bounded-difference max-plus product to break the prior bound of +2 approximation of all pairs shortest paths. Paper accepted by ICALP 2022.

Undergraduate research in Combinatorics May 2022 – Sep 2022
MIT

- Work on Ruzsa's conjecture of minimizing the number of four term arithmetic progressions of Fourier Uniform set with given density. Use Fourier analysis to obtain a coloring model which simplifies the problem. Improve the previous bound with constructions under the new setting. Paper in progress.

China National Olympiad in Informatics Winter Camp Jan 2022 – Jan 2022
Remote from MIT

- Hold a lecture on algorithms, especially dynamic programming and construction algorithms. Also teach younger students general paradigms of thinking and handling related problems.

Publications

- On Problems Related to Unbounded SubsetSum: A Unified Combinatorial Approach. Accepted by SODA 2023. https://arxiv.org/pdf/2202.13484.pdf
- Approximating Knapsack and Partition via Dense Subset Sums. Accepted by SODA 2023. https://drive.google.com/file/d/11StI1_lhI-HvC60xeQhLg-fnUvGhaUa9/view?usp=sharing
- New additive approximations for shortest paths and cycles. Accepted by ICALP 2022. https://doi.org/10.4230/LIPIcs.ICALP.2022.50

Projects

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.

Dynamic Descendant | Jun 2021 – Jun 2021

- Propose an algorithm to maintain the k-th level preferred descendant of a node subject to modifying preferred child. Achieve $O(\log \log n)$ time per operation, which matches the theoretical lower bound.

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.

Chess AI with alpha-beta prunning | *C++* Sep 2019 – Jan 2020

- Combine alpha-beta pruning with reinforcement learning evaluations. Use patterns of self-played games to evaluate states. Outperforms simple alpha-beta pruning algorithm, and do not require much computational power to train.

Technical Skills

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