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Mohammad Mahdi Khodabandeh

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Education

Fall 2022–Now **Ph.D. student in Computing Science,** *Simon Fraser University (SFU),* Burnaby, BC, Canada
Advisor: Dr. Igor Shinkar (Theory Group)

2017–2022 **B.Sc. in Computer Engineering,** *K. N. Toosi University of Technology (KNTU),* Tehran, Iran
Project: Efficiently Finding Solutions for NP-complete Problems Using Graph Neural Networks
Advisor: Dr. Hossein Khasteh

2012–2016 **High School Diploma in Mathematics and Physics Discipline,** *National Organization for Development of Exceptional Talents (NODET),* Zanjan, Iran

Research Interests

Algorithms & Complexity, Pseudorandomness, Interactive Proofs, Learning Theory

Publications

STOC 2024 **On the Power of Interactive Proofs for Learning** [Available at arXiv:2404.08158][Talk Video]
Tom Gur, Mohammad Mahdi Jahanara, **Mohammad Mahdi Khodabandeh,** Ninad Rajgopal, Bahar Salamatian, Igor Shinkar

Academic Activities

June 2024 Volunteer for STOC 2024, Vancouver
Fall 2024 TA for CMPT 789 Cryptography (SFU) — Dr. Jianliang Wu
Summer 2024 TA for CMPT 478 Current Topics in Quantum Computing (SFU) — Dr. Steven Pearce
Spring 2024 TA for CMPT 404 Cryptography (SFU) — Dr. Andrei Bulatov
Fall 2023 TA for MACM 101 Discrete Mathematics (SFU) — Dr. Andrei Bulatov
Summer 2023 TA for CMPT 307 Data Structures and Algorithms (SFU) — Dr. Valentine Kabanets
Spring 2023 Grad students social
Spring 2023 TA for CMPT 225 Data Structures and Programming (SFU) — Dr. Igor Shinkar
Fall 2022 TA for CMPT 125 Intro to CS and Programming II (SFU) — Dr. Igor Shinkar
Spring 2020 TA for Discrete Mathematics (KNTU) — Dr. Hossein Khasteh
Fall 2020 Taught a preparation course for ICPC (KNTU)
Spring 2019 TA for Discrete Mathematics (KNTU) — Dr. Hossein Khasteh

Honors and Awards

2024 PhD Research Scholarship from Simon Fraser University ($1.8k × 3)
Fall 2023 PhD Research Scholarship from Simon Fraser University ($1.8k)
2023 CS Graduate Fellowship from Simon Fraser University (Total $9k)
2022 CS Graduate Fellowship from Simon Fraser University (Total $9k)
2021 IEEEXtreme 15.0 Global Rank 29, Country Rank 1 — Standings
2020 ICPC Tehran Site **4th** Place — Standings
2020 IEEEXtreme 14.0 Global Rank 35, Country Rank 1 — Standings
2019 ICPC Tehran Site **5th** Place ∧ **Silver Medal** for the first time in KNTU — Standings
2019 Advanced to the ICPC Asia West Continent Final Contest — Standings
2018–2021 Master Level Competitive Programmer in Codeforces — Profile
2018 Ranked **6th** in CGPA among all CE students at KNTU

Language Skills

- **Farsi** Native
- **English** Advanced, **TOEFL 110** (Reading: 26 Listening: 30 Speaking: 29 Writing: 25)

Selected Courses

- Complexity Theory ..... (A+)(Grad)
- Graph Theory ..... (A+)(Grad)
- Applied Cryptography ..... (A)(Grad)
- Intro to Quantum Algorithms ..... (A)(Grad)
- Theory of Computation ..... (20.00/20.00)
- Discrete Mathematics ..... (20.00/20.00)

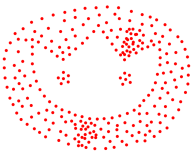
Projects During B.Sc.

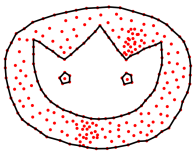
2018–2022 **Maintaining an Algorithms and Data Structures Library**

Maintaining an open-source algorithms and data structures library at my github page since 2018. `https://github.com/mohmahkho/competitive-programming`

2021–2022 **Quin: A Shape Reconstruction Algorithm with Five Comprehensive Properties**

Worked with Dr. Farnaz Sheikhi at KNTU in a research group to devise a novel method based on Delaunay triangulation for reconstructing boundaries of a given set of points in the two-dimensional plane. In this context, boundary loosely means the outer hull (outer boundary) and inner hull (holes) of the points. Our algorithm runs in time $\tilde{O}(n)$ for n points in the input. (Not published.)


Example input


Example output

2022 **Active Shape Models**

We implemented an algorithm for reproducing the face of a person, given multiple (~ 40) pictures of them with different facial expressions (such as laughing, frowning, etc.). We find landmarks on the person's face using `dlib` library in Python. Then we find the SVD of the gathered data as well as their average. Using some linear algebra, we transferred the facial expressions of any face (captured by the webcam) to the given model.

2021 **SAT Solver in VHDL**

Implemented a SAT solver in the hardware description language VHDL as the term project for Computer Aided Digital System Design.

2019 **Divide and Conquer Voronoi Diagram**

Implemented a divide and conquer algorithm for finding the Voronoi Diagram of a given two-dimensional point set as the term project for Algorithm Design.

2019 **CYK Algorithm**

Implemented the Cocke–Younger–Kasami algorithm for Chomsky normal form context-free grammars as the term project for Theory of Computation.

Technical Skills

- **Algorithms and Data Structures**

  Proficient theoretical and practical background, as demonstrated in ACM-ICPC competitions.
- **Programming Skills**

  C, C++, Python, Java, Bash
- **Libraries**

  Numpy, PyTorch (Python); CGAL, Boost (C++); OpenGL.