

# Shubhang Kulkarni

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## EDUCATION

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**University of Illinois, Urbana-Champaign** 2020–(expected) May 2025  
Ph.D. in Computer Science (Algorithms and Optimization). (GPA: 3.93/4.00)  
Advisor: Prof. Karthekeyan Chandrasekaran

**Purdue University** 2015 – 2019  
B.S. in Computer Science (Highest Distinction), Machine Intelligence Track, Mathematics Minor. (GPA: 3.96/4.00)

## RESEARCH AND WORK INTERESTS

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THEORETICAL COMPUTER SCIENCE: Combinatorial Optimization · Approximation Algorithms · Graph/Hypergraph Theory.  
OPERATIONS RESEARCH: Mathematical Programming · Polyhedral Optimization · Numerical Linear Algebra.  
COMPUTER SCIENCE APPLICATIONS: Software Engineering · Applied Mathematics · Data Science · Machine Intelligence.

## PROFESSIONAL EXPERIENCE

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**Apple** Research and Software Engineering Intern May 2022 - August 2022  
Privacy in Machine Learning Team

- Implemented and analyzed a public-key encryption scheme enabling keyword search over encrypted emails in the Apple Mail application for improving user privacy.
- Integrated Python-based encryption into existing private-search codebase and evaluated search efficiency and storage costs using the public Enron dataset.

**Argonne National Labs** Research Intern May 2021 - August 2021  
Mathematics and Computer Science Division

- Designed a dynamic data structure for non-convex vector sets to enhance polyhedral compilation, addressing the limitations of the existing `integer set library (isl)` data structure used by LLVM Polly.
- Implemented the data structure in Python and optimized performance through a comprehensive analysis of Polly's execution traces and comparison against `isl`.
- Project resulted in a [first-author](#) publication at IMPACT 2022.

**Microsoft** Software Engineering Intern May 2018 - August 2018  
Universal Store Core Commerce Dev Team

- Engineered a C#, ASP.NET API for automating the process of *tenant deletion*, removing the need for manual verification and reducing overall engineering time by ~30%.

**Montana State University** Research and Software Engineering Intern May 2017 - August 2017  
REU program

- Developed 'PanFR', a clustering tool for the hierarchical visualization of pangenomes
- Implemented a dual-component system with a Java-based server and a JavaScript (`d3.js`) front-end, presented at Rocky 2017 Conference, and adopted by the National Center for Genomics Research.

## TOOLS

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Programming Languages & Software: Python, Java, C++, C#, Javascript, Gurobi, LLVM Polly.  
Libraries: numpy, scipy, pytorch, isl, networkx, matplotlib, graphviz, pycrypto, d3.js.

## PROFESSIONAL SERVICE

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TEACHING ASSISTANT POSITIONS (\*Ranked Excellent by Students \*\*Ranked Outstanding by Students \*\*\*TA Award )

**Algorithms** (Grad Class): CS473 UIUC [F24, S24], CS580 Purdue [F19, S20]  
**Algorithms** (Undergrad Class): CS374 UIUC [\*S21, \*\*F21], CS381 Purdue [S19, S18, \*\*\*F17]  
**Discrete Mathematics** (Undergrad Class): CS173 UIUC [F20]  
**Data Structures** (Undergrad Class): CS251 Purdue [S19]  
**Computer Architecture** (Undergrad Class): CS250 Purdue [S17]

## CONFERENCE/JOURNAL REVIEWER:

Algorithmica '24, ICALP '24, STOC '24, IPCO '24, STACS '24, ISAAC '23, ITCS '20, NeurIPS '19, CSR '19.

## PUBLICATIONS

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\*co-first authored paper/manuscript. \*\*first authored paper/manuscript.

1. (**ESA '24**) \*C. Chekuri, R. Jain, S. Kulkarni, D. Zheng and W. Zhu. “From Directed Steiner Tree to Polymatroid Steiner Tree in Planar Graphs”. In *European Symposium on Algorithms (ESA)* 2024. [[link](#)]
2. (**ESA '24**) \*K. Bérczi, K. Chandrasekaran, T. Király, and S. Kulkarni. “Hypergraph connectivity augmentation in strongly-polynomial time”. In *European Symposium on Algorithms (ESA)* 2024. [[link](#)]
3. (**ICALP '24**) \*K. Bérczi, K. Chandrasekaran, T. Király, and S. Kulkarni. “Splitting-off in hypergraphs” In *51st EATCS International Colloquium on Automata, Languages, and Programming (ICALP)* 2024. [[link](#)]
4. (**AIED '23**) S. Poulsen, S. Kulkarni, G. Herman, and M. West. “Efficient feedback and partial credit grading for proof blocks problems.” In *Artificial Intelligence in Education - 24th International Conference (AIED)* 2023. [[link](#)]
5. (**AIED '22**) S. Poulsen, S. Kulkarni, G. Herman, and M. West. “Benchmarking partial credit grading algorithms for Proof Blocks problems”. In *Artificial Intelligence in Education - 23rd International Conference, (AIED)* 2023. [[link](#)]
6. (**IMPACT '22**) \*\*S. Kulkarni and M. Kruse. “Polyhedral Binary Decision Diagrams for Representing Non-Convex Polyhedra”. In *The 12th International Workshop on Polyhedral Compilation Techniques (IMPACT)* 2022. [[link](#)]
7. (**Algorithmica '21**) \*K. Chandrasekaran, E. Grigorescu, G. Istrate, S. Kulkarni, Y.S. Lin, and M. Zhu. “The maximum binary tree problem”. *Algorithmica*, 83:1–42, 08 2021. [[link](#)]  
(**ESA '20**) Preliminary version in *European Symposium on Algorithms (ESA)* 2020. [[link](#)]
8. (**IPEC '20**) \*K. Chandrasekaran, E. Grigorescu, G. Istrate, S. Kulkarni, Y.S. Lin, and M. Zhu. “Fixed-parameter algorithms for longest heapable subsequence and maximum binary tree.”. In *In 15th International Symposium on Parameterized and Exact Computation (IPEC)* 2020. [[link](#)]
9. (**FSTTCS '20**) \*A. Block, J. Blocki, E. Grigorescu, S. Kulkarni, and M. Zhu. “Locally decodable/correctable codes for insertions and deletions”. In *40th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, (FSTTCS)* 2020. [[link](#)]
10. (**ITC '20**) \*J. Blocki, S. Kulkarni, and S. Zhou. “On locally decodable codes in resource bounded channels”. In *Information Theoretic Cryptography (ITC)* 2020. [[link](#)]
11. (**ROCKY '17**) A. Cleary, T. Ramaraj, I. Kahanda, J. Mudge, S. Kulkarni, and B. Mumey. “Exploring Frequented Regions in Pan-Genomic Graphs.” In *The 15th Annual Rocky Mountain Bioinformatics Conference (ROCKY)* 2017.

## MANUSCRIPTS IN SUBMISSION

1. \*K. Chandrasekaran, C. Chekuri, and S. Kulkarni. “On deleting vertices to reduce density in graphs and supermodular functions”. In *conference submission 2024* [[link](#)].
2. \*K. Chandrasekaran, C. Chekuri, S. Fiorini, S. Kulkarni, and S. Weltge. “Polyhedral aspects of feedback vertex set and pseudoforest deletion set”. In *journal submission 2024*. [[link](#)]

## SELECT TECHNICAL COURSEWORK

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**Graduate:** Numerical Analysis, Advanced Data Structures, Combinatorial Optimization, Randomized Algorithms, Approximation Algorithms, Complexity Theory, Combinatorial Mathematics, Integer Programming, Algorithms for Big Data, Extremal Graph Theory, Linear Algebra, Passwords and Human Authentication, Mathematical Toolkit for CS, Algorithm Design, Analysis and Implementation, Economics and Computation, Reasoning About Programs.

**Undergraduate:** Algebra, Probability, Analysis of Algorithms, Data Structures, Artificial Intelligence, Data Mining, Operating Systems, Computer Architecture, Software Engineering.

## RELEVANT ACTIVITIES

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Speaker at European Symposium on Algorithms (ESA '24)	September 2024
Speaker at 51st International Colloquium on Automata, Languages, and Programming (ICALP '24)	July 2024
Speaker at 25th International Symposium on Mathematical Programming (ISMP '24)	July 2024
Visiting Researcher at Institute for Computational & Experimental Research in Mathematics	Jan '23 - May '23
Visiting Researcher at Eötvös Loránd University	Aug '22 - Nov '22
Organizer of Approximation Algorithms Reading Group (Purdue University)	May '20 - Aug '20
Organizer of Advanced Algorithms Reading Group (Purdue University)	Jan '20 - May '20
Disability Resource Center Note-taker	Jan '16 - May '16

## SCHOLARSHIPS

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Purdue University Nylin Scholarship	2018
Purdue University Grub Scholarship	2017
Purdue University Corporate Partner Scholarship sponsored by Crowe Horwath (now Crowe Global)	2016