

Vikram Kher

vkher@usc.edu
[vikram-kher.github.io](https://github.com/vikram-kher)
github.com/vikram-kher

SENIOR UNDERGRADUATE, COMPUTER SCIENCE & APPLIED MATH, USC VITERBI SCHOOL OF ENGINEERING

EDUCATION **University of Southern California**, Los Angeles, California
Bachelor of Science, Computer Science, *Summa Cum Laude*, Aug 2018 - May 2022
Bachelor of Arts, Applied and Computational Mathematics, Aug 2018 - Dec 2022 (Expected)
Overall GPA: 3.99
Number of PhD/Graduate Courses: 5

RESEARCH
INTERESTS Algorithm Design, Algorithmic Game Theory,
Auction Theory, Computational Social Choice

PUBLICATIONS Patel, D., **Kher, V.**, Desai, B. et al. Machine learning based predictors for COVID-19 disease severity. Sci Rep 11, 4673 (2021). <https://doi.org/10.1038/s41598-021-83967-7>

MANUSCRIPTS Matthew Ferland, **Vikram Kher**. NP-Hardness of a 2D, a 2.5D, and a 3D Puzzle Game. (2022). ArXiv:2202.10529. <https://doi.org/10.48550/arXiv.2202.10529>

TEACHING Undergraduate Teaching Assistant, Introduction to Algorithms and Theory of Computing,
Aug 2020 - Dec 2020 and Aug 2022 - Dec 2022

TALKS AND
PRESENTATIONS Sprouts Combinatorial Game Theory Undergraduate Conference, Apr 2022
NP-Hardness of a 2D, a 2.5D, and a 3D Puzzle Game

RESEARCH
EXPERIENCE **Exploring Fine-Grained Buy-Many Mechanisms**
Advisor : Dr. Ariel Schwartzman, DIMACS REU June 2022 - Present

- Investigated revenue properties of buy- k mechanisms, a new class of auctions where the seller must guard against a buyer purchasing any multi-set of at most k menu options. This new format interpolates between classical buy-one and buy-many mechanisms
- Proved that bundling can approximate up to a polynomial factor the revenue-optimal buy- k mechanism for buyers with unit demand valuations
- Conjectured and made progress towards proving that there exists distributions over item valuations such that there is a strict separation in revenue between the optimal buy- k and buy- $(k+1)$ mechanisms
- Wrote python program to experimentally validate above conjecture by computing revenue-optimal mechanisms for particular distributions, code available [here](#)

Distortion-Based Analysis of Single Transferable Vote (STV) Mechanism

Advisor : Prof. David Kempe, USC Jan 2021 - Present

- Utilized LP-duality framework and network flow techniques to conduct worst-case analysis of Single Transferable Vote mechanism
- Developed two new, streamlined proofs using flow techniques that recover STV's known distortion upperbound of $O(\ln)$
- Wrote python program to experimentally test performance of STV against various election scenarios, code available [here](#)

Modeling ICU Outcomes for COVID-19 Patients

Advisor : Prof. Assad Oberai, USC May 2020 - Dec 2020

- Developed predictive modeling systems to determine ICU outcomes for COVID-19 patients based on blood draw and lung imaging data
- Found certain proteins like CRP and D-Dimer influence ICU classification
- Conducted exploratory data analysis with data sparsity matrices, t-SNE analyses, correlation matrices
- Co-authored publication in Nature's Journal of Scientific Reports available [here](#)

PROJECTS

NP-Hardness in Popular Online Puzzle Games

Mentor : PhD Candidate Matthew Ferland

Jan 2020 - Dec 2021

- Created 3-SAT reductions to in-game maps for the three popular puzzle games: **Baba Is You**, **Fez**, and **Catherine**
- Manuscript emphasizes the potential educational value of the reductions in an undergraduate algorithms class

Gladeo App

Club : Code the Change

Aug 2019 - May 2020

- Developed app for career mentorship non-profit Gladeo as part of a team
- Created backend routes to handle account creation, password resetting, among other services using Node and Express
- Enabled automatic video uploading from app using YouTube's APIs

AWARDS & ACHIEVEMENTS

- The Honor Society of Phi Kappa Phi's 2021 Summer Research Scholarship (\$1,000)
- Best Presentation at Viterbi Summer 2020 Research Showcase (Voted by Faculty)
- Viterbi Dean's List (2018-2022)
- USC Academic Achievement Award (2020)

COURSES & SKILLS

Courses: Advanced Analysis of Algorithms (PhD Level), Complexity Theory (Graduate Level), Boolean Function Analysis (PhD Level), Convex and Combinatorial Optimization (PhD Level, Spring 2022), Combinatorial Analysis (Graduate level), Applied Combinatorics, Probability Theory, Calculus I-III, Linear Algebra
Languages: C, C++, Python, Java, L^AT_EX

INTERESTS & CLUBS

Interests: Russian Literature, Pocket Billiards, Art History
Clubs: Code the Change (Developer Position), Association of Computing Machinery