

Vikram Kher

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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 Taken: 5

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

PUBLICATIONS Dhruv Patel, **Vikram Kher**, Bhushan Desai, 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 Sepehr Assadi, **Vikram Kher**, George Li, Ariel Schwartzman. Fine-Grained Buy-Many Mechanisms Are Not Much Better Than Bundling. In preparation for submission to EC 2023.

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>

Vikram Kher, Kameron Shahabi, Derek Jones, Sina Shaham. Social Choice Distortion Analysis Using Optimization Techniques. (2022). [Class Project Report](#).

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

- Investigated revenue properties of buy- k mechanisms, a new class of auctions where a buyer can purchase any multi-set of at most k menu options.
- Proved that bundling, a simple mechanism, can achieve within an exponential factor of the revenue of optimal buy- n mechanism for buyers with monotone valuations (no known bound previously).
- Conjectured and partially proved that there exists distributions over item valuations that witness a strict separation in revenue between the optimal buy- k and buy- $(k+1)$ mechanism.
- Experimentally validated conjecture using code to compute revenue-optimal mechanisms for particular distributions, files available [here](#).

Distortion-Based Analysis of Single Transferable Vote (STV) Mechanism and Investigating Committee Elections

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 (code written for empirical testing available [here](#)).
- Developed a new, streamlined proof using flow techniques that recover STV's known distortion upperbound of $O(\ln)$.
- Designed new, fairer notion of committee cost to prevent low-cost committees from succumbing to "tyranny of the majority."
- Proven a linear-time algorithm on the line that always selects a committee with a cost within a constant factor of the optimum.

Modeling ICU and Ventilation Outcomes for COVID-19 Patients

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

- Developed predictive modeling systems to determine ICU and mechanical ventilation outcomes for COVID-19 patients based on demographic, clinical, and blood draw data.
- Demonstrated that Random Forest Classifier performed best of algorithms tested (AUC=0.80).
- Showed that reducing data from 72 features to 5 features allowed for comparable accuracy (AUC=0.78) with reduced model complexity.
- Discovered that elevated levels of certain proteins like CRP and D-Dimer significantly influence ICU classification.

NP-Hardness in Popular Online Puzzle Games

Mentor : PhD Candidate Matthew Ferland, USC

Jan 2020 - Dec 2021

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

TEACHING	Undergraduate Teaching Assistant, Introduction to Algorithms and Theory of Computing	Fall 2020, Fall 2022
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TALKS AND PRESENTATIONS	USC Computer Science Theory Group, Fine-Grained Buy-Many Mechanisms Are Not Much Better Than Bundling, Slides	Oct 2022
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	Sprouts Combinatorial Game Theory Undergraduate Conference, NP-Hardness of a 2D, a 2.5D, and a 3D Puzzle Game	Apr 2022
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AWARDS & ACHIEVEMENTS	<ul style="list-style-type: none"> - Semi-finalist for USC's 2022 Valedictorian/Salutatorian(s) - 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) - Dornsife Dean's List (2020-2022) - USC Academic Achievement Award (2020) 	
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COURSES & SKILLS	Courses: Advanced Analysis of Algorithms (PhD Level), Complexity Theory (Graduate Level), Boolean Function Analysis (PhD Level), Convex and Combinatorial Optimization (PhD Level), Combinatorial Analysis (Graduate level), Real Analysis I (In progress), Applied Combinatorics, Probability Theory, Numerical Methods (In progress), Calculus I-III, Linear Algebra Languages: C, C++, Python, Java, L ^A T _E X	
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STUDENT ACTIVITIES	Undergraduate TA for Introduction to Algorithms Class <i>Under Prof. David Kempe</i>	Fall 2020, Fall 2022
	<ul style="list-style-type: none"> - Held weekly office hours to help reinforce algorithmic concepts like Greedy, Divide and Conquer, and Dynamic Programming. - Graded students' exams and homeworks and additionally monitored online Piazza forum. 	

Code the Change
USC Club

Aug 2019 - Present

- Partnered with non-profits to develop pro-bono software for them.
- Developed app for career mentorship non-profit Gladeo to help connect high schoolers with young professionals ([code](#)).
- Worked with non-profit Humans Against Trafficking to use machine learning algorithms to read Instagram bios to determine predatory account behavior.

Volunteer at The Coding School

Non-profit Organization

Aug 2019 - May 2020

- Held free weekly online lessons with low-income middle schoolers to learn the basics of Python.
- Created lesson plans and sample projects for students to complete on weekly basis.

Intern at City Year Seattle

Non-profit Organization

July 2019 - Aug 2019

- Organization focused on improving public school resources through the creation of after-school programming taught by Americorp members.
- Interned in fundraising department to help bring in more donations to fund additional activities and services.

INTERESTS & CLUBS

Interests: Russian Literature, Pocket Billiards, Art History

Clubs: Code the Change (Developer Position), Association of Computing Machinery