Vikram Kher

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Ph.D. Student, Computer Science, Yale University

Education

Yale University
Ph.D., Computer Science, *Aug 2023 - Present*

University of Southern California
Bachelor of Science, Computer Science, *Aug 2018 - May 2022*
Bachelor of Arts, Applied and Computational Mathematics, *Aug 2018 - Dec 2022*
Overall GPA: 3.99, *Summa Cum Laude*

Research Interests

Algorithmic Game Theory, Learning Theory,
Auction Theory, Computational Social Choice

Publications

Yusuf Hakan Kalayci, David Kempe, **Vikram Kher** (2023). Proportional Representation in Metric Spaces and Low-Distortion Committee Selection. The 38th Annual AAAI Conference on Artificial Intelligence.

Sepehr Assadi, **Vikram Kher**, George Li, Ariel Schvartzman (2023). Fine-Grained Buy-Many Mechanisms Are Not Much Better Than Bundling. Proceedings of the 24th ACM Conference on Economics and Computation.

Dhruv Patel, **Vikram Kher**, Bhushan Desai, et al. (2021). Machine learning based predictors for COVID-19 disease severity. Journal of Scientific Reports Volume 11, 4673.

Manuscripts

Matthew Ferland, **Vikram Kher**. NP-Hardness of a 2D, a 2.5D, and a 3D Puzzle Game. (2022). arXiv:2202.10529

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

Research Experience

Investigating Proportional Representation in Committee Elections
Advisor : Prof. David Kempe, USC *Jan 2021 - Jan 2024*

- Demonstrated that existing definitions of committee cost do not incentivize the proportional representation of voting groups.
- Designed new, fairer definition for when a committee is representative of a coalition of voters, avoiding previous pitfalls.
- Proved that the Expanding Approvals Rule of Aziz and Lee outputs a committee that achieves a strong proportional representation guarantee under our new definition.

Exploring Fine-Grained Buy-Many Mechanisms
Advisor : Dr. Ariel Schvartzman, 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 exist 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.

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: Ph.D. 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

Graduate Teaching Assistant, Yale, *Fall 2024*
Introduction to Algorithms
- Held weekly office hours to help reinforce algorithmic concepts like Greedy, Divide and Conquer, and Dynamic Programming.
- Lead weekly discussion sections focused practical problem solving.
- Designed bi-weekly problems sets.

Undergraduate Teaching Assistant, USC, *Fall 2020, Fall 2022*
Introduction to Algorithms

Talks and Presentations

USC Computer Science Theory Group, *Oct 2022*
Fine-Grained Buy-Many Mechanisms Are Not Much Better Than Bundling,
Slides

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

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)
- Dornsife Dean's List (2020-2022)
- USC Academic Achievement Award (2020)

Courses & Skills

Graduate Courses: Topics in Algorithmic Game Theory, Combinatorial Optimization and Approximation Algorithms, Econometrics, Modern Challenges in Statistics, Advanced Analysis of Algorithms, Complexity Theory, Boolean Function Analysis, Convex and Combinatorial Optimization, Combinatorial Analysis
Languages: C, C++, Python, Java, LaTeX

Student Activities

Code the Change

USC Club *Aug 2019 - Dec 2022*

- Developed pro-bono software for partner non-profits.
- Built app for career mentorship service Gladeo to help connect high schoolers with young professionals.(code).
- Collaborated with Humans Against Trafficking to apply machine learning algorithms for analyzing Instagram bios for predatory account behavior.

Volunteer at The Coding School
Non-profit Organization *Aug 2019 - May 2020*

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

Interests & Clubs

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