Vaishali Surianarayanan

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EDUCATION

University of California Santa Barbara, USA — *Sept 2019 - Aug 2024* (Expected)
PhD Candidate, Computer Science
Advisor: Prof. Daniel Lokshtanov
GPA: 4.0/4.0

PSG College of Technology, India — *July 2014 - May 2019*
Integrated M.Sc, Theoretical Computer Science
CGPA: 9.9/10.0

AREAS OF INTEREST

- Graph Theory, Computational Geometry, Randomized Algorithms, Exact-Exponential Algorithms, Approximation Algorithms, Parameterized Complexity, Distributed Systems, and Databases.

RESEARCH EXPERIENCE

PhD Candidate, UCSB — *Sept 2019 - present*
Advisor: Prof. Daniel Lokshtanov

- Research Focus: Modern algorithms for graph partition and resource allocation problems.

University of Bergen, Norway — *Aug - Oct 2022*
Host: Prof.Fedor V.Formin and Prof. Saket Saurabh

- Worked on **fairness** motivated graph problems such as gerrymandering in elections and fair-clustering in AI.

Tata Institute of Fundamental Research, Mumbai — *Aug 2019*
Host: Prof. Jaikumar Radhakrishnan

- Worked on a shortest path problem called parametric shortest path that had ties with Computational Geometry, Graph Theory and Circuit Complexity. The problem has applications in traffic networks.

Internship - Institute of Mathematical Sciences, Chennai — *Dec 2018 - April 2019*
Advisor: Prof. Saket Saurabh

- Parameterized approximation algorithms help overcome the inapproximability and fixed parameter intractability of problems. Explored this topic during the internship and gave a series of talks on it.

Internship - Institute of Mathematical Sciences, Chennai — *May 2017 - Dec 2017*
Advisor: Prof. Venkatesh Raman

- Closed a 11 year open problem on the fixed parameter tractability of a graph edge deletion problem called König Edge Deletion by proving it to be W[1] hard. The work has been published in TCS journal.
- Studied algorithms and hardness for a graph partitioning problem called minimum spanning k-forest.

INDUSTRY EXPERIENCE

Systems and Infrastructure Intern - LinkedIn, Sunnyvale (June - Sep 2023)

- Working on Apache Pinot, a realtime distributed OLAP datastore, designed to answer OLAP queries with low latency.
- Designing and implementing efficient off-heap data structures to speed up Distinct queries.

Research Intern, Distributed Database - Futurewei Technologies, Inc. (June - Aug 2022)

- Designed a new in-memory distributed database with **strict serializability** guarantee having low latency(μs) for non-concurrent transactions, **high concurrency** and **low memory** usage (patent in progress).

Engineering Intern, Cloud Data and Storage - Futurewei Technologies, Inc. (June - Sept 2021)

- Worked on K2, an open-source platform for building low-latency(μs) in-memory distributed OLTP databases.

- Implemented YCSB benchmark using C++17 and SeaStar, an event-driven framework using futures. Utilized **Prometheus** and **Grafana** dashboards with PromQL to visualize and interpret the benchmark results.
- Obtained **2x** throughput and **50%** reduction in latency for write-heavy workloads using one-shot transactions.

Engineering Intern - Cisco Systems, India (May - July 2018)

- Developed an application module for an existing internal Cisco application to support multiple languages such as Python, Ruby, and, JS, by using Script Engines in Java for backend and React JS for frontend. [Report]

PUBLICATIONS

- Vaishali Surianarayanan. **Polynomial Ramsey Bounds and χ-boundedness for Weakly Closed Graphs** (under submission)
- Úrsula Hébert-Johnson, Daniel Lokshtanov, Chinmay Sonar, and Vaishali Surianarayanan. **Parameterized Complexity for Kidney Exchange Revisited** (under submission)
- Tanmay Inamdar, Daniel Lokshtanov, Saket Saurabh and Vaishali Surianarayanan. **Parameterized Complexity of Fair Bisection:(FPT-Approximation meets Unbreakability)** In European Symposium on Algorithms (ESA 2023).
- Daniel Lokshtanov, Saket Saurabh and Vaishali Surianarayanan. **Breaking the All Subsets Barrier for Min k-cut** In 50th EATCS International Colloquium on Automata, Languages and Programming (ICALP 2023)
- Úrsula Hébert-Johnson, Chinmay Sonar, Subhash Suri, and Vaishali Surianarayanan. **Anonymity-Preserving Space Partitions** In 32nd International Symposium on Algorithms and Computation (ISAAC 2021)
- Daniel Lokshtanov, and Vaishali Surianarayanan. **Dominating Set is FPT in Weakly Closed Graphs is Fixed Parameter Tractable** In 41st IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2021)
- Daniel Lokshtanov, Saket Saurabh, and Vaishali Surianarayanan. **A Parameterized Approximation Scheme for Min k-Cut.** In 60th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2020) and in SIAM Journal on Computing FOCS 2020 special edition.
- Majumdar Diptapriyo, Rian Neogi, Venkatesh Raman, S. Vaishali. **Tractability of König Edge Deletion Problems.** Theoretical Computer Science 796 (2019): 207-215.
- Vaishali, S., M. S. Atulya, and Nidhi Purohit. **Efficient Algorithms for a Graph Partitioning Problem.** In International Workshop on Frontiers in Algorithmics, pp. 29-42. Springer, Cham, 2018.

AWARDS AND ACCOMPLISHMENTS

- Invited to attend Dagstuhl Seminar on Parameterized Approximation in Germany.
- Awarded UCSB IPS travel grant to attend DIMACS Workshop on Modern Techniques in Graph Algorithms 2023
- **UCSB Grad Slam finalist** ($1000 cash award) - a 3 minute research elevation pitch contest. [Talk]
- Awarded the **Lead Teaching Assistant** position for CS Department at UCSB 2021-2022.
- **Outstanding Teaching Assistant Award** 2021 awarded by CS Department, UCSB.
- Active member of Women in Computer Science (WiCS), UCSB
    - Board Advisor (2022-current
    - Co-President (2021-2022
    - VP Alumni Operations (2020-2021)
- Elected **Graduate Student Representative** at UCSB
- Received UCSB Grace Hopper Conference (GHC) **Scholarship** 2022
- Gold Medal for **Best Outgoing Student Award** 2019, PSG College of Technology
- Gold Medal for **Academic Excellence** 2019, Highest CGPA in PSG College of Technology
- Grace Hopper Conference India **Scholar** 2018
- Fully funded trip to Women In Theory Conference 2018 at Harvard University.
- **Coding Contests:** ACM Lady Ada Contest, India 2018 (National Finalist), ACM ICPC (Regionals 2016), Ranked 11^{th} in Track A of PACE Challenge 2018, Goldman Sachs's WE BUILD contest, India 2017 (National Finalist).
- **Executive Editor** of The Bridge, the official magazine of PSG College of Technology, during 2016-2017.
- Won gold and silver medals as part of the women's basketball team at PSG College of Technology

TALKS AND PRESENTATIONS

- **Breaking the all Subsets Barrier for Min k-cut**, ICALP 2023, Paderborn, Germany [Slides]
- **Polynomial Ramsey Bounds and χ-boundedness for Weakly Closed Graphs**, DIMACS Workshop on Modern Techniques in Graph Algorithms 2023, Rutgers University [Poster]
- **Kidney meets Angel: Programming the perfect kidney matchmaker**, 2023 UCSB Grad Slam finalist [Talk] (29:57)
- **Algorithms for Weakly Closed Graphs**, 2022 University of Bergen, Norway
- **Algorithmic Decision Making**, 2021 PSG College of Technology (Virtual)
- **Dominating Set is FPT in Weakly Closed Graphs is Fixed Parameter Tractable**, FSTTCS '21, Virtual [Talk]
- **Parameterized Approximation Scheme for Min k-cut**, HALG 2021, Virtual
- **Parameterized Approximation for Min k-cut**, Parameterized Complexity 301 (workshop) 2020, Virtual [Talk]
- **Dominating Set is FPT in Weakly Closed Graphs is Fixed Parameter Tractable**, 2020 UCSB
- **Parameterized Approximation Scheme for Min k-cut**, FOCS '20, Virtual [Talk]
- Gave a series of talks for a course on **Parameterized Approximation**, 2019 IMSc
- **Edmonds' Blossom algorithm and Edmonds-Gallai Decomposition**, TCS Summer Programme 2018, IMSc.
- **Efficient Algorithms for a Graph Partitioning Problem**, WIT 2018, Harvard University.
- **Greedy Online Algorithms and Freckle Graphs**, student session at TCS Summer Programme 2016, IMSc.

ADDITIONAL ACADEMIC EXPERIENCES

International Colloquium on Automata, Languages and Programming (ICALP 2023) Paderborn, Germany *(July 2023)*

- Attended technical talks and interacted with women technologists both from academia and industry.

DIMACS Workshop on Modern Techniques in Graph Algorithms Rutgers University, *(June 2023)*

- Attended talks and tutorials and presented a poster on our work on Ramsey bounds for weakly closed graphs.

Real Time Analytics Summit San Francisco, *(April 2023)*

- Attended technical talks and interacted with engineers and CEOs from database and analytics industry.

Grace Hopper Celebration 2022 USA (Virtual), *(Sept 2022)*

- Attended technical talks and interacted with women technologists both from academia and industry.

FSTTCS 2021 Virtual, *(Dec 2021)*

- Attended various sessions and presented our paper on the dominating set in weakly closed graphs.

32nd International Symposium on Algorithms and Computation (ISAAC 2021) Virtual, *(Nov 2021)*

- Attended various sessions and presented our paper on anonymity partitioning.

Highlight of Algorithmis (HALG) 2021 Virtual, *(July 2021)*

- Attended various sessions and presented our work on the min k-cut problem.

Parameterized Complexity 301 Virtual, *(Dec 2020)*

- Attended technical sessions and gave a talk on Parameterized Approximation.

IEEE Symposium on Foundations of Computer Science (FOCS) 2020 Virtual, *(Nov 2020)*

- Attended various sessions and presented our paper on the min k-cut problem.

Women in Theory (WIT) 2020 Workshop Virtual, *(June 2020)*

- Shared past WIT experience in the short talk session.

Parameterized Complexity 101 IISER Pune, *(March 2019)*

- Attended technical talks and tutorials on Parameterized Complexity.

Recent Trends in Algorithms NISER Bhubaneshwar, *(Feb 2019)*

- Attended technical talks and tutorials.

Grace Hopper Celebration India Bangalore, *(November 2018)*

- Attended technical talks and interacted with women technologists both from academia and industry.[Certificate]

Women in Theory (WIT) 2018 Workshop Harvard University, *(June 2018)*

- Attended technical talks and tutorials by professionals in the field of Theoretical Computer Science. [Certificate]

ACM Summer School on Graph Theory and Graph Algorithms IIT Gandhinagar, *(June - July 2017)*

- Learned topics from advanced graph theory and algorithms including some parameterized algorithms.[Certificate]

4th CSA Undergraduate Summer School IISc, *(July 2016)*

- Current trends in Computer Science both in academia and industry were discussed.[Certificate]

Summer Programme in Theoretical Computer Science IMSc, *(May-July 2016)*

- Exposed to diverse topics such as Parameterized Complexity, Tree automata, and Extremal Combinatorics.[Certificate]

TEACHING AND MENTORING EXPERIENCES

- **Instructor for CS 16: Introduction to C++ at UCSB - Spring 2023:**
  - Planned and taught a class of nearly 140 students. Managed a team comprising of 4 TAs and 2 ULAs.
- Mentored three undergraduate students at UCSB with research on graph algorithms.
- **Teaching Assistant** in the Computer Science department at UCSB:
  - CS 501 (Lead TA, AY 2021-2022): Teaching of Computer Science - Fall 2021
  - CS 190A: Algorithmic Decision Making - Fall 2020
  - CS 8: Introduction to Python - Summer 2020
  - CS 130B: Data Structure and Algorithms II - Spring and Winter 2020, Spring 2021
  - CS 24: Problem Solving with Computers I (C++) - Fall 2019

COMMUNITY AND PROFESSIONAL SERVICE

- Conference Reviews: VLDB 2023, WG 2022, SODA 2021 and ISAAC 2020, 2021.
- Journal Reviews: Algorithmica, Mathematics of Operations Research and Mathematical Programming (MAPR).
- Community Service:
  - Active member of Women in Computer Science (WiCS) (2019-current).
  - Student Commitee Event Organization Representative for UCSB CS Department (2022-2023).
  - Student Committee Diversity Representative for UCSB CS Department (2019-2021).
  - CS Graduate Affairs Committee Student Representative at UCSB (2021-2022).
  - Lead Teaching Assistant UCSB CS Department (2021-2022).
  - Gave a talk to high school girls part of the Fremont Branch of ProjectCS Girls (November 2022).
  - Part of Make a Difference - an association for teaching underprivileged children in India (2014-2019).

SKILLS AND COURSEWORK

Languages: C++, Python, C, Java, R, Ruby, HTML | **Tools & Tech:** Git, Keras, Matlab, Unity, SQL, AWS

Graduate Courses: Randomized Algorithms, Computational Geometry, Runtime Systems, Human Computer Interface / VR, Quantum Cryptography, Advanced Distributed Systems, Combinatorial Methods, Deep Learning, Scalable Web Services, Advanced Database Systems.

Undergraduate Courses: Advanced Data Structures and Algorithms, Data Base Management Systems, Operating Systems, Computer Architecture, Parallel Computing, Machine Learning, Artificial Intelligence, Software Patterns, Probability and Statistics, Linear Algebra, Cryptography and Optimization Techniques.

OTHER CODING PROJECTS

- Built an online meeting scheduler service to find optimal meeting times for large groups using **Rails**. Scaled it with server side caching and optimized database queries to handle **50k+** users/min. [Code] [Report].
- Built **LSTM** models to predict future price of items for profit-trading in the MMO Old School Runescape.[Report]
- Developed a **distributed** highly available banking system using **blockchain** and **RAFT** protocol in Python.
- Built a deep RNN based model using **Keras** to reconstruct handwritten noisy digits with MNIST dataset
- Developed a simplified **distributed block chain** by implementing multi-threaded socket programs in Python and the Wuu-Bernstein algorithm for data consistency.
- **Fires *increase* Covid'19!** Data analysis in Python using *Pandas* to establish a causality relationship between the Amazon fires and increase in Covid'19 in Brazil (can be extended to the California fires).
- **Computational Geometry Challenge '20:** Developed algorithms for minimum convex partition problem.
- Augmented an existing C++ interpreter (Picoc) with *Coroutine* support (functions that can be suspended).[PPT].
- **Oculorum Musica:** An interactive and immersive VR music visualizer developed in Unity that allows the user to draw and interact with objects that respond to background music.[Report] [Demo]
- Developed an application to connect house helps with house owners across the country and maintain financial transactions as part of a **Microsoft Hackathon**, using Microsoft Azure SQL DB, Java, and JS.
- **PACE Challenge:** Implemented a space efficient version of the Dreyfus Wagner algorithm - a FPT algorithm parameterized by the number of Steiner nodes for the Steiner Tree problem - in C++ for PACE 2018 challenge.[Report]
- Designed an efficient system to store and perform banking transactions on financial data using Python as part of **Goldman Sachs We Build** contest (India) in 2017 (**National finalist**).