

K Prahlad Narasimhan

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Research Interests

I enjoy working on algorithmic problems involving computational geometry and graph theory. Currently, I am working on finding instances where the geometric Steiner tree problem admits near-linear time algorithms and on the parameterized complexity of the Dominator Coloring problem. I am also interested in approximation algorithms, parameterized complexity, and optimization theory.

Education

State University of New York <i>PhD in Applied Mathematics and Statistics</i>	Stony Brook, NY, USA <i>August 2022 – Present</i>
National Institute of Science Education and Research <i>Int. MSc in Mathematics (CGPA: 8.93), Minor in Computer Science (CGPA: 9.6)</i>	Bhubaneswar, OD, IN <i>July 2017 – May 2022</i>
Vidya Mandir - Mylapore <i>AISSE percentage: 96.2%, AISSE GPA: 10</i>	Chennai, TN, IN <i>June 2013 – May 2017</i>

Work Experience

State University of New York <i>Teaching Assistant for AMS 303</i>	Stony Brook, NY, USA <i>August 2022 – Present</i>
Aalto University <i>Research Assistant; Part of the AScI Summer Programme</i>	Espoo, FI <i>May 2022 – August 2022</i>

Publications

[A1] Aritra Banik, Prahlad Narasimhan Kasthurirangan, and Venkatesh Raman. Dominator Coloring Parameterized by Cluster Vertex Deletion Number. [Preprint](#).

Abstract: We initiate the study of Dominator Coloring (which borrows properties from Graph Coloring and Dominating Set) through the lens of structural parameterization. The main result of the paper proves that the problem is fixed-parameter tractable (FPT) when parameterized by the size of the input graph's cluster vertex deletion set. We also describe simpler and faster algorithms for the problem when it is parameterized by larger parameters such as clique modulator size and twin cover size.

[C1] Kasthurirangan Prahlad Narasimhan. One-Sided Discrete Terrain Guarding and Chordal Graphs. In *7th Conference on Algorithms and Discrete Applied Mathematics (CALDAM 2021)*, pages 122-134, 2021. [DOI](#). [Preprint](#).

Abstract: The main result of the paper proves that a restricted version of the Terrain Guarding problem is equivalent to the Clique Cover problem in chordal graphs, extending a result proved for orthogonal terrains in [1]. This work is a step forward in understanding the longstanding question on whether Terrain Guarding, parameterized by the size of the guard set, is FPT. The full version of this work is in review in *Discrete Applied Mathematics*. [Preprint](#).

Talks and Presentations

Geometric Steiner Tree

Presentation of results obtained during my time as a research assistant at Aalto

Espoo, FI
August 2022

The Four-Color Theorem

Online presentation as part of the Harvard GSAS [Mini-Course on Computation](#)

Bhubaneswar, OD, IN
January 2022

Guarding Terrains and Covering Chordal Graphs

Online presentation of [\[C1\]](#) at [CALDAM 2021](#)

Bhubaneswar, OD, IN
February 2021

Selected Research Internships

Geometric Steiner Tree

With [Sándor Kisfaludi-Bak](#)

Espoo, FI
May 2022 - Present

- Working on finding non-trivial instances of the 1-Steiner tree problem which admit near-linear time algorithms.
- Obtained promising preliminary results in this direction while at Aalto University.

Parameterized Complexity of Dominator Coloring

With [Dr. Aritra Banik](#) and [Dr. Venkatesh Raman](#)

Bhubaneswar, OD, IN
November 2021 - September 2022

- Designed efficient FPT algorithms for Dominator Coloring parameterized by those parameters that measure the distance between a graph and a tractable graph class.
- Resulted in [\[A1\]](#) which had its origins in my Master's Thesis.

Geometric Hitting Set Problems Using Local Search

With [Dr. Aritra Banik](#) and [Dr. Rajiv Raman](#)

Bhubaneswar, OD, IN
June 2021 - October 2021

- Understood the seminal work on the PTAS for geometric hitting set problems using local search [\[2\]](#), the algorithm's optimality [\[3\]](#), and a few of its applications [\[4\]](#), [\[5\]](#). [Report](#).
- The goal was to (dis)prove that the state-of-the-art PTAS for Terrain Guarding is optimal.

Optimization Constructs

With [Dr. Aritra Banik](#) and [Dr. Sutanu Roy](#)

Bhubaneswar, OD, IN
August 2020 - January 2021

- Worked on linear and semidefinite optimization and explored its uses in approximation of NP-Hard problems.
- A part of my 7th semester assessment. [Report](#).

Terrain Guarding

With [Dr. Aritra Banik](#)

Bhubaneswar, OD, IN
March 2020 - October 2020

- Worked on fixed-parameter tractable and approximation algorithms in the context of computational geometry.
- Presented my work [\[C1\]](#) on the Terrain Guarding problem at CALDAM 2021. [Report](#).

Fellowships and Awards

- [30th Annual Fall Workshop on Computational Geometry](#) – Awarded travel support to attend the workshop held at North Carolina State University, NC on October 14th and 15th, 2022.
- [ASCI Summer Programme](#) – Selected by the Aalto Science Institute through a competitive process (acceptance rate of 4%) to work as a research assistant in the summer of 2022.

- Awarded “Best Student Paper Presentation” at CALDAM 2021 [6].
- [INSPIRE SHE](#) – Merit based scholarship awarded by the Department of Science and Technology - Government of India, which fully funds my education at NISER. Duration: July 2017 to May 2022.
- [IAS SRF](#) – Summer research fellowship awarded by the Indian Academy of Sciences to around two thousand students (acceptance rate of 10%) to pursue a summer internship at a research lab anywhere in the country. Duration: May 2019 to June 2019.

Mentorship and Volunteering

- Subreviewer for [WALCOM 2023](#).
- Teaching assistant for the Mini-Course on Computation organized by [Chi-Ning Chou](#) at Harvard University in January 2022.
- Mentored three freshmen in 2020 and 2021 for a talk series hosted by NISER’s mathematics club titled “The Mathematics of Logic”.
- Designed a T-Shirt for Zaariya, the social service club of NISER, in 2018. The club raised in excess of Rs. 84,000 and redirected the profits to fund projects focusing on educating underprivileged students from the rural parts of Odisha.

Science Outreach

NiSERCast

Host of a podcast aimed at high school students

Bhubaneswar, OD, IN

April 2021

- Hosted Prof. V. Muruganandam in the inaugural episode of the podcast to talk about life as a first-generation student in academia, the effects of technology on his research, and his work on mathematics outreach programs across the country.
- Available on [Spotify](#), [Apple Podcasts](#), and [Google Podcasts](#).

NISER Open Day

Introducing high school students to the sciences

Bhubaneswar, OD, IN

2017 - 2020

- Gave talks and demonstrations to high school students on mathematics and computer science in 2017, 2018, and 2019.
- Head of the design team and computer science wing of the program in 2020.

Student-Run Clubs

Interdisciplinary talks aimed at undergraduates

Bhubaneswar, OD, IN

2017 - 2019

- Delivered talks titled “The Four Number Game” and “An Introduction to Kleene Algebras” at NISER’s mathematics club in 2018 and 2019.
- Gave a talk on “Computing with DNA” based on [7] in 2017 at NISER’s biology club.

Language Proficiency

- Proficient in Tamil (native tongue), English, and Hindi.
- TOEFL iBT - 114 out of 120. Test taken on September 18, 2021.
- General GRE - 332 out of 340. Test taken on September 16, 2021.