PRAFULLKUMAR TALE

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Electrical Engineering and Computer Science
Indian Institute of Science Education
and Research Bhopal, India

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Fields of Interests

- Parameterized Complexity
- Conditional Lower Bounds
- Graph Theory
- Graph Algorithms
- Algorithmic Engineering

Work Experiences

Indian Institute of Science Education and Research Bhopal, India
Position: Assistant Professor — January 2024 – Present

Indian Institute of Science Education and Research Pune, India
Position: INSPIRE Faculty Fellow — September 2022 – December 2023

CISPA Helmholtz Center for Information Security, Saarbrücken, Germany
Position: Post-Doctoral Researcher — July 2020 – August 2022

Max-Planck Institute for Informatics (MPII), Saarbrücken, Germany
Position: Post-Doctoral Researcher — March 2020 – June 2020

University Of Bergen, Bergen, Norway
Position: Researcher (An internship during Ph.D.) — Jan 2019 – June 2019

Ebay/PayPal Pvt Ltd
Position: Software Engineer — June 2012 – July 2013

Education

The Institute of Mathematical Sciences (IMSc), HBNI, Chennai — Aug 2015 – Feb 2020
Ph.D. in Theoretical Computer Sciences

The Institute of Mathematical Sciences (IMSc), HBNI, Chennai — Aug 2013 – Aug 2015
Master of Science in Theoretical Computer Sciences

Indian Institute of Technology (IIT), Roorkee — July 2007 – May 2012
Master of Science in Applied Mathematics — (Five-year Integrated Degree Program)

Teaching Experience

3. **Data Structure and Algorithms @ IISER-Bhopal** — Jan 2024 – Apr 2024
   Course-coordinator for this core course offered by Electrical Engineering and Computer Science Department. The class consists of 190 students most of whom are second year undergraduate students. (Course webpage)

2. **Mathematics of Network Algorithms @ IISER-Pune** — Aug 2023 – Dec 2023
   Course-coordinator of course jointly offered by Department of Mathematics and Department of

Data Science at IISER-Pune. The course focuses on the mathematical side of artificial neural networks closely following the Deep Learning book by Courville, Goodfellow, and Bengio. The class consisted of 31 students from undergraduate, graduate and PhD program. (`Course webpage`)

1. **Algorithms @ IISER-Pune** Jan 2023 – May 2023
Course-coordinator of course offered by Department of Mathematics at IISER-Pune. We covered basics of algorithms closely following the Algorithm Design book by Kleinberg and Tardos. The class consisted of 54 students from undergraduate, graduate and PhD program.

Mentoring Experience

- For PACE 2024 Jan 2024 – April 2024
Mr. Aneesh Diwanji, Mr. Aradhya Jindal, Mr. Chaitanya Kolhe, Ms. Yashaswini Mathur
(All 2^{nd} students of BS-MS program at IISER-Bhopal)
- For Graph Theory project. Jan 2024 – April 2024
Ms. Tejal R, Mr. Adheesh Trivedi (Both 2^{nd} students of BS-MS program at IISER-Bhopal)
- Mr. Pritam Acharya, a student of BS-MS program at IISER-Pune Aug 2023 – Dec 2023.
- Mr. Jetharam Bhambhu, a student of BS-MS program at IISER-Pune Aug 2023 – Dec 2023.
- Mr. Rajat Adak, a student of MSc in Math & Computing at IIT Hyderabad May 2023 – July 2023
- Ms. Rucha Siddam, a student of MSc in Mathematics at IIT Gandhinagar May 2023 – July 2023
- Ms. Saraswati Nanoti, a PhD student at IIT Gandhinagar May 2023 – July 2023
- Mr. T I Darsan, a student of BS-MS program at IISER-Pune Jan 2023 – May 2023.

Manuscripts

4. **Double Exponential Lower Bound for Telephone Broadcast**
(This is a single author paper.)

3. **Tight (Double) Exponential Bounds for Identification Problems: Locating-Dominating Set and Test Cover**
with Dipayan Chakraborty, Florent Foucaud, Diptapriyo Majumdar

2. **Conflict and Fairness in Resource Allocation**
with Susobhan Bandopadhyay, Aritra Banik, Sushmita Gupta, Pallavi Jain, Abhishek Sahu, Saket Saurabh

1. **α-approximate Reductions: a Novel Source of Heuristics for Better Approximation Algorithms**
with Fredrik Manne, Geevarghese Philip, Saket Saurabh

Publications[1]

25. **Problems in NP can Admit Double-Exponential Lower Bounds when Parameterized by Treewidth and Vertex Cover**
with Florent Foucaud, Esther Galby, Liana Khazaliya, Shaohua Li, Fionn Mc Inerney, Roohani Sharma
[C-24] (To Appear) International Colloquium on Automata, Languages and Programming (**ICALP**), 2019

[1]The norm in the theoretical computer science community is to publish a preliminary version of results in conferences (which have page limits) and a full version in journals. Also, the authors' name appear in alphabetical order of their last names, and hence there is no notion of the first author. I attest that I have made significant contributions to all the articles.

24. **Revisiting Path Contraction and Cycle Contraction**
with R. Krithika, Kutty Malu V K
[C-23] (To Appear) Graph-Theoretic Concepts in Computer Science (**WG**), 2022

23. **Parameterized Complexity of Biclique Contraction and Balanced Biclique Contraction**
with R. Krithika, Kutty Malu V K, Roohani Sharma
[C-22] Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**), 2023

22. **Romeo and Juliet Meeting in Forest Like Regions**
with Neeldhara Misra, Manas Mulpuri, Gaurav Viramgami
[C-21] Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**), 2022

21. **Domination and Cut Problems on Chordal Graphs with Bounded Leafage**
with Esther Galby, Daniel Marx, Philipp Schepper, Roohani Sharma
[C-20] International Symposium on Parameterized and Exact Computation (**IPEC**), 2022
[J-17] **Algorithmica**, Volume 86 (5): 1428-1474 (2024)

20. **Metric Dimension Parameterized by Feedback Vertex Set and Other Structural Parameters**
with Esther Galby, Liana Khazaliya, Fionn Mc Inerney, Roohani Sharma
[C-19] Mathematical Foundations of Computer Science (**MFCS**), 2022
[J-16] SIAM Journal on Discrete Mathematics (**SIDMA**), Volume 37 (4): 2241-2264 (2023)

19. **Reducing the Vertex Cover Number via Edge Contractions**
with Paloma T. Lima, Vinicius F. dos Santos, Ignasi Sau, Uéverton S. Souza
[C-18] Mathematical Foundations of Computer Science (**MFCS**), 2022
[J-15] Journal of Computer and System Sciences (**JCSS**), Volume 129: 22-38 (2022).

18. **The Complexity of Contracting Bipartite Graphs into Small Cycles**
with R. Krithika, Roohani Sharma
[C-17] Graph-Theoretic Concepts in Computer Science (**WG**), 2022

17. **Parameterized Complexity of Weighted Multicut in Trees**
with Esther Galby, Dániel Marx, Philipp Schepper, Roohani Sharma
[C-16] Graph-Theoretic Concepts in Computer Science (**WG**), 2022
[J-14] Theoretical Computer Science (**TCS**), Volume 978: 114174 (2023)

16. **A Framework for Parameterized Subexponential Algorithms for Generalized Cycle Hitting Problems on Planar Graphs**
with Dániel Marx, Pranabendu Misra, Daniel Neuen
[C-15] ACM-SIAM Symposium on Discrete Algorithms (**SODA**), 2022

15. **Sparsification Lower Bound for Linear Spanners in Directed Graphs**
(This is a single author paper without a conference version.)
[J-13] Theoretical Computer Science (**TCS**), Volume 898: 69-74 (2022)

14. **On the Parameterized Approximability of Contraction to Classes of Chordal Graphs**
with Spoorthy Gunda, Pallavi Jain, Daniel Lokshtanov, Saket Saurabh
[C-14] Approximation, Randomization, and Combinatorial Optimization **APPROX/RANDOM**, 2020
[J-12] ACM Transactions on Computation Theory (**ToCT**), Volume 13(4): 27:1-27:40 (2021)

13. **Parameterized Complexity of Maximum Edge-Colorable Subgraph**
with Akanksha Agrawal, Madhumita Kundu, Abhishek Sahu, Saket Saurabh
[C-13] Annual International Computing and Combinatorics Conference (**COCOON**), 2020
[J-11] **Algorithmica**, Volume 84 (10): 3075 – 3100 (2022)

12. **On the Parameterized Complexity of Maximum Degree Contraction**
with Saket Saurabh
[C-12] International Symposium on Parameterized And Exact Computation (**IPEC**), 2020
[J-10] **Algorithmica**, Volume 84: 405 – 435 (2022)

11. **On the Parameterized Complexity of Grid Contraction**
with Saket Saurabh, Ueverton Dos Santos Souza
[C-11] Scandinavian Symposium and Workshops on Algorithm Theory (**SWAT**), 2020
[J-09] Journal of Computer and System Sciences (**JCSS**), Volume 129: 22-38 (2022)

10. **Subset Feedback Vertex Set in Chordal and Split Graphs**
with Geevarghese Philip, Varun Rajan, Saket Saurabh
[C-10] International Conference on Algorithms and Complexity (**CIAC**), 2019
[J-08] **Algorithmica**, Volume 81 (9): 3586-3629 (2019)

9. **Path Contraction Faster than 2^n**
with Akanksha Agrawal, Fedor Fomin, Daniel Lokshtanov, Saket Saurabh
[C-09] International Colloquium on Automata, Languages and Programming (**ICALP**), 2019
[J-07] SIAM Journal on Discrete Mathematics (**SIDMA**), 34(2): 1302-1325 (2020)

8. **An FPT Algorithm for Contraction to Cactus**
with R. Krithika, Pranabendu Misra
[C-08] Annual International Computing and Combinatorics Conference (**COCOON**), 2018
[J-06] Theoretical Computer Science (**TCS**), Volume 954: 113803 (2023).

7. **Exact and Parameterized Algorithms for (k, i)-Coloring**
with Diptapriyo Majumdar, Rian Neogi, Venkatesh Raman
[C-07] Algorithms and Discrete Applied Mathematics, (**CALDAM**), 2017

6. **Paths to Trees and Cacti**
with Akanksha Agrawal, Lawqueen Kanesh, Saket Saurabh
[C-06] International Conference on Algorithms and Complexity (**CIAC**), 2017
[J-05] Theoretical Computer Science (**TCS**), Volume 860: 98-116 (2021)

5. **On the Parameterized Complexity of Contraction to Generalization of Trees**
with Akanksha Agarwal, Saket Saurabh
[C-05] International Symposium on Parameterized and Exact Computation (**IPEC**), 2017
[J-04] Theory of Computing Systems (**ToCS**) Volume 63 (3): 587-614 (2019)

4. **Parameterized and Exact Algorithms for Class Domination Coloring**
with R. Krithika, Ashutosh Rai, Saket Saurabh
[C-04] **SOFSEM** 2017: Theory and Practice of Computer Science
[J-03] Discrete Applied Mathematics (**DAM**), Volume 291: 286-299 (2021)

3. **Lossy Kernels for Graph Contraction Problems**
with R. Krithika, Pranabendu Misra, Ashutosh Rai
[C-03] Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**), 2016

2. **Dynamic Parameterized Problems**
with R. Krithika, Abhishek Sahu
[C-02] International Symposium on Parameterized and Exact Computation **IPEC**, 2016
[J-02] **Algorithmica**, Volume 80(9): 2637-2655 (2018)

1. **Harmonious Coloring: Parameterized Algorithms and Upper Bounds**
   with Sudeshna Kolay, Ragukumar Pandurangan, Fahad Panolan, Venkatesh Raman
   [C-01] Graph-Theoretic Concepts in Computer Science (**WG**), 2016
   [J-01] Theoretical Computer Science (**TCS**), Volume 772: 132-142 (2019)

Reviewer for

Journals:

- SIAM Journal on Discrete Mathematics (**SIDMA**) (2022)
- Algorithmica (2024)×2, (2023), (2022), (2018)
- Journal of Computer and System Sciences (**JCSS**) (2021), (2021), (2020), (2020)
- Theoretical Computer Science **(TCS)** (2023)×2, (2022), (2021), (2019), (2019)
- Discrete Mathematics & Theoretical Computer Science (**DMTCS**) (2024), (2021)
- Discrete Applied Mathematics (**DAM**) (2021)

Conferences:

- ACM-SIAM Symposium on Discrete Algorithms (**SODA**) (2023)
- International Colloquium on Automata, Languages, and Programming (**ICALP**) (2023), (2020)
- European Symposium on Algorithms (**ESA**) (2023), (2022)×2, (2020) (2019)
- Symposium on Theoretical Aspects of Computer Science (**STACS**) (2024), (2023), (2020)
- Algorithms and Data Structures Symposium (**WADS**) (2023)
- Scandinavian Symposium on Algorithm Theory (**SWAT**) (2024)
- International Workshop on Graph-Theoretic Concepts in Computer Science (**WG**) (2024), (2023), (2022)×2, (2021), (2017)
- Mathematical Foundations of Computer Science (**MFCS**) (2024), (2023)
- International Symposium on Algorithms and Computation (**ISAAC**) (2022), (2021), (2020)
- International Symposium on Parameterized and Exact Computation (**IPEC**) (2003)×2, (2018), (2017), (2016)
- Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**) (2023)
- International Computing and Combinatorics Conference (**COCOON**) (2020), (2018)
- International Symposium on Fundamentals of Computation Theory (**FCT**) (2023)×2

Research Visits

Universite Clermont Auvergne, Clermont-Ferrand, France Sept 2023

Indian Institute of Science (IISc), Bangalore, India. July 2023

National Institute of Science Education and Research (NISER), Bhuvaneshwar, India. July 2023

Indraprastha Institute of Information Technology Delhi (IIIT-Delhi), India June 2023

University of Bergen, Bergen, Norway May 2017 – July 2017

University of Bergen, Bergen, Norway Sep 2016 – Nov 2016

Max-Planck Institute for Informatics (MPII), Saarbrücken, Germany June 2015 – July 2015

Invited Talks

Regarding Research

(*T*3) **Parameterized Approximation Algorithms Workshop (PAAW) 2022**:
Title : Parameterized Approximability of Contraction to Classes of Chordal Graphs
Date : 4^{th} July 2022

(*T*2) **Parameterized Complexity 301**:
Title : Graph Contraction: Old and New Developments
Date : 31^{st} December 2020

(*T*1) **Parameterized Complexity Seminar**:
Title : Parameterized Approximability of Contraction to Classes of Chordal Graphs
Date : 24^{th} November 2020

Regarding Teaching

(*T*1) Invited to deliver a 90-minutes long talk at Maharashtra State Development of Educators and Enhancement in Delivery (MS-DEED) Programme. The programme aims to engage in developing the professional capacity of teachers who teach B.Sc. and M.Sc.-level students.
Date: 22^{nd} May 2023.

Programming Experience

∘ **Lossy Kernelization in Practice** Jan 2019 – June 2019
We posit that a carefully crafted lossy reduction rule can yield improved approximation solution in practice. I have implemented (in C++ and CPLEX) different algorithms to solve Dominating Set on sparse graphs for various benchmark instances to support our hypothesis.

∘ **The Parameterized Algorithms and Computational Experiments Challenge (PACE)**
Implemented various algorithms to solve the following problems on large graphs: Vertex Cover using C++ (in 2019), Steiner Tree using C++ (in 2018), and Minimum Fill-In using Python (in 2017).

∘ **SymPy – Open Source Project** March 2011 – May 2012
One of the authors of SymPy, an open-source Python library for symbolic mathematics. I have contributed to its development by submitting functions, reviewing pull requests, fixing patches.

Conferences and Workshops Attended

∘ **ICGT 2022** July 4 – 8, 2022
Attended 11^{th} workshop on International Colloquium on Graph Theory and Combinatorics at Montpellier, France.

∘ **WG 2022** June 22 – 24, 2022
Attended 48^{th} edition of the International Workshop on Graph-Theoretic Concepts in Computer Science at Tubingen, Germany, and presented our work.

∘ **IPEC 2020** December 14 – 18, 2020
(Virtually) Attended 15^{th} International Symposium on Parameterized and Exact Computation, and presented our work.

◦ **SWAT 2020** June 22 – 24, 2020
(Virtually) Attended 17^{th} Scandinavian Symposium and Workshops on Algorithm Theory and presented our work.

◦ **Algorithmic Tractability via Sparsifiers** August 9 – 12, 2019
Attended workshop on tools used to sparsify the instances of hard problems that arise algorithmically. This workshop was organized in Leh, India, and supported by the ERC Grant LOPRE and the Institute of Mathematical Sciences.

◦ **WorKer 2019** June 3 – 7, 2019
Attended a workshop on Kernelization organized by the University of Bergen (UiB) at UiB, Norway.

◦ **CIAC 2017** May 24 – 26, 2017
Attended Algorithms and Complexity - 10^{th} International Conference, CIAC 2017 in Athens, Greece and presented our work.

◦ **Rangoli Of Algorithms (RoA) and FSTTCS 2016** December 11 – 12, 2016
Attended RoA as a part of the IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science organized at Chennai Mathematical Institute, India.

◦ **CTD 2016** April 28 – 29, 2016
Attended Chennai Theory Day organized by Chennai Mathematical Institute and presented research work on various graph coloring.

◦ **WorKer 2015** June 1 – 4, 2015
Attended workshop on Kernelization organized by the University of Bergen at Sophus Lie Conference Center, Norway.

◦ **FSTTCS 2014** December 15 – 17, 2014
Attended IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science organized at India International Centre, New Delhi.

◦ **Advanced School on Parameterized Algorithms & Kernelization (ASPAK)** Mar 3 – 8, 2014
This school was focused on several recent advances in parameterized algorithms and kernelization. It covered many fundamental as well as few advanced techniques.

Academic Achievements and Scholarships

◦ **INSPIRE Faculty Fellowship** 2022
Awarded INSPIRE Faculty Fellowship by the Department of Science and Technology, Govt. of India to carry out independent research.

◦ **CV Raman Post-Doctoral Fellowship** 2022 *(Declined)*
Awarded the CV Raman Post-Doctoral Fellowship by Indian Institute of Sciences, Bangalore.

◦ **Best Student Paper Award at IPEC** 2016
Awarded Best Student Paper Award for our paper titled 'Dynamic Parameterized Problems' at International Symposium on Parameterized and Exact Computation, IPEC 2016.

◦ **National Board for Higher Mathematics (NBHM)** 2010 *(Declined)*
Selected for M.A./M.Sc. Scholarship conducted by NBHM and funded by Department of Atomic Energy, Govt of India. Only twenty-two students throughout the nation were selected in that year.

◦ **Innovation in Science Pursuit for Inspired Research (INSPIRE)** 2008 *(Declined)*
Awarded Innovation in Science Pursuit for Inspired Research (INSPIRE) scholarship by the Department of Science and Technology, Govt of India, for perusing basic science at Indian Institute of Technology.

◦ **Kishore Vaigyanik Protsahan Yojana (KVPY)** 2008 to 2012
Recipient of Kishore Vaigyanik Protsahan Yojana scholarship awarded by Department of Science and Technology, Govt of India in 2007. It is the highest-paid scholarship at the graduate level.

◦ **Merit-cum-means Scholarships (MCM)** 2007 to 2008
Awarded merit-cum-means scholarships by Indian Institute of Technology for being second in the Mathematics department in the academic year 2007.

◦ **IIT Joint Entrance Examination – 2007**
Secured All India Rank 3289 in IIT-JEE and 3524 in AIEEE. (Among the top 1 % of students in the nation.)

◦ **National Talent Search Examination (NTSE)** 2005 to 2007
Awarded with National Talent Search Examination in the year 2005. This scholarship is given to the top 750 students in India.

◦ **Physics Olympiad – 2006**
In the top 1 % (out of 42000 students) at the National level in the Physics Olympiad conducted by the Indian Association of Physics Teachers (IAPT).

References

◦ **Prof. Saket Saurabh**
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◦ **Prof. Dániel Marx**
CISPA Helmholtz Center for Information Security, Saarbrücken, Germany
Email: marx@cispa.de

◦ **Prof. Geevarghese Philip**
Chennai Mathematical Institute, Chennai, India
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◦ **Prof. Ignasi Sau**
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