Karthik C. S.

Courant Institute of Mathematical Sciences, New York University, NY-10012, USA.

karthikcs.org karthik0112358@gmail.com

Research Interests

I am broadly interested in **Theoretical Computer Science**. In particular, I have spent the last few years thinking about the **Hardness** of **Geometric** problems, such as **Clustering**, **Closest Pair**, and **Fixed Point** Computation. More recently, I've been interested in the connections between Geometry and **Fairness**.

Education

- **Ph.D.** in Computer Science — *September 2014 – June 2019*
  Weizmann Institute of Science, Rehovot, Israel — *Advisor*: Prof. Irit Dinur
  Ph.D. Thesis: New Arenas in Hardness of Approximation
- **M.S.** in Computer Science — *September 2012 – July 2014*
  École Normale Supérieure, Lyon, France — *Advisor*: Prof. Hervé Fournier
  Master Thesis: Lower bounds for Multilinear Branching Programs

Employment

- **Postdoctoral Fellow** — *September 2020 – August 2021*
  Host: Prof. Subhash Khot — **New York University**, New York, USA
- **Postdoctoral Fellow** — *September 2019 – August 2020*
  Host: Prof. Amir Shpilka — **Tel Aviv University**, Tel Aviv, Israel
- **Postdoctoral Fellow** — *July 2019 – September 2019*
  Host: Prof. Irit Dinur — **Weizmann Institute of Science**, Rehovot, Israel

Selected Academic Awards and Honors

- Tel Aviv University **Postdoctoral Matching** scholarship — *2019*
- **LIP** fellowship — *2013*
- **Labex** scholarship — *2012*
- Kishore Vaigyanik Protsahan Yojana (**KVPY**) fellowship — *2007*
- Indian National Mathematical Olympiad (**INMO**) Awardee — *2007*
- National Talent Search Examination (**NTSE**) scholarship — *2006*

Selected Teaching Experience

- **A Theorist's Toolkit** — **Teaching Assistant**
  Course Instructor: Prof. Irit Dinur — *March-July 2018*
- **CS 101: Computer Programming and Utilization** — **Teaching Assistant**
  Course Instructor: Prof. Soumen Chakrabarti — *January-April 2012*
  Course Instructor: Prof. Deepak Phatak — *August-November 2011*

Research Visits

- **Google Research, Mountain View** *November 2019*
  Host: Dr. Pasin Manurangsi
- **Eötvös Loránd University, Budapest** *September 2019*
  Host: Prof. Dömötör Pálvölgyi
- **Microsoft Research India** *July-August 2019*
  Host: Dr. Prateek Jain
- **Shanghai University of Finance and Economics** *June 2019*
  Host: Prof. Bundit Laekhanukit
- **University of California, Santa Barbara** *May 2019*
  Host: Prof. Daniel Lokshtanov
- **Sorbonne University, Paris** *April 2019, December 2019*
  Host: Dr. Vincent Cohen-Addad
- **University of California, Berkeley** *July 2018, August 2018*
  Host: Pasin Manurangsi
- **INRIA Sophia Antipolis** *September 2013, June 2014, January 2017*
  Host: Prof. Jean-Daniel Boissonnat

Publications

- **On Communication Complexity of Fixed Point Computation**
  Joint work with Anat Ganor and Dömötör Pálvölgyi.
  To appear in *ACM Transactions on Economics and Computation* (**TEAC**).
- **On Efficient Low Distortion Ultrametric Embedding**
  Joint work with Vincent Cohen-Addad and Guillaume Lagarde.
  In the Proceedings of the International Conference on Machine Learning (**ICML**), 2020.
- **A Survey on Approximation in Parameterized Complexity: Hardness and Algorithms**
  Joint work with Andreas Emil Feldmann, Euiwoong Lee, and Pasin Manurangsi.
  In **Algorithms**, 13(6), 146, 2020 (*by invitation* to special issue titled 'New Frontiers in Parameterized Complexity and Algorithms').
- **Hardness Amplification of Optimization Problems**
  Joint work with Elazar Goldenberg.
  In the Proceedings of the Innovations in Theoretical Computer Science (**ITCS**), 2020.
- **Inapproximability of Clustering in ℓ_p-metrics**
  Joint work with Vincent Cohen-Addad.
  In the Proceedings of the Symposium on Foundations of Computer Science (**FOCS**), 2019.
- **On Closest Pair in Euclidean Metric: Monochromatic is as Hard as Bichromatic**
  Joint work with Pasin Manurangsi.
  In the Proceedings of the Innovations in Theoretical Computer Science (**ITCS**), 2019.
  In **Combinatorica**, 40(4): 539–573, 2020.
- **Parameterized Intractability of Even Set and Shortest Vector Problem from Gap-ETH**
  Joint work with Arnab Bhattacharyya, Suprovat Ghoshal, and Pasin Manurangsi.
  In Proceedings of International Colloquium on Automata, Languages, and Programming (**ICALP**), 2018.

- **On the Parameterized Complexity of Approximating Dominating Set**
  Joint work with Bundit Laekhanukit and Pasin Manurangsi.
  In the Proceedings of the Symposium on Theory of Computing (**STOC**), 2018.
  In *Journal of the ACM* (**JACM**), 66(5): 33:1–33:38, 2019.
  Invited to SIAM Journal on Computing Special Issue for STOC 2018 (*regretfully declined*).
  Invited to Highlights of Algorithms (**HALG**) 2019.
- **Towards a General Direct Product Testing Theorem**
  Joint work with Elazar Goldenberg.
  In the Proceedings of the IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**), 2018.
  In *ACM Transactions on Computation Theory* (**TOCT**), 12(1): 7:1–7:18, 2020.
- **On The Complexity of Closest Pair via Polar-Pair of Point-Sets**
  Joint work with Roee David and Bundit Laekhanukit.
  In the Proceedings of the Symposium on Computational Geometry (**SoCG**), 2018.
  In *SIAM Journal on Discrete Mathematics* (**SIDMA**), 33(1): 509–527, 2019.
- **Communication Complexity of Correlated Equilibrium with Small Support**
  Joint work with Anat Ganor.
  In the Proceedings of the International Conference on Approximation Algorithms for Combinatorial Optimization Problems (**APPROX**), 2018.
- **Ham Sandwich is Equivalent to Borsuk-Ulam**
  Joint work with Arpan Saha.
  In the Proceedings of the Symposium on Computational Geometry (**SoCG**), 2017.
- **An Efficient Representation for Filtrations of Simplicial Complexes**
  Joint work with Jean-Daniel Boissonnat.
  In the Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (**SODA**), 2017.
  In *ACM Transactions on Algorithms* (**TALG**), 14(4): 44:1–44:21, 2018.
- **Did the Train Reach its Destination: The Complexity of Finding a Witness**
  In *Information Processing Letters* (**IPL**), 121(5): 17–21, 2017.
- **On the Sensitivity Conjecture for Disjunctive Normal Forms**
  Joint work with Sébastien Tavenas.
  In the Proceedings of the IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (**FSTTCS**), 2016.
- **Building Efficient and Compact Data Structures for Simplicial Complexes**
  Joint work with Jean-Daniel Boissonnat and Sébastien Tavenas.
  In the Proceedings of the Symposium on Computational Geometry (**SoCG**), 2015.
  In **Algorithmica**, 79(2): 530–567, 2017.

Submitted Manuscripts

- **On Approximability of Clustering Problems Without Candidate Centers**
  Joint work with Vincent Cohen-Addad and Euiwoong Lee.
- **Deterministic Replacement Path Covering**
  Joint work with Merav Parter.
- **On Hardness of Approximation of Parameterized Set Cover and Label Cover: Threshold Graphs from Error Correcting Codes**
  Joint work with Inbal Livni Navon.

- **Fairness of Linear Regression in Decision Making**
  Joint work with Vincent Cohen-Addad, Claire Mathieu, and Namrata.

Selected Talks

- **Towards a Unified Framework for Hardness of Approximation in P**
  Frontiers of Parameterized Complexity August 2020
  TAU Theory Fest, Tel Aviv January 2020
- **Ultrametrics meet Fine-Grained Complexity**
  Weizmann Institute of Science July 2020
- **Clustering: How hard is it to classify data?**
  Google, Mountain View November 2019
  Columbia University November 2019
  Weizmann Institute of Science December 2019
  Hebrew University of Jerusalem December 2019
- **Inapproximability of Clustering in ℓ_p-metrics**
  Fine-Grained Approximation Algorithms & Complexity Workshop, Bertinoro May 2019
  Shanghai University of Finance & Economics June 2019
  Tel Aviv University June 2019
  Microsoft Research India August 2019
  Indian Institute of Science August 2019
  Eötvös Loránd University, Budapest September 2019
- **New Arenas in Hardness Amplification**
  Ben-Gurion University March 2019
  Hebrew University of Jerusalem April 2019
  Sorbonne University April 2019
- **On Complexity of Closest Pair Problem**
  Indian Institute of Science August 2018
  FILOFOCS Workshop, Institut Henri Poincaré, Paris October 2018
  Tel Aviv University October 2018
  Technion – Israel Institute of Technology January 2019
  Hebrew University of Jerusalem April 2019
  National Institute of Science Education and Research, Bhubaneswar August 2019
- **A Framework for Parameterized Hardness of Approximation**
  Hebrew University of Jerusalem January 2018
  Tel Aviv University March 2018
  Stanford University July 2018
  Simons Institute for Theory of Computing, Berkeley August 2018
- **An Efficient Representation for Filtrations of Simplicial Complexes**
  Topology for Data Analysis Winter School, INRIA Sophia Antipolis January 2017
- **Building Efficient and Compact Data Structures for Simplicial Complexes**
  Ben-Gurion University December 2015
- **In and Around the Sensitivity Conjecture**
  Microsoft Research, India September 2015

Professional Service

Program Committee Member: IPEC'21.

Reviewer for Conferences: SODA'21, FOCS'20, ICALP'20, STOC'20, ITCS'20, SODA'20, ISAAC'19, APPROX'19, ESA'19, CCC'19, ICALP'19, STOC'19, FOCS'18, PODC'18, ICALP'18, RANDOM'18, STACS'18, CSR'18, SPAA'17.

Reviewer for Journals: Games and Economic Behavior, ACM Journal of Experimental Algorithmics, Algorithmica.

Reviewer for Grant Proposals: French National Research Agency (ANR).