Ninad Rajgopal

Contact Information

Theoretical Computer Science Lab,
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Research Interests

Theoretical Computer Science, especially Discrete and Computational Geometry, Combinatorics, Algorithms.

Education

Indian Institute of Science, Bangalore, Karnataka, India

M.Sc(Engg.), Department of Computer Science and Automation, August 2011 to present

- *Advisor* : Dr. Sathish Govindarajan
- *Courses* : Design and Analysis of Algorithms, Graph Theory and Combinatorics, Probability and Statistics, Topics in Combinatorial Geometry
- *CGPA* : 6.3/8.0

Visvesvaraya Technological University, Belgaum, Karnataka, India

B.E., Computer Science and Engineering, July 2006 - June 2010

- *Aggregate* : 76.08 %
- *College* : Sri Jayachamarajendra College of Engineering, Mysore, Karnataka, India

Honors and Awards

NTSE (National Talent Search Examination) Scholarship, 2004

Academic Experience

Indian Institute of Science, Bangalore, Karnataka, India

Teaching Assistant - Design and Analysis of Algorithms **August-December 2012**
Duties have included office hours and sharing the responsibilities for grading homework assignments and exams.

Publications

Ninad Rajgopal, Pradeesha Ashok, Sathish Govindarajan, Abhijit Khopkar, Neeldhara Misra: **Hitting and Piercing Rectangles Induced by a Point Set.** COCOON 2013: 221-232

Submitted Journal Papers

Pradeesha Ashok, Sathish Govindarajan, Ninad Rajgopal: **Selection Lemmas for Geometric Objects.** CoRR, abs/1401.0443, 2014. Submitted to Computational Geometry: Theory and Applications (CGTA).

Master's Thesis (In progress)

Topic : *Hitting and Piercing Geometric Objects Induced by a Point Set.*

Abstract : Let P be a set of points in $\mathbb{R}^d$ and let $\mathcal{R}$ be the set of all objects of a particular kind (hyperspheres, boxes etc.) induced (spanned) by P, such that each object in $\mathcal{R}$ has a distinct tuple of points from P on its boundary. We consider various hitting and piercing problems for some families of geometrical objects induced by a point set. Firstly, we look at *Selection lemma* type results which typically bound the maximum number of induced objects that are pierced by a single point. Selection Lemmas are classical results in discrete geometry and have been well studied. In the *First selection lemma*, we consider the set of all distinct induced objects of a particular kind. We prove a tight bound of $\frac{n^2}{8}$ for induced axis-parallel rectangles. We also prove non-trivial bounds for higher dimensional boxes and disks. In the generalization of the first selection lemma, known as the *Second selection lemma*, we consider an m-sized arbitrary subset $\mathcal{S} \subseteq \mathcal{R}$. We show the existence of a point which pierces $\frac{m^3}{24n^4}$ axis-parallel rectangles, for the second selection lemma of axis-parallel rectangles. This improves upon the previous bounds of Smorodinsky and Sharir (2004) when there are sub quadratic number of induced rectangles. Finally, we consider the *Minimum hitting set* problem for induced objects, which is a special case of the geometric hitting set problem which has been extensively studied. We prove that computing the minimum hitting set problem for the set of all induced lines is NP-Complete.

Academic Projects

Computing the hitting set for lines induced by a pointset.

Course : Topics in Combinatorial Geometry **March 2012 - May 2012**

Explored the problem of computing the minimum hitting set for the set of all lines induced by a point set P. For general lines, this problem is known to be strongly NP-Hard (Megiddo et al. 1982) and APX-Hard (Anil Kumar et al. 2000). Explored the possibility of polynomial time algorithms for this problem during the course project. Proved the NP-Completeness of this problem by a reduction from the Multi-color clique problem, after the duration of the course project.

Fast Greedy K-Means algorithm using K-d trees.

B.E. project **February 2010 - May 2010**

The Fast Greedy K-Means algorithm (N.Hussein 2002), deterministically initialises the initial centroids and gives an approximate solution for the global minimum of the clustering problem. The algorithm also uses a few heuristics to improve the computation of the cluster to which a point is assigned. The K-d tree is the underlying data structure used to perform all these optimizations. Implemented this algorithm and experimentally got improved performance over the naive K-means algorithm for large point sets. Also got a better performance over the naive version, when the number of clusters were high.

Professional Experience

National Instruments (NI) R & D, Bangalore, Karnataka, India

Software Engineer **July 2010 - July 2011**

Role : Developed and maintained the test automation framework and automated tests for **LabVIEW RT**, which is a real time module for LabVIEW.

References

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More available upon request.