Anant Dhayal

M.S. by Research
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AREAS OF INTEREST

Computational Complexity, Approximation Algorithms, Combinatorics and Graph Algorithms

PUBLICATION

Title : Polynomial Min/Max-weighted Reachability is in Unambiguous Logspace
Authors : Anant Dhayal, Jayalal Sarma and Saurabh Sawlani
Conference : FSTTCS 2014

EDUCATION

DEGREE	COLLEGE/UNIVERSITY	%/CGPA	YEAR
M.S. in CSE	IIT Madras, Chennai	10/10	2012-2015
B.Tech. in CSE	The LNMIIT, Jaipur	7.37/10	2008-2012
XII (CBSE)	St. Paul's Sr. Sec. School, Jodhpur	79.2%	2006-2007
X (CBSE)	Delhi Public School, Jodhpur	75.4%	2004-2005

M.S. PROJECTS

- **Title : Monotone Dualization of Boolean Functions** (Oct 2014 - present)
  Other Members : Jayalal Sarma, Raghavendra Rao & Saurabh Sawlani
  Summary : Currently the most space efficient algorithm for Monotone Dualization requires $\mathcal{O}(\log^2 n)$ space, and the most time efficient algorithm runs in $n^{o(\log n)}$ time. We are trying to bring down these complexity bounds by designing a new parallel branching.

- **Title : Unambiguity vs Non-Determinism** (Jan 2014 - present)
  Other Members : Jayalal Sarma & Saurabh Sawlani
  Summary :
  - Graphs having unique min(max)-weight paths from a vertex s to any other vertex are called min(max)-unique w.r.t. s. If the number of min(max)-weight paths is bounded by a polynomial in the size of the graph, then the graph is called min(max)-poly w.r.t. s.
  - The Reachability problem (Reach) for Min-Unique Graphs and the Longest Path problem (LongPath) for Single-Source Max-Unique Graphs is in UL. We improved the UL algorithms to make them work for Reach in Min-Poly Graphs and LongPath in Single-Source Max-Poly Graphs. Then, we gave a reduction from Reach to Single-Source LongPath which preserves Max-Unique and Max-Poly property. This puts Reach for Max-Unique Graphs and Max-Poly Graphs in UL.
    (**Accepted for presentation at FSTTCS 2014**)
  - Now, we are trying to build L(or UL)-computable Min(Max)-Poly weighting schemes for some well known and well studied sub-classes of graphs. This will pull down the problem of reachability for these sub-classes from NL to UL.

- **Title : Graph Reachability & Graph Isomorphism** (July 2013 - Dec 2013)
  Other Members : Jayalal Sarma
  Summary : Reach logspace reduces to Graph Isomorphism (GI). GI is in L for graphs which are either $K_{3,3}$-minor-free or K_5-minor-free. But, we showed that Toran's Gadget in the reduction contains both, $K_{3,3}$ and K_5 as minors, even for restrictions like Mangroves. So, when the original gadget failed even in pulling down Mangrove Reach to L, we tried to design a new gadget.

- **Title : Nisan's Generator & Randomized Logspace Algorithms** (Dec 2012 - July 2013)
  Other Members : Jayalal Sarma
  Summary : We studied the construction of Nisan's Pseudorandom Generator and its usage to pull down RL to Steve's Class-2 i.e. $\mathcal{O}(\log^2 n)$ space and polynomial time. We also studied the paper on "Time-Space Tradeoff in Derandomizing Probabilistic Logspace" and the paper which uses constructor for proving 'RL $\subseteq$ L/$\mathcal{O}(n)$'. Taking help from all these, we tried to reduce the present complexity bounds for class RL.

SCHOLASTIC ACHIEVEMENTS

- Ranked 1^{st} out of 23 students in M.S., Dept. of Computer Science, IIT Madras.
- Secured All India Rank 642 in CSE GATE 2012, among 156,780 applicants.
- Secured All India Rank 5,675 in IITJEE 2008, among 320,000+ applicants.
- Secured All India Rank 10,736 in AIEEE 2008, among 900,000+ applicants.
- Secured Rank 38 in Rajasthan Pre Engineering Test 2008, among 50,000+ applicants.
- Secured All India Rank 36 in TSI Maths Olympiad (level III) in class XI (2005-06).

M.S. COURSES

o Advanced Theory of Computation
o Advanced Data Structures & Algorithms
o Modern Techniques in Theory of Computation
o Advanced (Approximation) Algorithms
o Advanced Complexity Theory
o Algorithmic Algebra
o Mathematical Concepts for CS
o Introduction to Research

B.TECH. COURSES

Theory :
o Theory of Computation
o Discrete Mathematics
o Data Structure & Algorithms
o Design & Analysis of Algorithms

Mathematics :
o Numerical Analysis
o Numerical Solution of Partial Differentiation
o Non-Linear Dynamics & Chaos
o Introduction to Wavelets

TEACHING EXPERIENCE

- **Advanced Theory of Computation (July - Nov 2014) :** Responsible for conducting tutorials and evaluating answer scripts.
- **Advanced Complexity Theory (Jan - May 2014) :** Responsible for conducting tutorials and evaluating answer scripts.
- **Advanced Theory of Computation (July - Nov 2013) :** Responsible for conducting tutorials and evaluating answer scripts.
- **Computational Engineering (Jan - May 2013) :** Assisted students in performing experiments and evaluated them by conducting viva voce.

TALKS AND PRESENTATIONS

- IIT Madras, 'Poly Min/Max-weighted Reachability is in UL', in t-Meet, a theory seminar series. Will also present the same at FSTTCS, in December 2014.
- IIT Madras, 'BPSPACE(S) $\subseteq$ DSPACE($S^{3/2}$)', as a part of Advanced Complexity Theory course.
- IIT Madras, 'Linear Advice for Randomized Logarithmic Space : RL $\subseteq$ L/$\mathcal{O}(n)$', as a part of Modern Techniques in Theory of Computation course.
- IIT Madras, 'Cleaning up the primal solution : The shortest *s-t* path problem', as a part of Advanced Algorithms course.
- IIT Madras, 'Primes in P' and 'Grid Graph Reach in UL', as a part of Introduction to Research course.

CONFERENCES/WORKSHOPS/SEMINARS

- Was a member of the organizing committee of WALCOM 2014 organized by IIT Madras in Feb 2014.
- Attended the 4th Mysore Park Theory Workshop 2013 in Algorithms and Complexity supported by Infosys.
- Attended ASPAK 2014 organized by Institute of Mathematical Sciences, Chennai in March 2014.
- Attended NWGC 2013 organized by Indian Statistical Institute, Chennai in Jan 2013.
- Active participant of t-Meet in IIT Madras and Complexity Seminar in Institute of Mathematical Sciences.

INTERNSHIP PROJECTS

- Time : January 2012 to May 2012 (8th Semester, B.Tech.)
  Place : BITS-Pilani, Pilani Campus
  Topic : Scheduling of kernel threads in Distributed Systems
  Guide : Asst. Prof. Mayuri Digalwar

- Time : May 2011 to July 2011 (3rd year summer break, B.Tech.)
  Place : TCS Innovation Labs, Gurgaon
  Topic : Inverse Kinematics
  Guide : Dr. Prithwijit Guha, Head of the Vision Department

B.TECH. PROJECTS

- Made URL Classifiers as a project in the Web-Mining course and tested it on a data-set containing information on urls accessed over a period of 120 days with 50k urls per day.
- Made Lexical Analyzer and Parser for a part of C-Language using Lex & Yacc.
- Made a project about Server-Client Based Chat Application on Local Area Network (on the GUI Interface) and Wake on LAN in Computer Networks using Socket Programming.
- Made Suduko Solver using Prolog and C as a project in the course Artificial Intelligence.
- Made a project on Online Shopping Mall in the course DBMS using MySql, PHP and Dreamweaver.
- Studied and worked on Self-Organized Criticality under the guidance of Prof. Shrimali.
- Studied and submitted a report on Spintronics using as reference various research papers under the guidance of Prof. Somnath Biswas.

TECHNICAL SKILLS

- **Languages:** C, C++, Core Java, MySql, Prolog, PHP, MATLAB.
- **Platforms:** Windows - 8/7/ VISTA/XP, UNIX(Linux), DOS.
- **Software:** Dream Viewer, MATLAB, MS Office, Wire shark, Latex, Lex & Yacc, Multisim.
- **Hardware:** C.R.O., FGPA.

POSITIONS OF RESPONSIBILITY

- IIT Madras, Research Branch Counselor of CSE department for M.S./Ph.D. Scholars for 2013-14 session.
- IIT Madras, Library T.A. of CSE Department from July 2012 to December 2012.
- IIT Madras, Captain of M.S. cricket team in CS Cup 2013.
- LNMIIT, Head of the Anti-Ragging Committee and member of the Sports Committee for 2011-12 session.
- LNMIIT, Elected as a Senate Member of the Student Gymkhana for 2011-12 session.
- LNMIIT, Head of the management team of two cultural events in the annual fest Vivacity-2010.