Surajkumar Harikumar

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EDUCATION

Program	Institution	CGPA/%	Graduation Year	Class Rank
BTech+MTech: Electrical Engg.	Indian Institute of Technology, Madras	9.39	2016	4/80
Class XII (Science + CS)	PSBBSS School, KK Nagar	97.6%	2011	1/280
Class X	PSBBSS School, KK Nagar	96.8%	2009	1/400

RESEARCH PROJECTS

IIT MADRAS | Designing High Threshold Protograph LDPC Codes
August 2014 – Present | Chennai, India | Mentor - Prof. Andrew Thangaraj

- **Vision** - Design Heuristics to find High Threhsold Protograph LDPC Codes over the BEC.
- Derived Mathematical Upper Bounds on threshold, by bounding the multivariable optimization problem as a single variable optimization problem. Further bounds on the functional forms gave bounds which depend only on the protograph matrix entries. the bounds were found to be within 20% of the threshold value.
- Used the bounds to find theoretically optimal protographs of small sizes, matching the computationally obtained best codes.
- Engineered a heuristic that performs constrained-random search over a reduced space for high threshold protograph codes.
- Improved the best known protograph thresholds for small codes by 25%, designed large codes within 7% of theoretical limit.
- **Presented paper at IEEE IWSDA '15**, IEEE Journal Submission in Oct '15.

CARNEGIE MELLON UNIVERSITY | Designing Flexible LDPC codes for Energy Scalability
May 2014 – July 2014 | Pittsburgh, PA | Mentor - Prof. Pulkit Grover

- **Vision** - To engineer total-energy minimizing (TotEm) LDPC codes for short distance communication (BLE, WiFi). The codes are designed to be energy-efficient at the decoder, and can scale between various power and energy requirements.
- Developed a mathematical framework for measuring average change in degree distribution of the LDPC code from adding nodes, which closely mimics random addition.
- Designed an incremental node addition framework, which connects smaller (local) LDPC codes to form a larger (global) code, providing **exponential accuracy increase** at the cost of more energy at the global decoder.

PUBLICATIONS

- **Surajkumar Harikumar**, Jayanth Ramesh, Manikandan Srinivasan, Andrew Thangaraj, "Threshold Upper Bounds and Optimized Design of Protograph LDPC Codes for the Binary Erasure Channel", 7th International Workshop on Signal Design and its Applications in Communications (to be presented at IEEE IWSDA '15 in September).

EXPERIENCE

NPTEL MOOC - NETWORKS & SYSTEMS | Teaching Assistant
June 2015 – Present | Chennai

- One of 3 TAs for the Networks & Systems MOOC (5000+ participants).
- In charge of course materials, notes, assignments, and forum moderation.

PHASORZ TECHNOLOGIES | Web Stack Developer
May 2013 – Aug 2013 | Chennai, India | Healthcare-Tech Startup

- Worked on R&D and Web development for the doctor messaging platform (now DocsApp in Bangalore)
- Created web-infrastructure and APIs for Android, solutions for Security, Data Analytics, Image compression, data fragmentation for bad internet connectivity, using PHP, Amazon AWS

SHAASTRA TECH FEST | Coordinator of WebOperations
July 2013 – Jan 2014 | IITM, Chennai
- Was part of a 12-member team using Django to build the Shaastra website, which gathered over 3 million views.
- Developed a Facilities portal for item control, automated report generation. Created an item-optimization algorithm, for re-use and distribution of items, used across 25 Shaastra events.

GADGETRONICA | Assosciate Writer
March 2013 – March 2014 | Chennai
- Authored over 50 articles on Mobile & Computing tech, Product reviews and releases for Gadgetronica (PhoneRadar)
- Covered Kickstarter Campaigns, Apple WWDC, Google I/O, device releases, and phone reviews.

SELECT COURSE PROJECTS

FIRA Simurosot: CBR approach for defensive strategies | CS6250 - MBR for Artificial Intelligence
- Developed an Instance Based Learning agent for selecting the best Defender Robot strategies for the FIRA Simurosot league (simulates 5v5 robotsoccer competition)

Performance Evaluation: Punctured Convolutional Codes | EE5120 - Error Control Coding
- Evaluated the performance of a rate 2/3 convolutional code (punctured rate 1/2), under Soft-Viterbi-Decoder.

Revisiting the Google PageRank Algorithm | EE4371 - Data Structures & Algorithms
- Presented a term paper on the historical significance and relevance of the Google PageRank algorithm.

Tournament Problem and Kirkman's Schoolgirls | EE6143 - Info. Theory and Coding
- Presented a paper on the solution to the Kirkman's Schoolgirls Problem using Steiner Triple Systems and the solution of Tournament Problem.

D-8QPSK Communication Stack Implementation | EE4140 - Digital Communication
- Implemented a D-8QPSK and 64-QAM communication system using GNU-Radio companion

AWARDS

- **One of 20 students worldwide** selected for CMU ECE program ('14)
- **All India Rank 800** in IIT-JEE among 450,000 applicants ('11)
- Received CBSE Award of Merit- **Top 0.1%** (among 1,000,000+ students) in Maths & CS ('11)
- Rank 1 in PSBBSS school both the Class X and Class XII CBSE board examinations ('09, '11)
- Selected for the final stage of KVPY scholarship test in Class XI,XII (among 300, 3000+ applicants) ('10, '11)

COURSES

Major		Electives	Minor
Modern Coding Theory	Digital Comm. Systems	MBR for Artificial Intelligence	Principles of Economics
Information Theory and Coding	Computer Organization	Multivariate Data Anaylsis	Advanced Operations Research
Multivariate Signal Processing	Digital Signal Processing	Computational Neuroscience	Game Theory
Numerical Methods for EE	Control Engineering	Data Structures & Algorithms	Production Economics
Probability Theory	Linear Algebra	Complex Analysis	Multivariable Calculus

SKILLS

- **Programming Languages**- C++ • Python • Matlab • LaTeX
- **Frameworks**- Django • Git • PHP • MySQL • Amazon AWS

CO-CURRICULAR AND EXTRA-CURRICULAR ACTIVITIES

- **WebOps** – Conducted a session on "Zen and the Art of Python" for 200+ freshers, The WebOps club, IITM
- **Volunteering** - Weekly visits to Govt. Sec School Velachery, teaching English to 150+ students, among 20 volunteers, as part of NSS IITM '11-'12
- **Music** – Performed as Pianist / Guitarist, as part of a band at culturals, including headlining at Reverberations '10
- **Coding** - District finalist at the ACM NLPC 2012 coding contest, with 200+ participants from across TN, India