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RESEARCH INTERESTS

Coding Channel coding and quantization with side information. Coding for cooperative communication. Multi-rate/Rateless codes. Generalizing and extending the notion of parity in channel codes. General techniques for mapping information theoretic random coding schemes to random-graph codes. Understanding the structure of the genetic code through genotype-phenotype maps. Discovering how messages are coded in sensory systems.

Communications and Information Theory Scaling laws and network capacity. Exploiting mobility in networks. The cost and benefit of channel state information and feedback in cooperative wireless networks. Practical aspects and standardization of relay communication protocols.

EDUCATION

Rice University

PhD in Electrical & Computer Engineering with advisors Prof. Behnaam Aazhang and Prof. Ashutosh Sabharwal (expected May 2007).

MS in Electrical & Computer Engineering, 2003. GPA: 4.08/4.

IIT Kharagpur, India

B. Tech. (Hons.) in Electronics & Electrical Communication Engineering, 2001. GPA: 9.34/10.

HONORS

- Patent inventor for “Variable Rate Soft Information Forwarding”, Nokia NC51557, 2006.
- One of three winners at Rice-Nokia Proposal Workshop, 2006.
- TI Fellowship, Rice University, 2001.
- Best Academician Prize, Nehru Hall, IIT Kharagpur, 2001.
- Third in Department of Electronics & Electrical Communication Engineering, IIT Kharagpur, 2001.
- National Talent Scholarship from National Council for Education, Research and Training, India.

RESEARCH AND WORK EXPERIENCE

- **Graduate Student, ECE Department, Rice University (August 2001 - Present)**

– *Cooperative Coding*

- * Design of practical LDPC coding schemes for decode-and-forward and estimate-and-forward relaying protocols. My research is intended as a step towards achieving the bigger goal of performing a proof-of-concept demonstration of relay communication on the Wireless Open-Access Research Platform (WARP) testbed being built at Rice University.

- ***Coding Theory***
 - * Design of multi-rate LDPC codes, using a combination of classical and modern techniques.
 - * Design and exploration of the properties of Variable Significance Parity Check (VSPC) codes.
- ***Research on MIMO Systems - Transit Access Points (TAP) Project***
 - * The project gave me an opportunity to look closely at implementation issues of 802.11a/g/n and 802.16 standards, such as synchronization, channel estimation and equalization for OFDM. On the other hand, the project, which involved several undergraduate students, also taught me how crucial prior planning is to a big project, and the challenges of ensuring productive and successful teamwork.
- ***Masters Thesis Research***
 - * **Exploiting Predictable Mobility for Power Efficient Sensor Network Communication.** Constructed a queuing model for the analysis of data collection by a mobile collector from a field of distributed sensors. Demonstrated through analysis and simulation that such mobile collectors can reduce power by several orders of magnitude.
 - * **Proved the Order-Optimality of Multi-hop Communication in a Sensor Network.** Showed that multi-hop communication can achieve a throughput scaling that can never be surpassed, even with the use of beamforming.
- ***Selected Small Projects***
 - * Applied Information Theoretic Metrics to Genotype-Phenotype Matching.
 - * Worked in a group that built a Reconfigurable Wireless Communication System capable of supporting 802.11 and WCDMA Standards on a single DSP+FPGA based Platform.
 - * Investigated the Feasibility of Implementing Expander Codes in Communication Systems.
 - * Studied the Relative Optimality of Coding vs Spreading in CDMA Systems.
 - * Compared Time-Domain Pitch-Estimation Techniques in Speech Signals.
 - * Incorporated Algorithmic Improvements within the SPIHT Image Coder.
- **Engineering Intern, Qualcomm Inc. (April-July 2006)**

Evaluated and proposed changes to enhance the performance of H-ARQ for the reverse link of UHDR-DO in the 3GPP2 standard proposal. The proposed changes were incorporated in the standards, and based on my performance, I was offered a full-time position.
- **IIT Kharagpur (August 1997 - May 2001)**
 - ***Senior Year Dissertation***
 - * Design and Partial Implementation of a Discrete Multi Carrier Modem on TMS320C62x.
 - ***Selected Projects***
 - * Developed Algorithms on Digital Mesh Traversal for Polygonal Approximation of the Cover Map in GIS (Geographical Information Systems) images.
 - * Developed Computationally Efficient Algorithms for Dominant Point Detection.
- **Summer Intern, Siemens India, Bangalore (May-June 2000)**

Performed Code Optimization for Software Tools written in JAVA and PERL.

TEACHING EXPERIENCE

- **Teaching Assistant, Rice University (August 2001 - Present)**
 - Graded student assignments and exams, organized help sessions and demonstrations, and delivered several lectures for the following courses: Digital Communication, Wireless Communication, Advanced Topics in Information and Communication Theory, Neural Networks and Information Theory. 10-40 students attended these classes.
 - Jointly designed a graduate course on “Advanced Topics in Information and Communication Theory” with Prof. Ashutosh Sabharwal.
 - Participated in a series of eight teaching workshops conducted by award-winning teachers. The workshops covered topics such as “Teaching Graduates”, “Case Studies From the Classroom: What Would You Have Done?”, and “Ethical Issues In the Classroom”.

PUBLICATIONS

• Refereed Journal Articles

1. A. Chakrabarti, A. Sabharwal, B. Aazhang, “On the Order-Optimality of Multi-hopping in Sensor Networks”, communicated to *IEEE Transactions on Wireless Communications*, April, 2006.
2. A. Chakrabarti, A. de Baynast, A. Sabharwal, B. Aazhang, “LDPC Code-Design for the Relay Channel”, to appear in *IEEE Journal on Selected Areas in Communications - Special Issue on Cooperative Communications and Networking*, Vol. 25, No. 2, Feb. 2007.
3. A. Chakrabarti, A. Sabharwal, B. Aazhang, “Communication Power Optimization in a Sensor Network with a Path-Constrained Mobile Observer”, *ACM Transactions on Sensor Networks*, Vol. 2, Issue 3, Aug. 2006, pages 297-324.
4. A. Chakrabarti, A. Jain, A.K.Ray, “Fast Algorithms for Dominant Point Detection with Variable Tradeoff between the Approximation Error and the Compression”, *IETE (Institution of Electronics and Telecomm. Engineers) Journal of Research*, Vol. 49, No. 5, Sep.-Oct. 2003.

• Journal Articles in Preparation

1. A. Chakrabarti, A. Sabharwal, B. Aazhang, “Quantizer Design and Implementation of Estimate-and-Forward Relaying”, in preparation for *IEEE Transactions on Communications*.

• Book/Magazine Articles

1. “Information Theoretic Limits and Code Designs for Cooperative Communications” accepted for publication in *IEEE Signal Processing Magazine*.
2. “Cooperative Communications : Fundamental Limits and Enabling Technologies” in *Cooperation in Wireless Networks: Principles and Applications* published by Springer, 2006.
3. “The Role of Telecommunications in Information Technology” in *Information Technology : Principles and Applications* published by Prentice Hall of India, 2004.

• Conference Proceedings

1. A. de Baynast, A. Chakrabarti, A. Sabharwal, B. Aazhang, “A Systematic Construction of LDPC Codes for Relay Channel in Time-Division mode”, *Asilomar Conference*, 2006.

2. V. Sivetskiy, A. Chakrabarti, A. Sabharwal, B. Aazhang, "Multi-source Synchronization and Channel Estimation", *IEEE CTW*, 2006.
3. A. Chakrabarti, A. de Baynast, A. Sabharwal, B. Aazhang, "Half-Duplex Estimate-and-Forward Relaying: Bounds and Code Design", *ISIT*, 2006.
4. A. Chakrabarti, A. de Baynast, A. Sabharwal, B. Aazhang, "Codes for Half Duplex Relay Channels", invited paper *International Zurich Seminar on Communications*, 2006.
5. A. Chakrabarti, A. de Baynast, A. Sabharwal, B. Aazhang, "LDPC Code Design for Half-Duplex Decode-and-Forward Relaying", *Allerton Conference*, 2005.
6. A. Chakrabarti, A. Sabharwal, B. Aazhang, "Sensitivity of Achievable Rates for Half-Duplex Relay Channel", invited paper *IEEE Workshop on SPAWC*, 2005.
7. A. Chakrabarti, A. Sabharwal, B. Aazhang, "Multi-Hop Communication is Order-Optimal for Homogeneous Sensor Networks", *International Workshop on IPSN*, 2004.
8. A. Chakrabarti, A. Sabharwal, B. Aazhang, "Using Predictable Observer Mobility for Power Efficient Design of Sensor Networks", *International Workshop on IPSN*, 2003.
9. A. Chakrabarti, A. Jain, A.K. Ray, "A Technique for Digital Mesh Traversal for Polygonal Approximation of the Cover Map for GIS Applications", *ICCCD*, 2000.
10. A. Chakrabarti, A. Jain, A.K. Ray, "A Novel Algorithm for the Generation of the Cover Map of a Remotely Sensed Image", *Indian Conference on CVGIP* 2000.
11. A. Chakrabarti, A. Jain, A.K. Ray, "Fast Algorithms for Dominant Point Detection in Digital Closed Curves", *International NUROP Congress*, 2000.

PATENTS

- A. Chakrabarti, A. de Baynast, A. Sabharwal, B. Aazhang, "Variable Rate Soft Information Forwarding", Nokia NC51557, June, 2006.

REFERENCES

- **Behnaam Aazhang**, Professor and Chair of Electrical & Computer Engineering, Rice University. MS 366, 6100 Main Street, Houston, TX 77005 USA. Ph: 713-348-4749. E-mail: aaz@rice.edu
- **Ashutosh Sabharwal**, Faculty Fellow of Electrical & Computer Engineering and Director of the Center for Multimedia Communication, Rice University. MS 380, 6100 Main Street, Houston, TX 77005 USA. Ph: 713-348-5057. E-mail: ashu@rice.edu
- **Ajoy Kumar Ray**, Professor of Electronics & Electrical Communication Engineering and Head of the School of Medical Science & Technology, IIT Kharagpur. Head, SMST, IIT-Kharagpur, Kharagpur - 721302, West Bengal, India, Ph: +91-3222-282220. E-mail: akray@smst.iitkgp.ernet.in
- **Richard Tapia**, University Professor and Professor of Computational & Applied Mathematics, Rice University. CAAM - MS 134, 6100 Main Street, Houston, Texas 77005 USA. Ph: 713-348-4049. E-mail: rat@rice.edu
- **Elza Erkip**, Associate Professor of Electrical Engineering, Polytechnic University. Five Metrotech Center, Brooklyn, NY 11201 USA. Ph: 718-260-3361. E-mail: elza@poly.edu