

Stefano Rini

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PERMANENT ADDRESS

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Education

- Ph.D. in Electrical and Computer Engineering 2005–2010
University of Illinois at Chicago, Chicago, IL, USA
GPA 4.0/4.0
- M.S. in Electrical and Computer Engineering 2005–2010
University of Illinois at Chicago, Chicago, IL, USA
GPA 4.0/4.0
- M.S. in Statistics 2005-2010
University of Illinois at Chicago, Chicago, IL, USA
GPA 4.0/4.0
- B.A. in Computer Science 2002–2005
Politecnico di Milano, Como, Milan, Italy
GPA 29.7/30
Graduated with 110/100, Summa Cum Laude

Research Experience

Post-Doctoral Student at Stanford University

November 2012 –Present

Employer: Professor Andrea Goldsmith

-Coding for relay-assisted down-link cellular networks: I research the effect of superposition coding for general down-link system where the base station is assisted by LTE-style relays. I show that cooperation in the form of superposition coding outperforms non cooperative strategies in both overall throughput and energy efficiency.

Random Coding For General Multi-terminal Networks: We focus on the problem of obtaining a general achievable region based on random coding arguments for a channel with any number of transmitters and receivers. Through the use of graphical Markov models, we define a compact representation of any scheme combining coded time-sharing, rate-splitting, superposition coding and binning. From this representation it is also possible to readily obtain the corresponding achievable region.

Post-Doctoral Student at the Technische Universität München

September 2011–November 2012

Employer: Professor Gerhard Kramer

-Code Design for Multi-Terminal Networks: I investigate the problem of code design for multi-terminal systems by seeking fundamental design guidelines and devised examples of code constructions that approach the theoretical optimum. While many codes are known to perform well on

simple point-to-point channels, the problem of designing codes for networks with a larger number of users is still an open challenge.

-Information Processing in the Human Auditory System: I studied the coding and processing of information in the neuronal system using an information theoretical approach and proposed evaluation tools for cochlear implants in hearing impaired patients. I am currently exploring a vast range of practical solutions for bettering the user's experience by improving the design of the electrical stimulations.

Post-Doctoral Student at Stanford University

February 2011–August 2011

Employer: Professor Andrea Goldsmith

-Interference Channel with a Cognitive Relay: I determined the limiting rate advantages and optimal strategies for cooperation and interference management in small relay networks. Relay nodes are devices designed to extend the coverage of wireless and support multiple base stations and my results provide important design guidelines for practical systems by providing a better understanding of the fundamental role of interference in these networks.

Doctoral Student at the University of Illinois at Chicago

August 2005–January 2011

Adviser: Professor Daniela Tuninetti

-Thesis with title “On the role of cognition and cooperation in wireless networks: an information theoretic perspective”:

In my doctoral thesis, I investigated the long-standing open problem of determining the largest attainable transmission rates in cooperating networks and provided crucial results on this topic. In wireless networks, neighboring devices can overhear each other's transmissions and this key feature of the wireless medium can be exploited to implement collaboration strategies among users. This promises to drastically increase the efficiency and the reliability of wireless networks.

Teaching Experience

Research Experience for Undergraduates: Jomar Sevilla

Summer 2013–present

Numerical Optimization of Transmission Schemes
Stanford University

With Jomar we develop an algorithm to optimize the derivation of achievable rate regions involving interference decoding and interference pre-coding for a general channel with any number of transmitters, receivers and any message allocation.

Master Thesis Supervisor: Michael Drews

Summer 2012–Fall 2013

Neurogram Matching Transformation Index
Department of Biophysics at the Technische Universität München

*Together with Michael we developed a similarity index among neurograms, a representation of the neuronal activity of the cochlea in the human ear. This index proves to be very useful in determining the quality of the electrical stimulation in cochlear implants.
This work is the subject of two conference papers and a patent application.*

Master Thesis Supervisor: Levon Ghaghanidze

Fall 2011–Summer 2012

The Automatic Rate Region Derivator
Department of Communication Engineering at the Technische Universität München

Levan and I are developing a software tool that derives a general achievable region based on superposition coding and binning for any multi-terminal network. This generalizes the derivation of a number of achievable regions known in the information theoretical literature. This work was submitted to an international conference and to two journal of communications.

Master Thesis Supervisor: Hrishikesh Ravi Mathukkarumukku Fall 2011–Summer 2012
Information Theoretic Security in Voting Systems
Department of Communication Engineering at the Technische Universität München

Hrishikesh and I are studying the security and privacy of electronic voting systems using information theoretical measures. We aim to provide practical tool to assess the performance of existing electronic voting systems in terms of secrecy and reliability.

Bachelor Thesis Supervisor: Sebastian Semmelbauer Fall 2011–Summer 2012
Reference Based DNA compression
Department of Communication Engineering at the Technische Universität München

Sebastian and I developed an algorithm for DNA compression using another DNA sequence as reference. The algorithm outperforms all the existing algorithms in the cases we analyzed. This work has been submitted to an international journal on nucleic acid research.

Bachelor Thesis Supervisor: Andrea Grigorescu Fall 2011–Spring 2012
Information Theoretical Aspects of Neural Coding
Department of Communication Engineering at the Technische Universität München

Andrea and I introduced a new entropy time-dependent and time-varying entropy estimator for the firing patterns of the human auditory system that closely correlates to the auditory input. Andrea presented her work at the Science of Information Summer School, Stanford, Summer 2012.

Project Supervisor Fall 2011–Spring 2012
Interference Alignment in a General Line-of-Sight Model
Department of Communication Engineering at the Technische Universität München and Nokia Siemens Network

I supervised an industry project for an application of interference alignment to cellular networks. By using the diversity provided by different OFDM frequencies, it is possible to align the interference experienced at different cellular users on the cell edge.

Teaching Assistant Fall 2011
System Aspect in Communications
Department of Communication Engineering at the Technische Universität München

I taught a weekly tutorial session, presenting a variety of exercises covering the material taught in class. I was also responsible for the preparation of the exercise material, exams and grading. The courses focused on the LTE network architecture.

Teaching Assistant Spring 2009
Electronics I
Department of Computer and Electrical Engineering at the University of Illinois at Chicago

I taught a weekly laboratory session and was also responsible for grading the homework and exams. The course focused on transistors and transistors networks.

Teaching Assistant Fall 2008
Analog Communication Circuits
Department of Computer and Electrical Engineering at the University of Illinois at Chicago

I taught a weekly laboratory session and was also responsible for grading the homework and exams. Through the course, the students built a radio by exclusively using analog circuitry.

Publications

Conference Papers

- S. Rini and A. Goldsmith, “On the Interference Channel with Common Messages and the role of Rate-Sharing” in *Proc. 2013 Information Theory Workshop, Seville, Spain*, September, 2013.
- S. Rini and A. Goldsmith, “On The Capacity of the MIMO Cognitive Interference Channel” in *Proc. 2013 International Symposium of Information Theory, Istanbul, Turkey*, August, 2013.
- E. E. Kurniawan, S. Rini and A. Goldsmith, “Transmit Power Minimization for the Z Interference Channel” in *Proc. 2013 Global Communication Conference, Budapest, Hungary*, June, 2013.
- M. Drews, S. Rini, M. Nicoletti and W. Hemmert, “A Neurogram Matching Similarity Index (NMSI) for the Assessment of Audio Quality” in *Proc. 2013 Perceptual Quality of Systems, Vienna, Austria*, February, 2013.
- M. Drews, M. Nicoletti, W. Hemmert and S. Rini, “The Neurogram Matching Similarity Index (NMSI) for the Assessment of Similarities among Neurograms” in *Proc. 2013 International Conference on Acoustics, Speech, and Signal Processing, Vancouver, Canada*, February, 2013.
- S. Rini and A. Goldsmith, “A General Approach to Random Coding for Multi-Terminal Networks” in *Proc. 2013 IEEE Information Theory and its Application, San Diego, USA.*, February, 2013.
- S. Rini, E. Kurniawan, L. Ghaghanidze and A. Goldsmith, “Rate Optimization for Relay-Assisted Downlink Cellular Systems Using Superposition Coding” in *Proc. 2013 IEEE International Communication Conference, Budapest, Hungary.*, June, 2013.
- E. Kurniawan, S. Rini and A. Goldsmith “Energy Efficient Cooperation for Two-Hop Relay Networks” in *Proc. 2012 APSIPA Annual Summit and Conference*, December, 2012. **Best Paper Award.**
- S. Rini, E. Kurniawan and A. Goldsmith, “Primary Rate-Splitting Achieves Capacity for the Gaussian Cognitive Interference Channel” in *Proc. 2012 IEEE Information Theory Workshop, Lausanne, Switzerland.*, September, 2012.
- S. Rini, “An Extension to the Chain Graph Representation of an Achievable Scheme” in *Proc. 2012 IEEE Information Theory Workshop, Lausanne, Switzerland*, September, 2012.
- A. Grigorescu, M. Rudnicki, M. Isik, W. Hemmert and S. Rini, “Improving the Entropy Estimate of Neuronal Firings of Modeled Cochlear Nucleus Neurons” in *Proc. 2012 13th Annual Conference of the International Speech Communication Association, Portland, USA*, September, 2012.
- S. Rini, C. Huppert, “The Capacity of the Semi-Deterministic Cognitive Interference Channel with a Common Cognitive Message and Approximate Capacity for the Gaussian Case” in *Proc. 2012 International Symposium of Information Theory, Boston, USA*, July, 2011.
- S. Rini, D. Tuninetti, N. Devroye, A. Goldsmith, “The Capacity of the Interference Channel with a Cognitive Relay in Very Strong Interference” in *Proc. 2011 International Symposium of Information Theory, Saint Petersburg, Russia*, July, 2011.
- S. Rini, D. Tuninetti, and N. Devroye, “A New Capacity Result for the Z-Gaussian Cognitive Interference Channel” in *Proc. 2011 International Symposium of Information Theory, Saint Petersburg, Russia*, July, 2011.

- S. Rini, D. Tuninetti, and N. Devroye, “Capacity to within 3 Bits for a Class of Gaussian Interference Channels with a Cognitive Relay” in *Proc. 2011 International Symposium of Information Theory, Saint Petersburg, Russia*, July, 2011.
- S. Rini, D. Tuninetti, and N. Devroye, “Inner and Outer Bounds for the Gaussian Cognitive Interference Channel and new Capacity Results” in *Proc. 2011 International Communication Conference, Kyoto, Japan*, June, 2011.
- S. Rini, D. Tuninetti, and N. Devroye, “New Results on the Capacity of the Gaussian Cognitive Interference Channel” in *Proc. 2010 Allerton Conference on Communication and Control, Monticello, IL, USA*, September, 2010.
- S. Rini, D. Tuninetti, and N. Devroye, “Outer Bounds for the Interference Channel with a Cognitive Relay” in *Proc. 2010 Information Theory Workshop, Dublin, Ireland*, September, 2010.
- S. Rini, D. Tuninetti, and N. Devroye, “State of the Cognitive Interference Channel: a new Unified Inner Bound, and Capacity to within 1.87 Bits,” in *Proc. 2010 International Zurich Seminar on Communications*, March, 2010.
- S. Rini, D. Tuninetti, and N. Devroye, “The Capacity Region of Gaussian Cognitive Radio Channels to within 1.87 Bits,” in *Proc. IEEE Information Theory Workshop, Cairo, Egypt*, January, 2010.
- S. Rini, D. Tuninetti, and N. Devroye, “The Capacity Region of the Gaussian Cognitive Radio Channels at High SNR,” in *Proc. IEEE Information Theory Workshop, Taormina, Italy*, October, 2009.

Journal Papers

- S. Rini, A. Goldsmith “On the Capacity of the MIMO Cognitive Interference Channel” submitted to *IEEE Journal in Selected Areas in Communication*.
- S. Rini and A. Goldsmith “An Achievable Region for a General Multi-terminal Network and the corresponding Chain Graph Representation” submitted to *IEEE Trans. Info. Theory*.
- A. Dytso, S. Rini, N. Devroye and D. Tuninetti “On the Capacity Region of the Gaussian Interference Channel with a Cognitive Relay” submitted to *IEEE Journal in Selected Areas in Communication*.
- S. Rini, E. Kurniawan, L. Ghaghanidze, A. Goldsmith “Energy Efficient Cooperative Strategies for Relay-Assisted Downlink Cellular Systems” to appear in *IEEE Journal in Selected Areas in Communication*. Available online at <http://arxiv.org/abs/1303.7034>
- S. Rini, C. Huppert “On the Capacity of the Cognitive Interference Channel with a Common Cognitive Message” *Trans. on Emerging Telecommunications Technologies*. Available online at <http://arxiv.org/abs/1208.3984>
- S. Rini, D. Tuninetti, N. Devroye, A. Goldsmith, “On the Capacity Region of the Interference Channel with a Cognitive Relay” to appear in *IEEE Trans. Info. Theory*. Available online <http://arxiv.org/abs/1107.4600>

- S. Rini, D. Tuninetti, and N. Devroye, “Inner and Outer Bounds for the Gaussian Cognitive Interference Channel and New Capacity Results” in *IEEE Trans. Info. Theory*. Volume: 58, Issue:7, Issue Date: Feb. 2012 On page(s): 820 - 848, Available online at <http://arxiv.org/abs/1010.5806>

- S. Rini, D. Tuninetti, and N. Devroye, “New Inner and Outer Bounds for the Discrete Memoryless Cognitive Interference Channel and some Capacity Results” in *IEEE Trans. Info. Theory*. Volume: 57, Issue:7, Issue Date: July 2011 On page(s): 4087 - 4109 Available online at <http://arxiv.org/abs/1003.4328>

Patents

- E. Kurniawan, A. Goldsmith and S. Rini “Practical Coding Schemes for Cognitive Overlay Radios”

This patent covers code design aspect for networks of cooperating transmitters. We propose encoding and decoding algorithms that are shown perform close to the theoretical optimum.

- S. Rini, M. Drews, W. Hemmert “Test method for cochlear implant stimulation strategies”

This patent develops evaluation tools for electrical stimulations in cochlear implants. We propose a new similarity index among neurograms which is an important tool in evaluating the quality of the stimulation strategies in cochlear implants.

Reviewer

- IEEE Communications Letters, **2012 IEEE COMML Reviewer Appreciation Program**

- IEEE Transaction of Information Theory

- IEEE Transactions on Communications

- IEEE Transactions on Wireless Communication

- IEEE Transactions on Vehicular Technology

- IEEE Journal on Selected Areas in Communications

- EURASIP Journal on Wireless Communications and Networking

- IEEE International Symposium on Information Theory

- IEEE Information Theory Workshop

- IEEE International Symposium on Information Theory and its Applications

- IEEE Wireless Communications and Networking Conference

- International Zurich Seminar on Communications

- International Symposium on Wireless Communication Systems

- International Journal of Advances in Engineering Sciences and Applied Mathematics

Honors and Awards

- Rotary Club Milano Sempione Fellowship, 2005–2008

- National finals of “Olimpiadi Italiane di Fisica” (Italian Physics Olympics), 2000

- Regional finals of "Olimpiadi Italiane di Fisica" (Italian Physics Olympics), 1999

Languages

- Italian, first language
- English, fluent
- Spanish, fluent
- German, intermediate

Interests

- Karate, 8th kyū Shotokan Karate (brown belt)
- Digital Photography, some pictures at <http://www.flickr.com/photos/rinistefano/>

References

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