Milind Rao

CONTACT INFORMATION

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EDUCATION

Stanford University **Sep 2013 - Jun 2019***
PhD Candidate in Electrical Engineering GPA: **4.17/4.3**
Thesis: *Coding for Computation: Learning with Partial Information*
Advisor : Andrea Goldsmith
Committee: Tsachy Weissman, John Duchi
MS in Electrical Engineering **June 2015**

Indian Institute of Technology, Madras **August 2009 - May 2013**
B. Tech in Electrical Engineering GPA: **9.68/10**
Thesis : *Machine Learning Techniques in Non-Linear Receivers for Intercell Interference Mitigation*
Advisor: K. Giridhar
Minor: Systems Engineering

RESEARCH INTERESTS

Signal Processing, Machine Learning, High-Dimensional Statistics, Distributed Optimization, Stochastic Control, Wireless Communications, Information Theory

PUBLICATIONS

1. **M. Rao**, S. Rini, & A. Goldsmith, "Distributed Convex Optimization with Limited Communication", *ICASSP 2019*.
2. **M. Rao**, N. Farsad, & A. Goldsmith, "Variable Length Joint Source-Channel Coding of Text Using Deep Neural Networks", *SPAWC 2018*.
3. N. Farsad, **M. Rao**, & A. Goldsmith, "Deep Learning for Joint Source-Channel Coding of Text", *ICASSP 2018*.
4. M. Chowdhury, **M. Rao**, & A. Goldsmith, "Direction Finding with Non-coherent Measurements from Large Antenna Arrays", *Asilomar 2017*.
5. **M. Rao**, T. Javidi, Y.C. Eldar & A. Goldsmith, "Fundamental Estimation Limits of Autoregressive Processes with Compressive Measurements", *ISIT 2017*.
6. **M. Rao**, T. Javidi, Y.C. Eldar & A. Goldsmith, "Estimation in Autoregressive Processes with Partial Information", *ICASSP 2017*.
7. **M. Rao**, A. Kipnis, T. Javidi, Y.C. Eldar & A. Goldsmith, "System Identification with Partial Samples: Non-asymptotic Analysis", *CDC 2016*.
8. N. Farsad, Y. Murin, **M. Rao** & A. Goldsmith, "On the Capacity of Diffusion-Based Molecular Timing Channels With Diversity", *Asilomar*, 2016.
9. M. Chowdhury, **M. Rao**, Y. Zhao, T. Javidi & A. Goldsmith, "Reducing Risk in Wind Power Delivery With Storage", *IEEE Transactions on Sustainable Energy*, 2015.
10. G. Malysa, M. Hernaez, I. Ochoa, **M. Rao**, K. Ganesan & T. Weissman, "QVZ: lossy compression of quality values", *BMC Bioinformatics*, 2015.
11. **M. Rao**, M. Chowdhury, Y. Zhao, T. Javidi & A. Goldsmith, "Value of Storage for Wind Power Producers in Forward Power Markets", *ACC 2015*.
12. **M. Rao**, F.J. Lopez-Martinez, M.S. Alouini & A. Goldsmith, "MGF Approach to the Analysis of Generalized Two-Ray Fading Models", *IEEE Transactions on Wireless Communications*, 2015.
13. **M. Rao**, F.J. Lopez-Martinez, M.S. Alouini & A. Goldsmith "MGF Approach to the Capacity Analysis of Generalized Two-Ray Fading Models", *ICC 2015*.
14. **M. Rao**, F.J. Lopez-Martinez & A. Goldsmith, "Statistics and System Performance Metrics for the Two Wave with Diffuse Power Fading Model", *CISS 2014*.

RESEARCH PROJECTS

Distributed Convex Optimization with Communication Constraints **Jan 2018 -**
Work with: Prof. Stefano Rini (NCTU, Taiwan) and Prof. Andrea Goldsmith
Communication is a bottleneck for decentralized learning platforms used to scale up computations. Proposed a randomized projection scheme to reduce the communication requirements of distributed sub-gradient optimization methods.

Neural Networks for Joint Source-Channel Coding **May 2017 -**

Work with: Dr. Nariman Farsad and Prof. Andrea Goldsmith

Developed NLP inspired neural networks to perform data-aware joint compression and error control coding for transmitting structured information such as text or audio across a noisy channel. Outperforms conventional separate source-channel coding schemes by 50%, captures semantic information, performs abstractive summarization in the rate limited regime.

Identifying High-Dimensional Time Series **Jun 2015 -**

Work with : Professors Yonina Eldar (Technion, Israel), Tara Javidi (UCSD) and Andrea Goldsmith

We propose order optimal algorithms for identifying high-dimensional covariance matrices and vector autoregressive process parameters from noisy missing data. We demonstrate how priors on the structure of the time series can be incorporated to reduce error and apply these results to estimate and control linear dynamical systems.

Wind Producers in the Futures Market **Jun 2014 - Jun 2015**

Work with : Professors Yue Zhao (SUNY), Tara Javidi (UCSD) and Andrea Goldsmith

We analyse the benefits of energy storage for a wind farm participating in a dual settlement market with uncertain wind and price forecasts.

Statistical Characterization of TWDP model **Sep 2013 - Jun 2014**

Work with : Prof. Andrea Goldsmith and Dr. Javier Lopez-Martinez

We proposed an alternative formulation of the Two Wave With Diffuse Power wireless fading model in terms of the Rice model, derived a closed form expression for its MGF and did performance analysis.

Work Experience

Yahoo Research **July-Sep 2017**

Worked with the Big ML team in query-ad matching by developing scalable neural networks to embed queries from search session data.

Blue Danube Systems **June - Aug 2015**

Developed non-coherent direction finding techniques for the large antenna arrays developed at Blue Danube Systems. These would be applied for geographically map hotspots of users for optimal wireless resource allocation.

Teaching Assistant **Aug - Dec 2014, 2015, 2016, 2017**

TA for the *EE359 - Wireless Communications* course taught by Prof. Goldsmith

TU-Berlin and Deutsche Telekom **May - July 2012**

Worked with *Prof. Pan Hui* on analysing the efficacy of delay tolerant device-to-device communication protocols.

Caravel Info Systems, Bangalore **May - July 2011**

Worked on system architecture and firmware development of a prototype for a sub-system in telemetry, the PCM De-Commutation system.

Scholastic Achievements

- Awarded an NSF Center for Science of Information Student Research Grant, 2016.
- Recipient of the Texas Instruments Stanford Graduate Fellowship, 2015-2018.
- Recipient of the Stanford Engineering Maitra-Luther Fellowship, 2013-2014.
- Placed 3rd in the Stanford Electrical Engineering PhD Qualifying Examinations, 2014.
- Awarded the Siemens Award for highest academic achievement in Electrical Engineering at IIT Madras, 2013.
- Awarded the University of Tokyo-IIT Scholarship for academic excellence in 2013.
- Awarded the DAAD scholarship for pursuing a summer research opportunity with Prof. Pan Hui at the Deutsche Telekom-TU Berlin Intelligent Networks group, 2012.
- Recipient of the IIT Madras Merit Award for placing 32nd nationwide in the Joint Entrance Examination for entry into the IITs, 2009.
- Awarded the CBSE Merit Scholarship for securing rank 10 in the All India Engineering Entrance Examination among a million applicants, 2009.
- Recipient of the *KVPY* (Young Scientist) fellowship by the Department of Science & Technology, Govt. of India, 2008-2009.

Courses

Optimization, Learning and Control: CS224D - Deep Learning for NLP, CS229T - Statistical Learning Theory, EE377 - Information Theory and Statistics, EE378A/B - Inference, Estimation and Information Processing, MS&E338 - Reinforcement Learning, MS&E351 - Dynamic Programming & Stochastic Control, EE364A/B - Convex Optimization, CS228 - Probabilistic Graphical Models, Introduction to Machine Learning, STATS315B - Data Mining, CME323 - Distributed Algorithms and Optimization,

Wireless Communication and Networks: EE359/360 - Multiuser Wireless Communication, MS&E 335 - Scheduling and Queues in Networks, EE376A/C - Universal Schemes in Information Theory, Digital Communication, Error Control Coding, Communication Networks.

Relevant Courses: STATS219/310A - Theory of Probability, CS265 - Analysis of Randomized Algorithms, Numerical Methods in Electrical Engineering, Complex Variables and Transform Techniques, Process Optimization, Robust Optimal Control, Modern Control Theory. EE292T - Smart Grid Seminar,

Skills

Python (libraries such as Tensorflow, Pyspark, Scikit-Learn, CVXPY), MATLAB, LaTeX.

Talks Presentation

National Chiao Tung University, Taiwan (**Invited**) Jan 2019
Information Theory Applications, San Diego (**Invited**) Feb 2019
Society of Biological Psychiatry, New York - Poster on determining genetic profile scores for cannabis use disorder. May 2019
International Conference on Acoustics, Speech and Signal Processing 2017 (poster), 2018
International Symposium on Information Theory, Aachen June 2017
Conference on Decision and Control, Las Vegas Dec 2016
International Communications Conference, London Jun 2015
Conference on Information Sciences and Systems, Princeton Mar 2014
Summer School on Information Theory (Poster) 2014, 2016, 2017
Multidisciplinary Data Science Workshop and Online Talk, Purdue 2016, 2017

Professional Services

Reviewer for IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, ICC, ISIT, IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, IEEE Communication Letters, Elsevier International Journal of Electronics and Communications, Springer Journal of Nonlinear Dynamics.

Mentoring

- Mentored two undergraduate students through the Research Experience for Undergraduates (REU) programme in Stanford EE in neural network based coding schemes. July 2018-
- Community Associate with the Stanford Graduate Life Office. Sep 2018 - Aug 2019
- Member of the Hostel Council and Student Counsellor in the Guidance and Counselling Unit at IIT-M, 2011 - 2012