IEEE Trans. on Information Theory Nov. 2013

23 Nov. 2013

Chandra R. Murthy

Signal processing for communication lab

Information-Theoretically Optimal Compressed Sensing via Spatial Coupling and Approximate Message Passing

D. L. Donoho, A. Javanmard, A. Montanari
Stanford University

- Consider reconstruction of a sparse vector from noisy linear measurements from a spatially coupled matrix (roughly, matrices with a banded diagonal structure)
- Construction of spatially coupled matrices + AMP based reconstruction algorithm
- Rigorous proof that with asymptotic sampling rate $\delta = \lim_{n\to\infty} m(n)/n$ the AMP algorithm successfully recovers *x*, provided $\delta > \bar{d}(p_X)$. where $\bar{d}(p_X)$. is the upper Renyi information dimension of *x*
- The proposed approach is robust to noise
- Extends to non-random signals, i.e., the entries of x need not have i.i.d. components.

A Unifying Variational Perspective on Some Fundamental Info. Theoretic Inequalities

S. Park, E. Serpedin,K. Quarage
Texas A&M University

- Derive fundamental info theoretic inequalities using a functional analysis framework
  - Main tool: calculus of variations
  - Advantage: global optimal solution obtained from FONC
- Main results:
  - Derive entropy max. and Fisher info min. theorems under different conditions
  - Worst case additive noise lemma proved using functional analysis
  - Entropy power ineq and extremal entropy inequality derived using calculus of variations
- Applications shown: Gaussian wiretap channel

Performance of a Distributed Stochastic Approximation Algorithm

P. Bianchi, G. Fort, W. Hachem
Telecom ParisTech

- A network with N nodes
- Node i generates $(\theta_{n,i})_{n\geq 1}$ as a 2-step process
  - [Local step]: $\tilde{\theta}_{n,i} = \theta_{n-1,i} + \gamma_n Y_{n,i}$
  - [Gossip step]: $\theta_{n,i} = \sum_{j=1}^{N} w_n(i,j)\,\tilde{\theta}_{n,j}$
  - Weights are a random row-stochastic matrix
- Contributions:
  - Assuming the algo is stable, prove its convergence to a consensus
  - Convergence also established as the frequency of the gossip step -> 0 at some controlled rate (W_n -> I as n -> ∞)
  - Derive a verifiable sufficient condition for stability of the algo
  - Establish a CLT on the estimates when W_n is doubly stochastic
    - Show that node estimate fluctuate synchronously for large n

Spatial Throughput of Mobile Ad Hoc Networks Powered by Energy Harvesting

Kaibin Huang
Hong Kong Polytechnic University

- Derive spatial thruput of a mobile ad-hoc EH network using tools from stochastic geometry
- Transmitters deployed according to a PPP
- Harvest energy at a given average rate, and transmit whenever they have sufficient energy to tx a packet
- Goal: choose the tx power to max network thruput
- Ans: max network thruput is proportional to the transmission probability, which equals the ratio of the energy arrival rate to the tx power
- Well-written paper!

Sookha

- Memoryless Multiple Access Channel with Asymmetric Noisy State Information at the Encoders
- Capacity of All Nine Models of Channel Output Feedback for the Two-User Interference Channel
- Bandits With Heavy Tail