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Signal processing for communication lab



Hidden Cliques and the Certification of the Restricted Isometry Property

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- RIP of order k : for every k -sparse vector x , it is true that

$$(1 - \delta)\|x\|^2 \leq \|\Phi x\|^2 \leq (1 + \delta)\|x\|^2$$

- Random constructions: k linear in m , where ψ is $m \times N$
- Deterministic constructions: k of order \sqrt{m} . Large gap!
- Question: computational complexity of checking RIP
- Positive results:
 - Suggest an algorithm that is better than brute force search
 - Algo “slightly” breaks the \sqrt{m} barrier
- Negative result:
 - Certification of RIP is an NP hard problem
 - Relate it to the problem of finding (large) cliques in graphs
- Good example of a well-written introduction!



Recursive Robust PCA or Recursive Sparse Recovery in Large but Structured Noise

C. Qiu, N. Vaswani, B. Lois, and L. Hogben
Iowa State Univ.

- Robust PCA problem: PCA in the presence of outliers
 - Alternatively, sparse signal recovery in large but structured noise
- Noise: dense in a (slowly-changing) low-dim. Subspace
- Propose and analyze recursive projected CS (ReProCS) algo
- Assume a subspace change model, and s.t. ReProCS can exactly recover the support set at all times
- Long paper, combines many results from
 - Linear algebra (a “ $\sin \theta$ ” theorem, Weyl’s, Ostrowski’s theorems)
 - Random matrix theory (tail bounds)
 - And extends these results too



Sufficient Conditions on the Optimality of Myopic Sensing in Opportunistic Channel Access: A Unifying Framework

Y. Liu, M. Liu, and S. H. A. Ahmad, Univ. of Michigan

■ System model

- Single-user pair with access to N channels
 - Markov ON-OFF channels
- Each slot, can sense $k \leq N$ channels; perfect sensing
- Out of those sensed to be available, can use $m \leq k \leq N$ channels
- Unit reward for each channel used; i.e., no fading, interference

■ Goal: maximize long-term discounted or average reward

■ Myopic policy: maximizes the one-step reward

■ Results:

- Sufficient conditions for optimality of the myopic policy
- Show cases where the myopic policy is suboptimal, for $m < k$



Sookha

- R. A. Chou and M. R. Bloch, Separation of reliability and secrecy in rate-limited secret-key generation
- M. Gavish and D. L. Dhonho, The optimal hard threshold for singular values is $4/\sqrt{3}$
- S. Kar and J. F. Moura, Asymptotically efficient distributed estimation with exponential family statistics