TSP Sep. 1, 2015

JW by Chandra Murthy

Iterative Reweighted l2/l1 Recovery Algorithms for Compressed Sensing of Block Sparse Signals

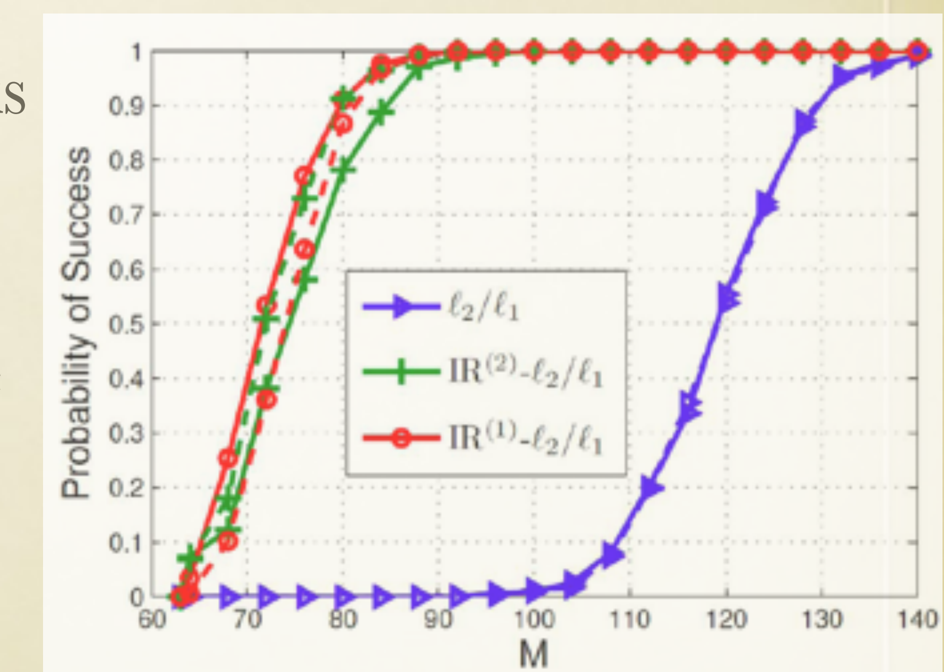
- Zeinalkhani, Z. ; Banihashemi, A.H., Carleton Univ., Canada
- The problem:
    - Block boundaries assumed known

$$\bar{\mathbf{x}} = [\bar{\mathbf{u}}_1^T, \bar{\mathbf{u}}_2^T, \ldots, \bar{\mathbf{u}}_L^T]^T = \arg\min_{\mathbf{u}_1,\ldots,\mathbf{u}_L} |\{i : \|\mathbf{u}_i\|_2 \neq 0, i = 1, \ldots, L\}| \quad \text{s.t.} \| \mathbf{y} - \mathbf{A}\mathbf{x}\|_2 \leq \alpha.$$

- Weighted l2/l1 minimization:

$$\hat{\mathbf{x}} = [\hat{\mathbf{u}}_1^T, \hat{\mathbf{u}}_2^T, \ldots, \hat{\mathbf{u}}_L^T]^T = \arg\min_{\mathbf{u}_1,\ldots,\mathbf{u}_L} \sum_{i=1}^{L} \omega_i \|\mathbf{u}_i\|_2 \quad \text{s.t.} \ \|\mathbf{y} - \mathbf{A}\mathbf{x}\|_2 \leq \alpha,$$

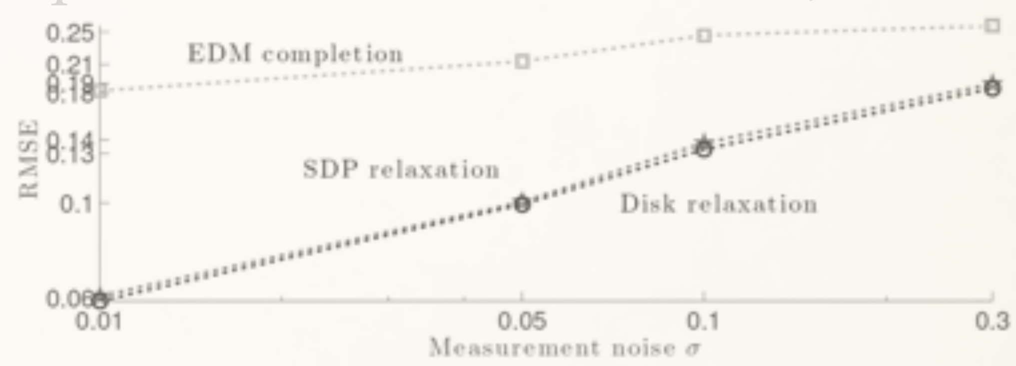
- Two choices for the weighting:
    - Inversely proportional to l2 norms of the blocks
    - Truncate l2 norms of the blocks to a threshold
- Show that, as block length increases, performance approaches the Wu-Verdu theoretical limit

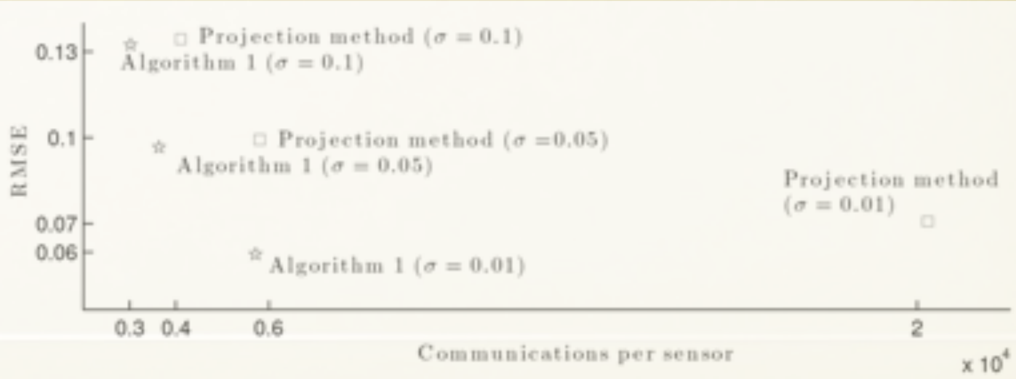


Simple and Fast Convex Relaxation Method for Cooperative Localization in Sensor Networks Using Range Measurements

- Soares, C. ; Xavier, J. ; Gomes, J., Univ. of Lisbon, Portugal

- The problem: minimize $f(x) = \sum_{i \sim j} \frac{1}{2}(\|x_i - x_j\| - d_{ij})^2 + \sum_i \sum_{k \in \mathcal{A}_i} \frac{1}{2}(\|x_i - a_k\| - r_{ik})^2$
- Contributions:
    - Convex lower bound for the cost function
    - Synchronous & distributed algorithm that optimizes the lower bound; proof of convergence
    - Asynchronous variant, a.s. convergence
    - Analysis of iteration complexity
    - Performance via simulations



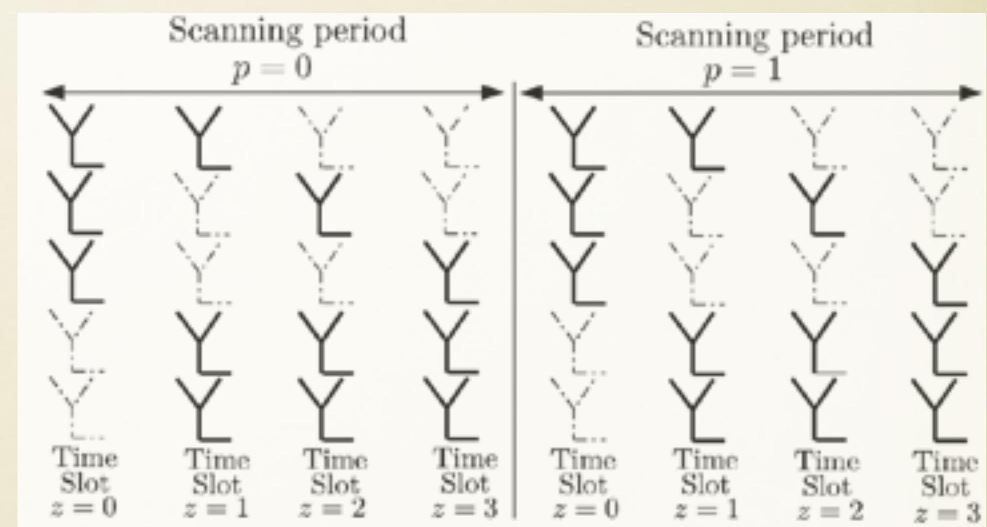


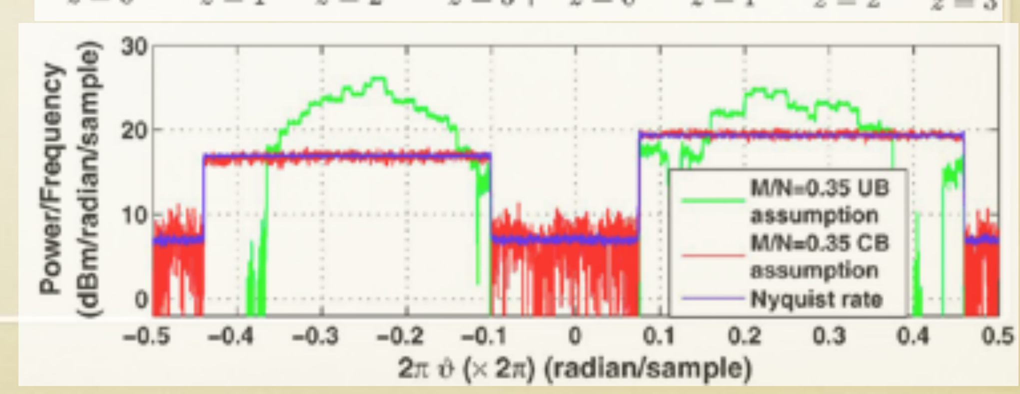
TSP Aug. 15, 2015

Some More Papers

Compressive Periodogram Reconstruction Using Uniform Binning

- Ariananda, D.D. ; Romero, D. ; Leus, G.
- Problem: reconstruction of periodogram using uniform bins
    - Does not assume periodogram is sparse, but that there are a small number of “sources” that result in the periodogram
    - Goal: Reconstruction from as few samples as possible
- Compressive sampling of the periodogram
- Reconstruction of the correlation matrix (from which the periodogram can be found)
- Bias and variance analysis
- Demonstrate efficacy through simulations





Fusing Censored Dependent Data for Distributed Detection

- H. He; P. Varshney, Syracuse Univ.
- GLRT framework for fusion of censored, dependent data based on "coupola theory"
  - Coupolas: parametric coupling of marginals to form joint distbns
  - Data dependency structure assumed unknown
  - Data quantized before sending to FC

Copulas		Parametric Form	Parameter Range
Elliptical copulas	Gaussian	$\Phi_\Sigma(\Phi^{-1}(v_1), \ldots, \Phi^{-1}(v_N))$, $\Phi_\Sigma(\mathbf{x}) = \int_0^{\mathbf{x}} \mathcal{N}(\mathbf{x}; \mathbf{0}, \Sigma) d\mathbf{x}$, $\mathbf{x} \in \mathbb{R}^N$; $\Phi^{-1}(v) = \inf_{x \in \mathbb{R}} \{u \le \int_0^x \mathcal{N}(x; 0, 1) dx\}$	$\Sigma = [\rho_{mn}], m, n = 1, \ldots, N$; $\rho_{mn} \in [-1, 1]$
	Student-t	$t_{\nu,\Sigma}(t_\nu^{-1}(v_1), \ldots, t_\nu^{-1}(v_N))$, $t_{\nu,\Sigma}$: multivariate Student-t CDF; t_ν^{-1} : inverse CDF of univariate Student-t	ν : degrees of freedom, $\nu \ge 3$
Archimedean copulas	Clayton	$\left(\sum_{n=1}^N v_n^{-\phi} - 1\right)^{-\frac{1}{\phi}}$	$\phi \in [-1, \infty) \backslash \{0\}$
	Frank	$-\frac{1}{\phi} \log\left(1 + \frac{\prod_{n=1}^N [\exp\{-\phi v_n\} - 1]}{\exp(-\phi) - 1}\right)$	$\phi \in \mathbb{R} \backslash \{0\}$
	Gumbel	$\exp\left\{-\left(\sum_{n=1}^N (-\ln v_n)^\phi\right)^{\frac{1}{\phi}}\right\}$	$\phi \in [1, \infty)$
	Independent	$\prod_{n=1}^N v_n$	–

- Optimal GLRT hard to implement; propose to use "controlled" noise
  - Sub-optimal but computationally efficient detector

Sensor Network Tomography: The Revenge of the Detected

- Marano, S. ; Matta, V. ; Willett, P.
- S sensors deployed at unknown locations
- At time t, Nt sensors detect a target; Nt is revealed to the target. Total number of sensors is also known
- By collecting {Nt, t = 1, 2, …}, can the target localize the sensors?
- Consider MSE in localization as performance metric
- Optimal ML detector: combinatorial complexity. Viable alternatives proposed, and their performance studied via sims
    - A trellis based estimator is found to offer the best performance

Poisson Group Testing: A Probabilistic Model for Boolean Compressed Sensing

- Emad, A. ; Milenkovic, O.