Journal Watch
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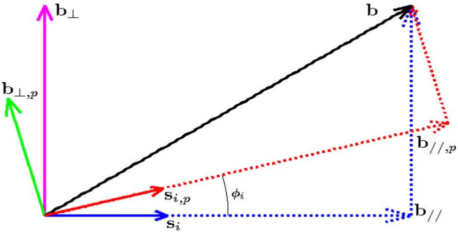
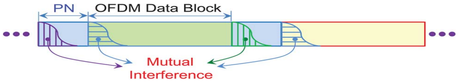
- Modified OMP that takes care of mismatch between the assumed and the actual bases
- In general, mismatch problem cannot be solved using denser basis
- Reconstruction problem :
  $\min_{\boldsymbol{x}} ||\boldsymbol{x}||_0$ subject to $\min_{\delta \boldsymbol{A} \in \boldsymbol{\Delta}} ||\boldsymbol{b} - (\boldsymbol{A} + \delta \boldsymbol{A})\boldsymbol{x}||_2 < \epsilon$
- OMP with perturbation procedure
  - Search over the dictionary to find the vector providing the largest absolute inner product with the residual
  - Perturb each vector in the current support
  - Project measurement vector onto the perturbed support to find the new residual

- Perturbation angle in kth iteration $\boldsymbol{\phi}^k = \min\{\phi_{\max}, \boldsymbol{\phi}', \phi_k *\}$
  - to avoid overlaps between perturbed columns $\phi_{\max} < \cos^{-1}(\mu(\boldsymbol{A}))/2$
  - user defined limit $\boldsymbol{\phi}'$
  - optimal angle calculated in the k th iteration $\phi_k^* = \tan^{-1}\left\{\frac{||\boldsymbol{b}_{\perp,k}||_2 - \epsilon}{||\boldsymbol{x}_k||_1}\right\}$
- Computational complexity is comparable to that of standard OMP



- TDS-OFDM with a known PN sequence instead of cyclic prefix or zero padding
  - A guard interval to alleviate inter block interference
  - Training sequence for synchronization and channel estimation



- Perfect channel information is required to
  - Subtract the contribution of the PN sequence
  - To demodulate OFDM data block using low-complexity channel equalization
- IBI-free region in the last portion of the received TS used to estimate channel
  - The guard interval length is greater than the largest expected channel delay spread, L

- In IBI-free region

$$\boldsymbol{y} = \boldsymbol{\phi} \boldsymbol{h} + \boldsymbol{n}$$

$\boldsymbol{\phi} \in \mathbb{R}^{G \times L}$ is a Toeplitz matrix of PN sequence, G is the length of IBI-free region

- Channel impulse response (CIR) for consecutive TDS-OFDM symbols share the same sparsity pattern
  - The path delays vary much slower than the path gains
- CIRs are reconstruction using Adaptive Simultaneous OMP (A-SOMP)
  - SOMP :$\max_k ||\boldsymbol{\phi}_k^{\mathrm{H}} \boldsymbol{R}||_1$ instead of $\max_k |\boldsymbol{\phi}_k^{\mathrm{H}} \boldsymbol{r}|$
  - Adaptive to the channel sparsity level, the number of observation vectors, and as the size of the IBI-free region
- CRLB of simultaneous multi-channel reconstruction is also derived

- The signal sparsity and recovery performance can be improved by replacing l_1 norm the with a "weighted" l_1 norm in LASSO
- LASSO problem:
  $\min_{\boldsymbol{x}} ||\boldsymbol{x}||_1$ subject to $||\boldsymbol{A}\boldsymbol{x} - \boldsymbol{y}||_2 < \epsilon$
  - Equivalent to $\min_{\boldsymbol{x}} \lambda ||\boldsymbol{x}||_1 + ||\boldsymbol{A}\boldsymbol{x} - \boldsymbol{y}||_2^2$
- The LASSO homotopy algorithm solves for one desired value of Lagrange multiplier λ
  - Traces the entire solution path for a range of decreasing values of λ
  - The solution follows a piecewise-linear path, the support of the solution changes only at certain critical values of λ
  - Every homotopy step, finds a critical value of λ and updates the support of the solution

- Weighted l_1-norm minimization problem : $\min_{\boldsymbol{x}} \sum_{i=1}^{N} \boldsymbol{w}_i |\boldsymbol{x}_i| + ||\boldsymbol{A}\boldsymbol{x} - \boldsymbol{y}||_2^2$
- Iterative re-weighting via homotopy
  - Solves weighted LASSO for a given set of $\{\boldsymbol{w}_i\}_{i=1}^{N}$ and quickly update the solution after every re-weighting iteration
- Adaptive re-weighting via homotopy
  - perform re-weighting at every homotopy step by updating $\{\boldsymbol{w}_i\}_{i=1}^{N}$ the as the signal estimate evolves
- The adaptive selection of the weights inside the homotopy often yields reconstructions of higher quality

- WSS intend to estimate or to decide over the occupancy parameters of a wide frequency band
- Exploit spectral prior information available to reduce the sampling rate
- Assume that the PSD of the individual transmissions is known up to a scaling factor
- The sensor receives a signal

$$x(t) = \sum_{i=1}^{I} \theta_i^{1/2} x_i(t)$$

  - $x_i(t)$ is the waveform transmitted by the i-th user operating in the to model noise band
  - θ_i represent the power of each component
  - One or more signals to model noise and interference

Wideband Spectrum Sensing From Compressed Measurements Using Spectral Prior Information

- Analog-to-information converter gives a vector $\boldsymbol{y} = \boldsymbol{\phi}\boldsymbol{x}$
- Assume that the signals are Gaussian distributed
- Estimation and detection
    - Solve $\boldsymbol{\theta}_{\mathrm{ML}} = \underset{\boldsymbol{\theta}}{\operatorname{argmax}} p(\boldsymbol{y}; \boldsymbol{\theta})$
    - Perform a binary hypothesis test for each signal
- Exploiting the fact that the basis matrices are Toeplitz, we use the asymptotic theory of circulant matrices to propose a dimensionality reduction technique
- Well-known structured covariance estimation algorithms to solve
- Gaussian assumption is released and a couple of algorithms are proposed for non-Gaussian signals

Other Papers

- **Beamforming Design for Multiuser Two-Way Relaying: A Unified Approach via Max-Min SINR**
  - Z. Fang, X. Wang, and X. Yuan
- **A Max-Product EM Algorithm for Reconstructing Markov-Tree Sparse Signals From Compressive Samples**
  - Z. Song and A. Dogandžić
- **Joint Sensor Selection and Multihop Routing for Distributed Estimation in Ad-hoc Wireless Sensor Networks**
  - S. Shah and B. Beferull-Lozano
- **Sequential Bayesian Sparse Signal Reconstruction Using Array Data**
  - C. F. Mecklenbräuker, P. Gerstoft, A. Panahi, and M. Viberg
- **SATS: Secure Average-Consensus-Based Time Synchronization in Wireless Sensor Networks**
  - J. He, P. Cheng, L. Shi, and J. Chen