Journal Watch
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Binary Matrices for Compressed Sensing

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Binary Matrices for Compressed Sensing

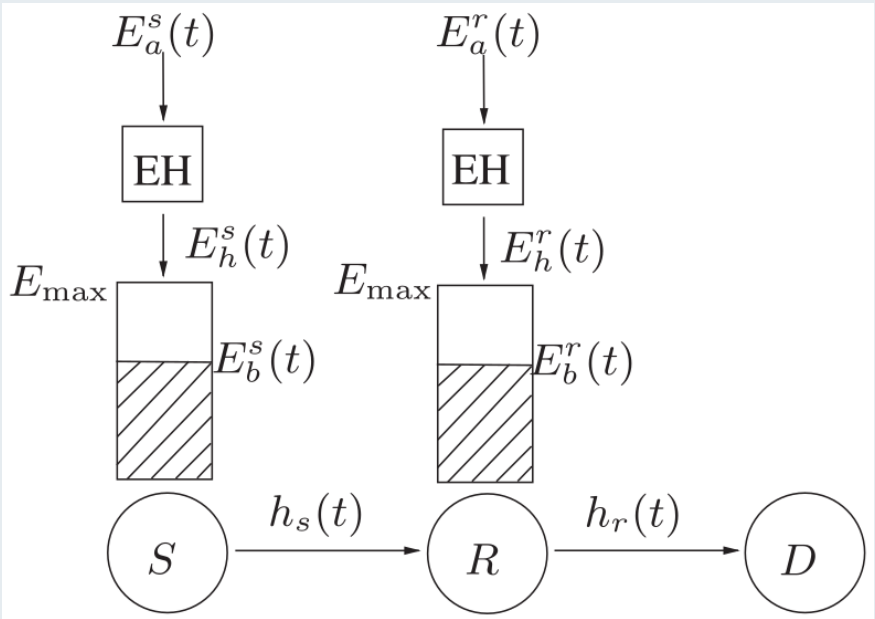
- **Goal:** Construction of optimum binary measurement matrix $\boldsymbol{A} \in \Re^{m \times N}$
  - Beneficial to storage and computation
- **Assumption:**
  - Exactly d nonzero elements per column (column degree)
  - High compression ratio: n/m
- **Contributions:**
  1. New performance parameter:
     - Min. μ_α avg. of nonzero values of $\frac{\langle \boldsymbol{A}_i, \boldsymbol{A}_j \rangle}{\|\boldsymbol{A}_i\| \|\boldsymbol{A}_j\|}$, for $i \neq j$
     - Weaker condition on sparsity: $k < \left(\frac{1}{2}\mu^{-1} + 1\right) < \left(\frac{1}{2}{\mu_\alpha}^{-1} + 1\right)$
     - Optimum value of $d = \lceil \sqrt{m} \rceil$

     (μ: mutual coherence; μ_α: new metric)
  2. Construction algorithm:
     - Greedy method using concepts of bipartite graph and tree
     - Better than random binary matrices

Online Joint Power Control for Two-Hop Wireless Relay Networks With Energy Harvesting

Min Dong, Wen Li, and Fatemeh Amirnavaei
University of Ontario Institute of Technology, Oshawa, Canada

Power Control for Two-Hop Relay Networks



- Half-duplex AF relaying
- Slow block fading channel
- System state: channel gains, energy arrived and battery levels
- **Goal:** Power control to maximize the long-term time-averaged rate

- **Formulation:** Joint stochastic optimization problem under battery operational and storage capacity constraints
- **Solution:** Closed-form solution using Lyapunov optimization depending on current state
- **Analysis:** Performance gap compared to the optimal policy is bounded.

Greedy Sampling of Graph Signals

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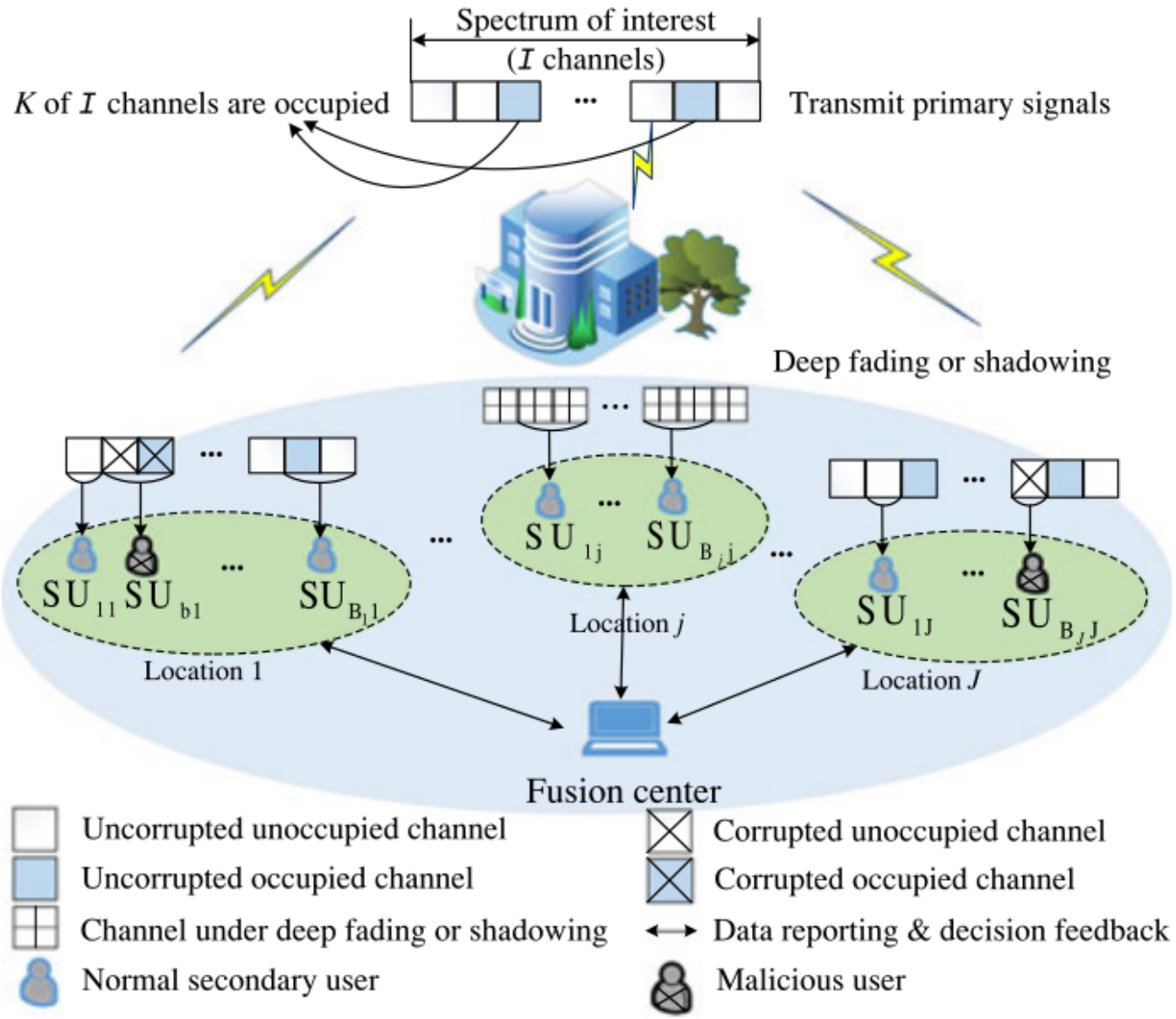
Greedy Sampling of Graph Signals

- **Preliminaries:**
  - Graph: Adjacency matrix $\boldsymbol{A} \in \Re^{n \times n}$
  - Graph signal: $\boldsymbol{x} \in \Re^{n}$
  - Graph FT: $\bar{\boldsymbol{x}} = \boldsymbol{V}^{\mathsf{H}} \boldsymbol{x}$ where $\boldsymbol{A} = \boldsymbol{V}^{\mathsf{H}} \boldsymbol{D} \boldsymbol{V}$
- **Model:** $\boldsymbol{y}_S = (\boldsymbol{x} + \boldsymbol{w})_S \in \Re^{s}$ with $s < n$
- **Assumption:** $\boldsymbol{x}$ is spectrally sparse
- **Goal:** Choice of S to estimate $\boldsymbol{z} = \boldsymbol{H}\boldsymbol{x} \in \Re^{m}$ from $\boldsymbol{y}_S$
- **Contributions:**
  - MSE bounds of optimal Bayesian linear interpolator for a given S
  - Greedy sampling set selection scheme: add one element to sampling set at a time using the bound
  - Derives near-optimality results for the scheme

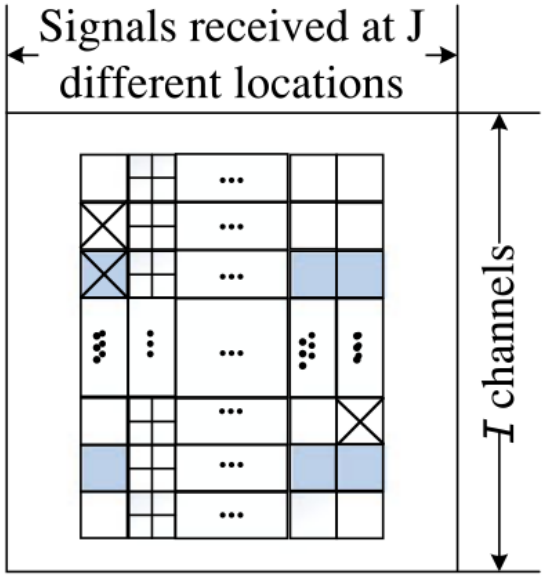
Malicious User Detection Based on Low-Rank Matrix Completion in Wideband Spectrum Sensing

Zhijin Qin, Lancaster University, Lancaster
Yue Gao, Queen Mary University of London
Mark D. Plumbley, University of Surrey, Guildford

Malicious User Detection



Malicious User Detection



Goal: Reconstruct the unsensed channels by a low-rank MC

input ↓

$$\hat{\boldsymbol{P}}, \hat{\boldsymbol{\Omega}} = \arg\min_{\boldsymbol{P},\boldsymbol{\Omega}} \sum_{i,j} \boldsymbol{\Omega}_{ij}(\boldsymbol{P}_{ij} - p_{ij})^2$$

$$\sum_{ij} 1 - \boldsymbol{\Omega}_{ij} \leq L \leftarrow \text{unknown}$$

Solution

- Estimate L from $\{p_{ij}\}$ using shrink and enlargement algorithm
- Alternating minimization to solve the optimization problem:
  - $\boldsymbol{P}$: Riemannian trust-region for MC
  - $\boldsymbol{\Omega}$: Indices of top L values of $\boldsymbol{P}_{ij} - p_{ij}$

Other Papers

- **A GAMP-Based Low Complexity Sparse Bayesian Learning Algorithm**
  - Maher Al-Shoukairi, Philip Schniter and Bhaskar D. Rao
- **A Covariance-Based Superpositional CPHD Filter for Multisource DOA Tracking**
  - Alireza Masnadi-Shirazi and Bhaskar D. Rao
- **A Proportional Time Allocation Algorithm to Transmit Binary Sensor Decisions for Target Tracking in a Wireless Sensor Network**
  - Engin Masazade and Abdulkadir Kose
- **Robust Cooperative Spectrum Sensing for MIMO Cognitive Radio Networks Under CSI Uncertainty**
  - Adarsh Patel, Hukma Ram, Aditya K. Jagannatham and Pramod K. Varshney