IEEE-TSP SEPTEMBER 15, 2015

Journal Watch

By:

Ribhu

SPC-Lab

TWO TIMESCALE JOINT BEAMFORMING AND ROUTING FOR MULTI-ANTENNA D2D NETWORKS VIA STOCHASTIC CUTTING PLANE

Authors : Liu A., Lau V. K. N., Zhuang F., Chen J.

D2D pairs know the instantaneous channel and the BS knows the long term statistics.

Beamforming: Short term control, requires instantaneous statistics

Flow Control : Long term control , requires long term statistics

Design Objective : Maximize the utility function subject to average transmit power constraint and instantaneous physical layer constraints.

This has both long term and short term constraints.

System considers a multi-hop D2D network with unicast flows

Nodes work as transmitters, relays and receivers

$\mathcal{P}0(\boldsymbol{\Theta})$ *(Mixed Timescale Cross-Layer Stochastic Optimiza-*
on Problem):

$$\min_{\Omega^w, \mathbf{d}\succeq 0, \mathbf{x}\succeq 0, \mathbf{r}\succeq 0} -\sum_{k=1}^{K} U_k(d_k) \tag{5}$$

$$\text{s.t.}\, \mathbf{G}\mathbf{x}_k = \mathbf{v}_k(d_k), \forall k = 1, \ldots, K, \tag{6}$$

$$\sum_{k=1}^{K} \mathbf{x}_{k,l} = r_l, \; \forall l \in \mathcal{L}, \tag{7}$$

$$\mathbf{r} \in \mathcal{C}(\mathbf{h}, \ddot{\mathbf{w}}), \forall \mathbf{h}, \tag{8}$$

$$\mathrm{E}\left[\sum_{l=1}^{L} \|\ddot{\mathbf{w}}_l\|^2 \middle| \boldsymbol{\Theta}\right] \le P, \tag{9}$$

Utility
Functi
on

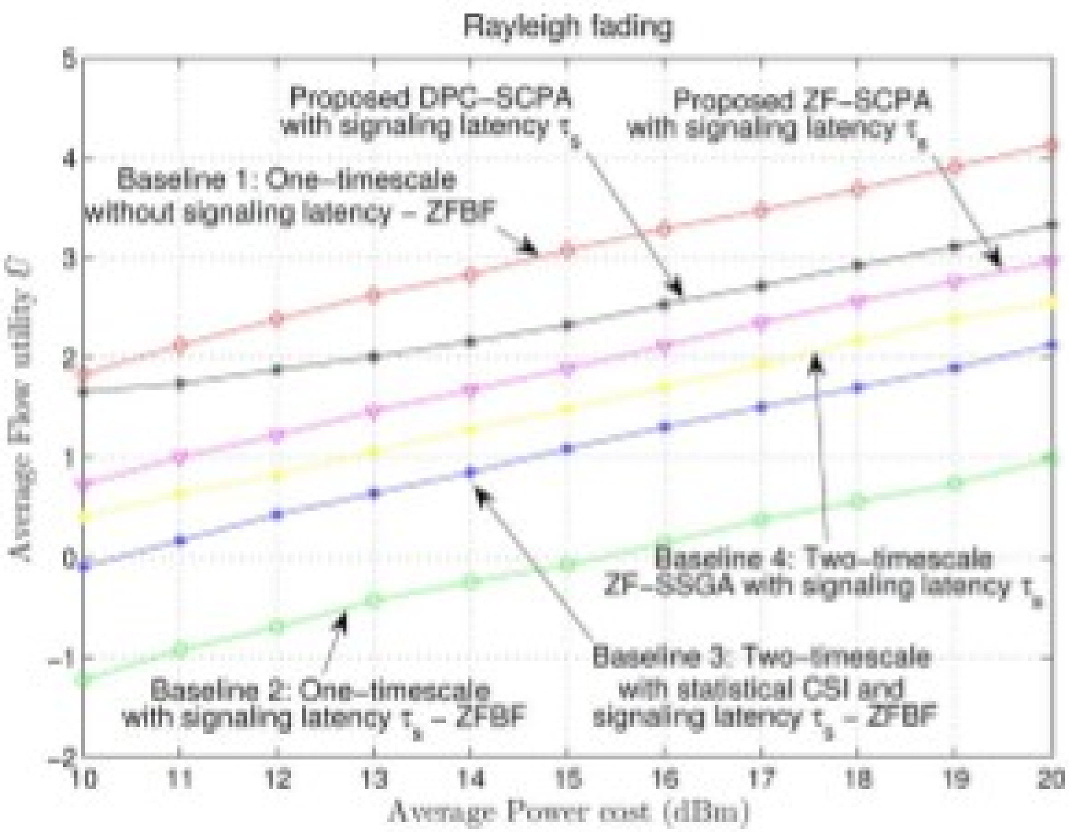
Flow Constr

Data Rate
Constrain

Capacity
Constrai
nt

Instantane
ous Power
Constraint

Can be split into two problems
Dirty paper coded and zero-forcing beamforming used
Rate problem solved modelled as a stochastic optimization problem
Stochastic cutting plane algorithm used to solve it



Rayleigh fading
Proposed DPC−SCPA with signaling latency τ_s
Proposed ZF−SCPA with signaling latency τ_s
Baseline 1: One−timescale without signaling latency − ZFBF
Baseline 4: Two−timescale ZF−SSGA with signaling latency τ_s
Baseline 3: Two−timescale with statistical CSI and signaling latency τ_s − ZFBF
Baseline 2: One−timescale with signaling latency τ_s − ZFBF
Average Flow utility U
Average Power cost (dBm)

MULTISCALE MULTI-LAG CHANNEL ESTIMATION USING LOW RANK APPROXIMATION FOR OFDM

Authors : Beygi, S. and Mitra, U

MSML a good model to approximate wideband channels, such as underwater acoustic channels and radar channels

Multiple paths, each with a delay, scale and an attenuation factor.

The ML estimate in this case is a non linear multidimensional Least Squares problem.

In OFDM communication the carrier orthogonality is corrupted by Doppler shifts.

It is shown that the channel is low rank and the channel rank is equal to the number of active sub-carriers in the OFDM signals

CONTRIBUTIONS

1. It shown that the closeness of Doppler scales induces a low rank in the channel

2. Porny method is used for is for spectral estimation and to exploit the low rank channel matrix

3. A bound on the error between the noiseless signal and the received signal is derived

SYSTEM MODEL

$$h(\mathrm{t},\tau) = \sum_{p=1}^{P} h_p(t)\,\delta\left(\tau - \tau_p(t)\right)$$

$$\tau_p(t) = \tau_p - a_p t$$

$$\tau_p \in [0, \tau_{max}]$$

$$\alpha_p \in [-a_{max}, a_{max}]$$

$$y(t) = \sum_{p=1}^{P} h_p x\left((1 + a_p)t - \tau_p\right) + n(t)$$

The received signal can be reduced to a difference equation in terms of the channel coefficients

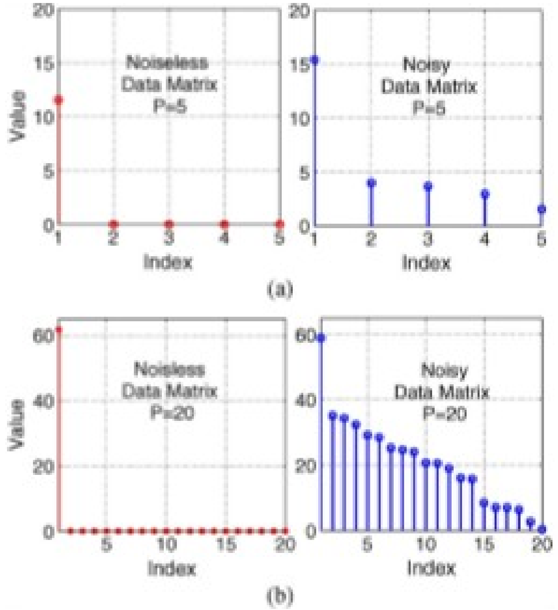


Fig. 1. (a) and (b) depict singular values of the data matrix $\mathbf{D}$ (left plots) and noisy data matrix $\mathbf{R} = \mathcal{H}(\mathbf{r})$ (right plots) for an OFDM signaling with P dominant paths. Doppler scales a_p are chosen randomly from $[-a, a]$ with $a = 0.001$. (a) $P = 5$; (b) $P = 20$.

$$\underset{\mathbf{d}}{\text{minimize}} \quad \|\mathbf{r} - \mathbf{d}\|_2^2 \ \text{s.t.} \quad \text{rank}(\mathbf{D}) = 1$$

$$\mathbf{d} = \underset{\mathbf{d}}{\operatorname{argmin}} \quad \|\boldsymbol{\xi}\|_2^2 + f_R(\mathbf{D})$$
$$\text{s.t.} \quad \mathbf{r} = \mathbf{d} + \boldsymbol{\xi},$$

$$f_R(\mathbf{D}) = \begin{cases} 0 & \text{if rank}(\mathbf{D}) = 1 \\ \infty & \text{otherwise} \end{cases}$$

$$L_\rho(\mathbf{d}, \boldsymbol{\xi}, \boldsymbol{\Theta}) = f_R(\mathbf{D}) + \|\boldsymbol{\xi}\|_2^2 + \langle \boldsymbol{\Theta}, \mathbf{D} + \Xi - \mathbf{R} \rangle + \frac{\rho}{2} \|\mathbf{D} + \Xi - \mathbf{R}\|_F^2,$$

$$\mathbf{d}^{k+1} = \underset{\mathbf{d}}{\operatorname{argmin}} \quad L_\rho(\mathbf{d}, \boldsymbol{\xi}^k, \boldsymbol{\Theta}^k),$$
$$\boldsymbol{\xi}^{k+1} = \underset{\boldsymbol{\xi}}{\operatorname{argmin}} \quad L_\rho(\mathbf{d}^{k+1}, \boldsymbol{\xi}, \boldsymbol{\Theta}^k),$$
$$\boldsymbol{\Theta}^{k+1} = \boldsymbol{\Theta}^k + \rho \left[\mathcal{H}(\boldsymbol{\xi}^{k+1} + \mathbf{d}^{k+1}) - \mathbf{R} \right].$$

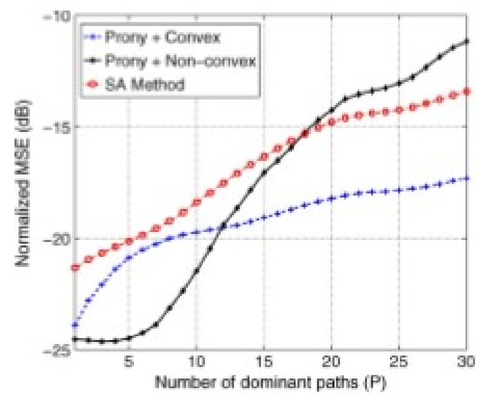


Fig. 4. Comparison of normalized MSE versus the number of dominant paths in a MSML channel—our proposed convex and non-convex approaches with SA method proposed in [20].

LEARNING THE STRUCTURE FOR STRUCTURED SPARSITY

Authors : Shervashidze and Bach

All the existing methods for learning under the assumption of structured sparsity rely on prior knowledge on how to weight individual subsets of variables during the subset selection procedure

This prior knowledge is unavailable in practice.

This paper follows a Bayesian approach to the problem of group weight learning.

Group parameters modelled as hyper-parameters of heavy tailed priors

The parameter vector is represented as a sum of latent vectors identically zero at indices not included in a subset $\mathcal{A}$ of indices.

The support is assumed to be included in a union of such sets

The problem is approached using probabilistic modelling with a broad family of heavy tailed priors

Followed by the derivation of a vibrational inference scheme to learn the parameters of these priors

A greedy algorithm is proposed making this inference scalable to settings where the number of groups considered is large

Experimentally shown that the model parameters may be recovered for data generated from a model

ANALYSIS AND DESIGN OF MULTIPLE ANTENNA COGNITIVE RADIOS WITH MULTIPLE PRIMARY USER SIGNALS

Authors : Morales-Jimenez, D. , Louie, R.H.Y. , McKay, M.R., Chen, Y.

Multi-antenna spectrum sensing system is considered for multiple primary user signals

The number of PU signals is assumed to be greater than the number of sensing antennas thus forcing the received signal covariance matrix to be full rank

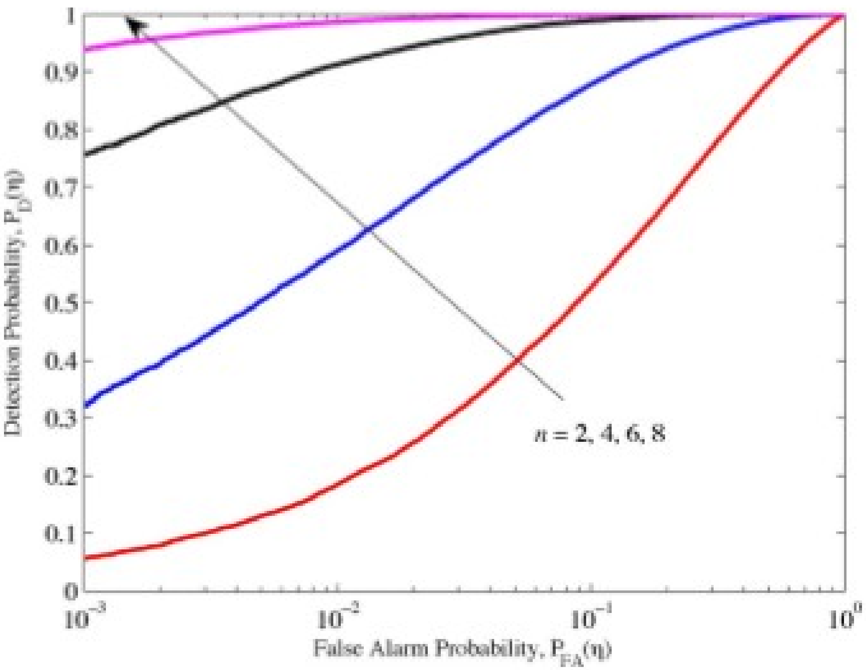
Earlier works include detection for non-full rank cases

The moments of the proposed detector under the two hypotheses are derived

Single primary user sending spatially multiplexed signal is considered as a special case

The moments of GLRT are derived as gamma functions under both the hypotheses

Asymptotic approximations are then made to approximate the pdf for large number of primary signals to Gaussian.



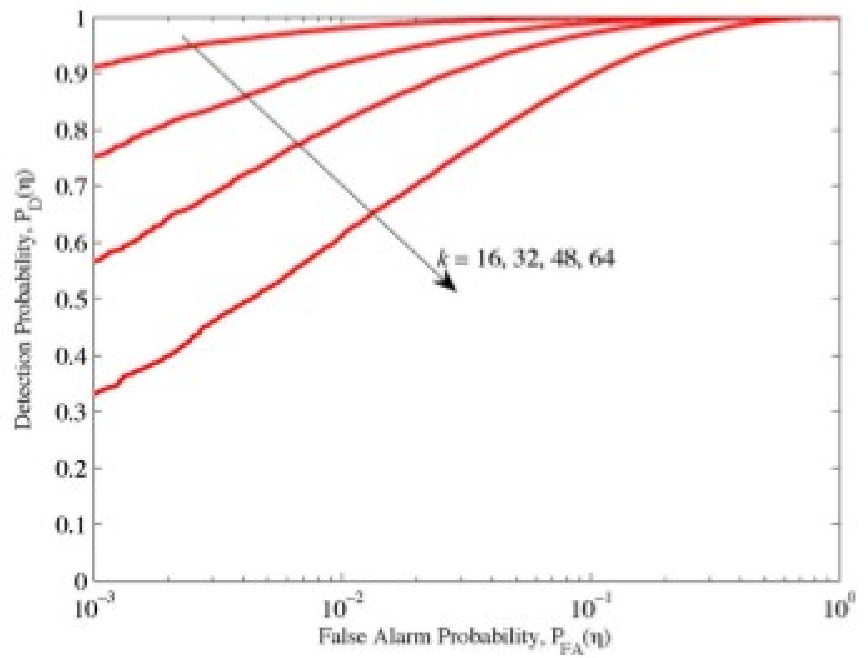


Fig. 7. ROC curve (detection probability vs. false alarm probability) with $n = 8$, $m = 40$, $N_0 = 6$.

SOME MORE PAPERS

Large-Scale Convex Optimization for Dense Wireless Cooperative Networks

-Yuanming Shi; Jun Zhang; O'Donoghue, B.; Letaief, K.B.

Compressive Sensing With Prior Support Quality Information and Application to Massive MIMO Channel Estimation With Temporal Correlation

-Rao, X. ;   Lau, V.K.N.

Nested Sparse Approximation: Structured Estimation of V2V Channels Using Geometry-Based Stochastic Channel Model

-Beygi, S. ;   Mitra, U. ;   Strom, E.G.