Journal Watch

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Sanjeev G.
SPC Lab.
Dept. of ECE, IISc.

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On the Degrees of Freedom of K user SISO Interference and X Channels with Delayed CSIT

Mohammad Javad Abdoli, Akbar Ghasemi, and Amir Keyvan Khandani
Huawei Technologies Canada Co., Ltd., Ciena Corporation, Ottawa, and department of Electrical and Computer Engineering, University of Waterloo

- K-user SISO AWGN IC + $(2 \times K)$-user SISO AWGN XC: Delayed CSIT w/ noiseless links
- Almost surely achievable DoFs are derived analytically, and are better than those shown by a) Maddah-Ali and Tse, b) Maleki, Jafar, and Shamai, and c) Ghasemi, Motahari, and Khandani
- Build on Maddah-Ali and Tse's work on K user MISO IC: multiphase transmission scheme
- For completeness : Multiphase PIN and Retrospective IA, Distributed Partial Interference Management via User Scheduling, Distributed Higher Order Symbol Generation.

Signal Space CoSaMP for Sparse Recovery with Redundant Dictionaries

Mark A. Davenport, Deanna Needell, and Michael B. Wakin
School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Department of Mathematics and Computer Science, Claremont McKenna College, Claremont, and Department of Electrical Engineering and Computer Science, Colorado School of Mines

- $y = A\,D\,\alpha + e$, with $x = D\alpha, \in \mathbb{R}^n$ (sparse), with overcomplete D
- Straightforward to solve if $D = I$, or unitary and if $A\,D$ satisfy RIP
- The proposed recovery method (SSCoSaMP) is more “signal focused”, unlike the previous work
- IHT $\rightarrow$ PLA. On very similar lines, CoSaMP $\rightarrow$ SSCoSaMP. Also, connected to some structured sparsity results
- Requirement : A should satisfy D-RIP

On Convexity of Error Rates in Digital Communications

Sergey Loyka, Victoria Kostina, and Francois Gagnon
School of Electrical Engineering and Computer Science, University of Ottawa, department of Electrical Engineering, Princeton University, and department of Electrical Engineering, Ecole de Technologie Supérieure, Montreal

- Convexity properties of SER/BER/PEP are discussed for a general class of detectors, for arbitrary constellations, bit mapping and coding
- Convexity in SNR (signal power), signal amplitude and noise powers
- Expansion on the known AWGN case, to a wide class of noise densities including unimodal and spherically invariant noises
- New, tighter bounds on convex/concave regions in high/low SNR case. High SNR case is linked to the channel coding theorem $\Rightarrow$ conjecture : all capacity achieving codes have convex error rates
- Any flat fading and linear diversity combining are shown to be convexity preserving

Convexity/concavity: scenario
AWGN: SER is convex at high and concave at low SNR; always convex in low dimensions ($n \leq 2$).
Arbitrary noise density: SER is convex if the power density is non-increasing at the boundaries of decision regions
Unimodal noise: SER is convex at high SNR; always convex if the noise power density is non-increasing.
SIRP noise: SER is convex at high and concave at low SNR; always convex if $n \leq 2$.
AWGN: BER/PEP are convex at high SNR
AWGN: BER is convex for capacity-approaching codes
SIRP noise: BER/PEP are convex at high SNR
Fading + SIRP noise (AWGN is a special case): fading is never good in low dimensions, including linear combining
Fading channel: any flat-fading and any linear combining are convexity preserving (under any noise)

Figure: Convexity in SNR (signal power)

Convexity/concavity: scenario
AWGN: SER in convex at high and concave at low SNR; always convex if $n = 1$.
Arbitrary noise density: SER is convex if the noise amplitude density is non-increasing at the boundaries of decision regions
Unimodal noise: SER is convex at high SNR; always convex if the noise amplitude density is non-increasing.
SIRP noise: SER is convex at high and concave at low SNR; always convex if $n = 1$.

Figure: Convexity in signal amplitude

Convexity/concavity: scenario
AWGN: SER in convex at high(low) and concave at low(high) SNR(noise power).
SIRP noise: SER is convex at high and concave at low SNR.
AWGN: PEP in convex at high and low SNR.
AWGN: BER in convex at high SNR.
SIRP noise: PEP/BER are convex at high SNR

Figure: Convexity in noise power

Distributed and Cascade Lossy Source Coding with a Side Information "Vending Machine"

Behzad Ahmadi and Osvaldo Simeone
Department of Electrical and Computer Engineering and CWCSPR, New Jersey Institute of Technology

- "Vending machine" $\Rightarrow$ side info. is controlled by the decoder, and depends on the message encoded at source (Permuter and Weissman)
- The distributed and cascaded setup are studied
- Encoder message = info. about the source + control info.
- Inner bounds on, and actual Rate-Distortion-Cost regions are derived, and its tightness is emphasized
- Achievable strategies for the distributed case: Combination of Berger-Tung distributed coding and Wyner-Ziv approach

A Recursive Algorithm for Mixture of Densities Estimation

Alessio Sancetta
Department of Economics, Royal Holloway, Egham Hill, Egham

- Novel procedure: Density estimation via empirical CF + iterative Hilbert space approximation algorithm
- The estimator is shown to be consistent, and it is verified for three problems
- Through simulations, it is shown that the proposed estimator is “better” (in the $\mathcal{L}_1$ loss sense) than Kelmela stagewise estimator, Newton recursive estimator, Gaussian kernel density estimator, and the location and scale estimation using EM algorithm

Sookha

- Optimal Coding for the Binary Deletion Channel With Small Deletion Probability - Yashodhan Kanoria and Andrea Montanari
- On the Stability of Finite Queue Slotted Aloha Protocol - Sayee Chakravartula Kompalli and Ravi R. Mazumdar
- Universal Estimation of Directed Information - Jiantao Jiao, Haim H. Permuter, Lei Zhao, Young-Han Kim, and Tsachy Weissman
- Universal Tests for Memory Words - Gusztáv Morvai and Benjamin Weiss