Journal Watch: IEEE Transactions on Information Theory, Vol. 58, No. 10, Oct 2012

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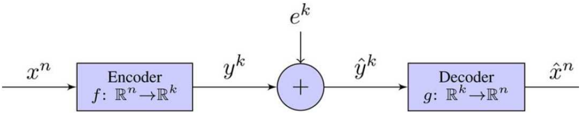
20 October, 2012

- Optimal Phase Transitions in Compressed Sensing

Authors: Y. Wu and S. Verdu

Affiliations: Department of Statistics, The Wharton School, University of Pennsylvania, USA and Department of Electrical Engineering, Princeton University, USA



- Goal: To investigate the fundamental tradeoff between reconstruction fidelity and measurement rate ($\frac{k}{n}$)
- Phase transitions (for noiseless measurement): For many input processes (i.i.d. ones), there exits a threshold $d(X)$ such that:
  - When $R > d(X)$, it is possible to achieve vanishing error probability
  - When $R \leq d(X)$, error probability approach 1
- Phase transitions (for noisy measurement): Noise sensitivity is considered to analyze reconstruction fidelity

- System model

$$\mathbf{P_X} = (1-\gamma)\mathbf{P_d} + \gamma\mathbf{P_c}$$

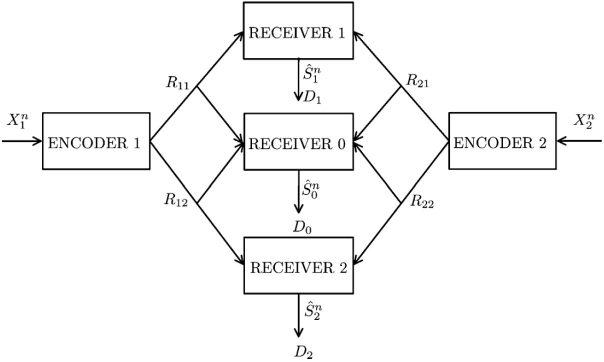
  where $\mathbf{P_d}$ and $\mathbf{P_c}$: discrete and cont. prob. measure
- For i.i.d. discrete-continuous mixtures: minimal measurement rate is given by the input information dimension, i.e., the weight of the absolutely continuous part (γ)
- Measurements corrupted by additive Gaussian noise:
  - optimal nonlinear encoder
  - optimal linear encoder
  - random linear encoder
- When input is i.i.d.: for any input distribution, the phase transition threshold for optimal encoding is given by the input information dimension $d(X) = \lim_{m\to\infty} \frac{H(\lfloor m\mathbf{X}\rfloor)}{\log m}$
- Look the paper for following three dimensions
  - Information dimension
  - MMSE dimension
  - Minkowski dimension

- Sum rate of the Vacationing CEO problem

Authors: Rajiv Soundararajan, Aaron B. Wagner, and Sriram Vishwanath

Affiliations: Department of Electrical and Computer Engineering, The University of Texas at Austin, USA and School of Electrical and Computer Engineering, Cornell University, USA

- Vacationing CEO problem: multiple encoders compress noisy versions of a single source in a distributed manner
- Combination of
  1. CEO problem
  2. multiple description (MD) problem



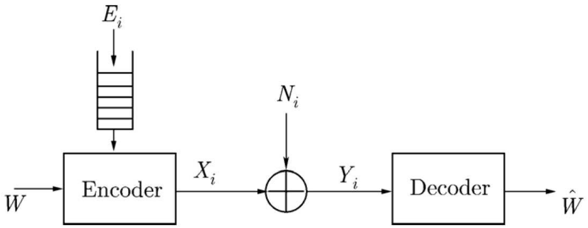
- Achievable scheme: Berger-Tung scheme for multiterminal source coding and the El Gamal-Cover scheme for MDs
- Gaussian scheme is optimal in the low distortion regime
- Time-sharing scheme with Gaussian codebooks is optimal in the high distortion regime

- Achieving AWGN Capacity Under Stochastic Energy Harvesting

  Authors: O. Ozel and S. Ulukus

  Affiliations: Department of Electrical and Computer Engineering, University of Maryland, USA

- To analyze point-to-point communication of energy harvesting nodes from an information-theoretic perspective
- For continuous alphabet channel:
  1. average power constraint
  2. amplitude constraint
- Energy arrives at transmitter as discrete time stochastic process
- Cumulative power constraint: $\sum_{i=1}^{k} X_i^2 \leq \sum_{i=1}^{k} E_i, \; i = 1, \ldots n$

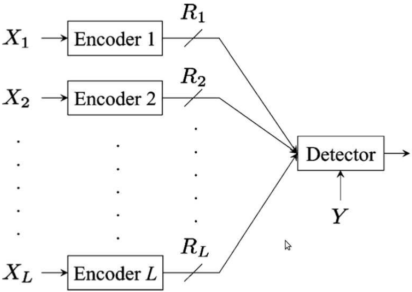


- Main result:
  The capacity of an AWGN channel with cumulative power constraint $=$ classical AWGN capacity with average power constraint
- Achievable scheme
  1. Save and transmit
  2. Best effort transmit scheme
- Also, considers a system in which the average recharge rate is time varying in a larger time scale
- Optimization problem: Majorization and Schur convexity

- On the Optimality of Binning for Distributed Hypothesis Testing

Authors: M. Rahman and A. B. Wagner

Affiliations: School of Electrical and Computer Engineering, Cornell University, USA



- Vector source $(\mathbf{X}_1, \ldots, \mathbf{X}_L, \mathbf{Y})$ has joint distribution

$$H_0: \quad P_{\mathbf{X}_1,\ldots,\mathbf{X}_L,\mathbf{Y}}$$
$$H_1: \quad P_{\mathbf{X}_1,\ldots,\mathbf{X}_L,\mathbf{Y}}$$

- Objective
  - Characterize all achievable encoding rates
  - Exponents of Type 2 error when Type 1 error is at most a fixed value

- Consider a class of L-encoder hypothesis testing problem against conditional independence
- Achievable scheme: Quantize-bin test
  - Encoder l first quantizes X_l^n by selecting a codeword U_l^n that is jointly typical with it
  - Encoder then sends index of the bin
- Provides outer bound for more general class of problem