Title
Achievable Rates for Joint Communication and Channel Estimation

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Achievable Rates for Joint Communication and Channel Estimation

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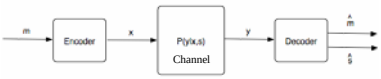
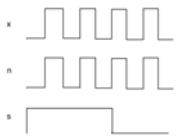
Signal Model, Problem Formulation and Assumptions

Signal Model



Problem Formulation

$$C_A(D) = \max_{p_x : E||x||^2 \le P,\ Ed(s,\hat{s}) \le D} I(X;Y)$$

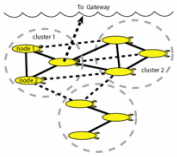


D ↑ ⟺ C ↑

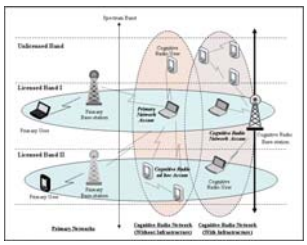
Assumptions

- **Channel state has coherence time T_c**
  State remains fixed for T_c units of time and then changes to another independent value
- **Joint channel estimation and communication**
  No training and explicit channel estimation is called for
- **No channel state information at either transmitter or receiver**

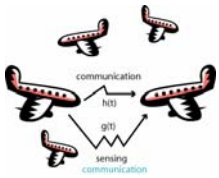
Applications



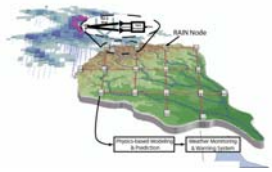
Active SONAR



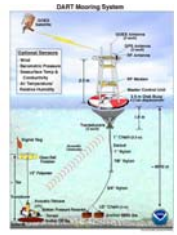
Cognitive Radio



Active RADAR



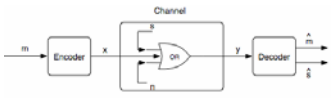
Optical Rain Detection



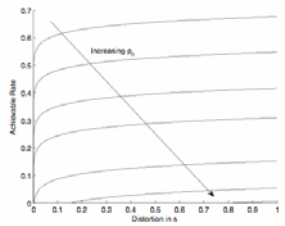
Tsunami Detection

Decode X first or Estimate S first?

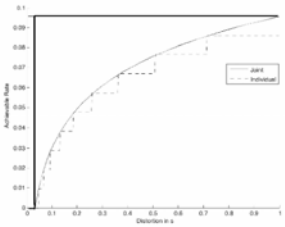
Binary Example



Y=X + S + N



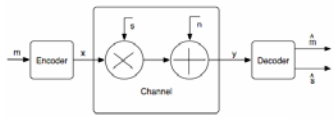
As p_n tends to 0.5
achievable rate
goes to 0

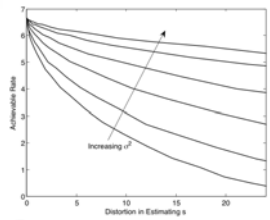


Decoding X first
is better than
Estimating S first

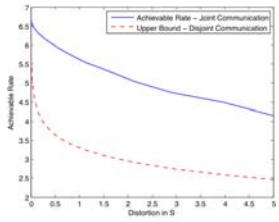
Real Example

Y=SX + N





As var(S) increases.
it gets easier to detect X



Joint comm/est outperforms
time orthogonal comm/est

Comparison with "regular" Sensing

- **Parameters to be measured are intrinsic to the network**
- **Tradeoff between communication and estimation -- communication is crucial to the estimation problem**
- **Time is the resource of contention as opposed to power/bandwidth**

References

- **S. Vedantam, W. Zhang, U. Mitra, A. Sabharwal, "Achievable rates for joint communication and estimation, ITW 2007, Lake Tahoe, CA, USA.**
- **S. Vedantam, U. Mitra, A. Sabharwal, "Distortion Bounds on Intrinsic Sensing in Multihop Networks", in preparation.**