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Two-Way Training Design for Discriminatory Channel Estimation in Wireless MIMO systems

Chao-Wei Huang, Xiangyun Zhou, Tsung-Hui Chang and Y.-W. Peter Hong
National Tsing Hua University, Taiwan, and University of Oslo, Norway

- Considers TDD MIMO system with a transmitter, legitimate receiver (LR) and unauthorised receiver (UR)

- Goal: Design a two way channel training that enables LR to estimate accurately, while UR's channel estimation is disrupted

- Reverse training: LR sends training signal X_l to transmitter, MMSE is employed to estimate channel H
- Forward training: Transmitter adds artificial noise to training signal. Artificial noise is imposed such that it is in the left null-space of estimated channel matrix $\hat{H}$
- LR and UR's employ LMMSE to estimate channel
- Allocate power between reverse, forward training and artificial noise to min $NMSE_L$ s.t. $NMSE_U > \gamma$ and with an avaerage power constraint.

On the Diversity and Multiplexing Tradeoff in MIMO Fading Channels With Two-Way Training and Power Control

Xiao Juan Zhang and Yi Gong
NTU, Singapore

- Point-to-point TDD wireless link with M transmit antennas, N receive antennas ($M \geq N$)
- Block fading with L symbols being transmitted in one block
- Two way training to obtain noisy CSIT $\hat{H}_b$ and noisy CSIR $\hat{H}_f$
- Source initiates training : Source sends training symbols with fixed power, receiver estimates imperfect CSIR, then source sends data symbols with fixed power
  multiple rounds: Source sends training symbols with fixed power, receiver estimates imperfect CSIR, then destination performs power controlled training, then source does power controlled data transmission
- Destination initiates training: Fixed power training form destination, source estimated CSIT, then does power controlled training, then does power-controlled data transmission
- DMT analysis for all these cases

Spectrum Sensing via Energy Detector in Low SNR

Saman Atapattu, Chintha Tellambura, and Hai Jiang
University of Alberta, Canada

- $\mathcal{H}_0 : y(n) = w(n)$ and $\mathcal{H}_1 : y(n) = hx(n) + w(n)$
- test statistic: $\Gamma(y) = \sum |y(n)|^2$
- When sample size is large, by CLT, pdf of $\Gamma(y)$ under $\mathcal{H}_1$ is gaussian with mean $N\sigma_w^2$ and variance $N\sigma_w^4(1 + 2\gamma)$ where γ is received SNR
- Under low SNR, variance becomes $N\sigma_w^4$ and also expression for probability of detection simplifies
- Derive expressions for average miss detection probability under Rayleigh fading and Nakagami$-m$ fading
- Threshold selection (λ) by minimizing the total error rate $P_e(\lambda) = P_f(\lambda) + P_m d(\lambda)$

Cyclic Feature based Wideband Spectrum Sensing using Compressive Sampling

Zhi Tian

- Cyclic spectrum is the Fourier series of the cyclic covariance function
- Cyclic-feature based detectors require sampling higher than nyquist rate, thus requires longer sensing time for wide-band sensing
- This works, exploits sparsity in both 2D cyclic spectrum and frequency
- There is no direct relationship between acquired compressive samples and cyclic spectrum, so by matrix manipulation they relate both of them, and reconstruct 2D Cyclic spectrum from compressive samples
- Propose a band-by-band inspection of 2D cyclic spectrum to detect the presence of primary

Relevant papers

- Short-Term Throughput Maximization for Battery Limited Energy Harvesting Nodes
  Kaya Tutuncuoglu Aylin Yener
- *On Monte Carlo Simulation of the Bit Error Rate*
  Brian Mazzeo and Michael Rice
- *Transceiver Design for MIMO systems with imperfect CSI at Transmitter and Receiver*
  Boon Sim Thian, Sheng Zhou, Andrea Goldsmith
- *Interference Alignment by Opportunistic User Selection in 3-User MIMO Interference Channels Jung Hoon Lee and Wan Choi*

Relevant papers

- K-user MIMO X Network System with Perfect Interference Alignment
  Seong-Ho Park and Young-Chai Ko
- *Compressed Correlation-Matching for Spectrum Sensing in Sparse Wideband Regimes*
  Josep Font-Segura, Gregori VÂ´azquez and Jaume Riba