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Cooperative Spectrum Sensing Scheme over Imperfect Feedback Channels

Jeong Woo Lee; *Chung-Ang University, Seoul, Korea*

- Related work
  - The optimal fusion rule with hard combining is the likelihood ratio test (LRT)
    - Requires the maximum amount of information regarding the system
  - Suboptimal fusion rules such as the ChairVarshney (CV) rule, the LRT based on channel statistics (LRTCS), the maximum ratio combiner (MRC) and the equal gain combiner (EGC) exist
- New cooperative spectrum sensing scheme based on soft combining
- Performs well over imperfect feedback channels even with very less system information
- A Majority-Decision-Aided weighting rule is introduced

System Model

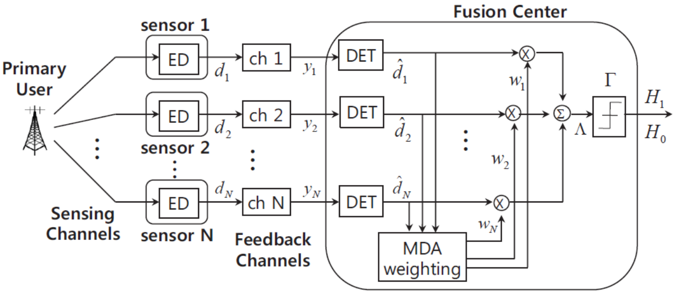

Figure : System model

- Decision statistic is computed as $\Lambda = \sum_{i=1}^{N} w_i \hat{d}_i$
- Larger weights are assigned to local decisions which are the same as the majority decision
  - Considered more reliable than the others
  - Make w_i inversely related to $|D_M - \hat{d}_i|$
- Result
  - Proposed scheme improves the sensing reliability in the imperfect feedback channel environment

Fusion Rule	Required Information
LRT	channel state information, $\bar{\gamma}_r$, p_d, p_f
LRT-CS	channel statistics, $\bar{\gamma}_r$, p_d, p_f
CV	$\bar{\gamma}_r$, p_d, p_f
proposed	$\bar{\gamma}_r$
EGC	none
k-out-of-N, OR	none

Figure : Information required by some hard combining fusion rules

Power Consumption and Packet Delay Relationship for Heterogeneous Wireless Networks

Peng-Yong Kong; *Khalifa University of Science, Technology and Research (KUSTAR), Abu Dhabi, United Arab Emirates*

- Related work
  - Expression for coverage and outage probability as a function of base station densities, transmission powers and SIR targets at different tiers
  - Optimal base station density that will minimize the power consumption subject to a predefined QoS requirement in terms of downlink data rate
- Objective
  - Develop a method to determine the relationship between power consumption and packet delay in heterogeneous networks

- System model
  - 2-tier heterogeneous network
  - The transmission power in each tier is fixed; No dynamic power control
  - Base stations in each tier are located in the Euclidean plane according to an independent PPP
- SIR at any randomly located user is a random variable with some distribution
- The data rate R experienced by a user depends on the SIR
- The packet transmission time $T = L/R$ is also a random variable

- Results
  - A method and a set of expressions to compute the relationship between power consumption and packet delay for a heterogeneous wireless network
  - Trade-off between packet delay and power consumption exists
  - Heterogeneous networks can be 20% more power efficient than homogeneous networks in achieving a given packet delay requirement

An Efficient Pilot Design Scheme for Sparse Channel Estimation in OFDM Systems

J. C. Chen; *National Kaohsiung Normal University, Taiwan*
C. K. Wen; *National Sun Yat-sen University, Taiwan*,
P. Ting; *Industrial Technology Research Institute, Taiwan*

- Use CEO to obtain optimal pilot positions to minimize the MSE of channel estimation
- The optimal pilot placement can be derived from an exhaustive search
  - Computationally expensive
- System model
  - OFDM system with N subcarriers; K subcarriers are selected as pilot subcarriers
  - The positions of the selected subset of pilot tones can be represented by

$$\mathrm{p} = \{p_n\}_{n=0}^{N1} \quad p_n \in 0, 1 \tag{1}$$

    - n is the index of the subcarriers;
  - Given the positions of K selected pilot subcarriers p, the received pilot vector, $Y(p) \in \mathbb{C}^{K\times 1}$ can be expressed as

$$Y(p) = \mathrm{diag}\{X(p)\}F(p)h + \eta \tag{2}$$

    - $h \in \mathbb{C}^{L\times 1}$, $F(p) \in \mathbb{C}^{K\times L}$, $\eta \in \mathbb{C}^{K\times 1}$

- Objective: Obtain h from Y and A
- If matrix A has more columns than rows then least squares estimation can be used
- If the number of pilots is smaller than the number of channel coefficients, the problem becomes under-determined
- To reduce the computational cost of the exhaustive search method, efficient CEO is introduced
- Result
  - The proposed pilot allocation method outperforms the equispaced pilot tones and random pilot tones

MMSE Performance Analysis of Generalized Multibeam Satellite Channels

D. Christopoulos, S. Chatzinotas, and B. Ottersten; *SnT-University of Luxembourg*

J. Arnau and C. Mosquera; *Signal Theory and Communications Department, University of Vigo, Spain*

Estimation of Observation Error Probability in Wireless Sensor Networks

X. He, X. Zhou, K. Anwar and T. Matsumoto; *School of Information Science, Japan Advanced Institute of Science and Technology JAIST, Japan*

Other Papers

- Auction Based Spectrum Trading for Cognitive Radio Networks
  Mohsen Nader Tehrani and Murat Uysal
- Carrier Sense Multiple Access with Collision Resolution
  Hyun-Ho Choi, Jung-Min Moon, In-Ho Lee,and Howon Lee
- Robust Transceiver Design for MIMO-OFDM Systems Based on Cluster Water-Filling
  Chengwen Xing, Dan Li, Shaodan Ma, Zesong Fei, and Jingming Kuang
- Jamming Energy Allocation in Training-Based Multiple Access Systems
  Hamed Pezeshki, Xiangyun Zhou, and Behrouz Maham