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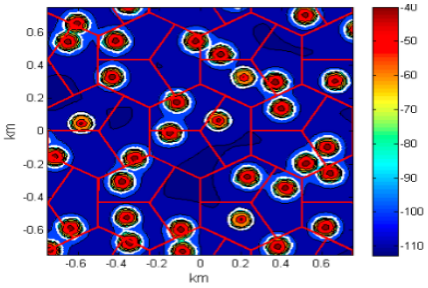
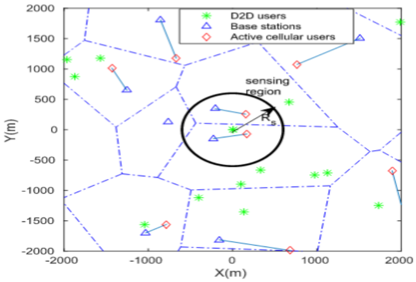
Spatial Spectrum Sensing-Based Device-to-Device Cellular Networks

Authors: CHao Chen, Lingjia Liu, Thomas Novlan, John D. Matyjas, Boon Loong Ng, and Jianzhong Zhang

Goal: Analyze spatial spectrum sensing (SSS) opportunities in D2D cellular networks (D2D-CN).

RF heat map and System model:





Objective:

$$\max R_n (= w_c R_c + (1 - w_c) R_d \ or \ R_p)$$
$$\text{Subject to } \overline{P_f} < \overline{P_f^*}$$

R_c and R_d are spatially averaged spectral efficiency of cellular and D2D users, and $\overline{P_f}$ is probability of false alarm.

Contributions:

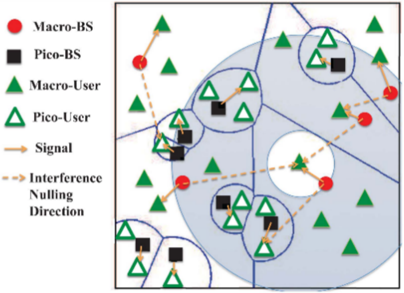
- Introduced SSS in D2D-CN and derived analytical expression for probability of detection and false alarm for SSS in HPPP wireless networks.
- Optimal sensing radius for SSS to maximize the overall network throughput.
- Analytical expressions for optimal performance of SSS under following power allocation strategies
  - constant power allocation at all cellular and D2D transmitter
  - channel inversion at cellular and constant power at D2D transmitters.

User-Centric Interference Nulling in Downlink Multi-Antenna Heterogeneous Networks

Authors: Ying Cui, Yueping Wu, Dongdong Jiang, and Bruno Clerck

Goal: System model

- Macro-BSs, pico-BSs and users are deployed according to PPP with different intensities.
- All the macro and pico stations are divided into two tiers.
- Each user is associated with one BS which provides long term average received signal power.
- Ecah BS uses TDMA for scheduling its users, hence no intra cell interference.



Performance metric

- Coverage probability $s(\beta) \triangleq \Pr(SIR < \beta)$

Contributions:

- User centric interference nulling scheme
  - SIR of typical user experience following interferences
    - residual aggregated interference from its potential IN macro-BSs
    - aggregated interference from interfering macro-BSs which are not its potential IN macro-BSs.
    - Aggregated interference from all interfering pico-BSs
  - Macro-BS uses ZFBF to cancell interference to K_I IN users and boosts signal to its scheduled users
  - Pico-BS uses MRT precoder to serve its users.
- Asymptotic outage probability analysis when $\beta \to 0$ for low and high SIR region: 1) analysis 2) Optimization problem
- Asymptotic coverage probability analysis when $\beta \to 0$ for low and high SIR region: 1) analysis 2) Optimization problem

On Downlink Resource Allocation for SWIPT in Small Cells in a Two-Tier HetNet

Authors: Sudha Lohani, Ekram Hossain, and Vijay K. Bhargava

Goal: To jointly optimize achievable throughput and energy harvesting rate of small cell users.

System model

- Downlink two-tier Hetnet. UEs associated to SBS are capable of energy harvesting.
- Flexible interference at the Macro cell users. EH and ID phase of all SUEs are synchronized.

Resource allocation for time switching approach

$$\max_{\mathbf{P_E},\mathbf{P_I},\alpha_\mathbf{I},\alpha_\mathbf{E}} \sum_{s=1}^{S} \left(w_{s,I} \frac{R_s - R_{tar}}{R_{tar}} + w_{s,E} \frac{E_s - E_{tar}}{E_{tar}} \right)$$

Subject to 1) binary constraint on α_I and α_E 2) either in EH or ID mode but not both 3) min and max rate constraints of EH and throughput rate.

- Above problem is non-convex (difference of concave (DC) functions) with combinatorial constraints. Linearizes/convexifies the constraints and solves the DC function iteratively using MM procedure.
- Similarly solves for the power splitting approach.

Buffer-Aided Diamond Relay Network With Block Fading and Inter-Relay Interference

Authors: Renato Simoni, Vahid Jamali, Nikola Zlatanov, Robert Schober, Laura Pierucci and Romano Fantacci

Goal: Optimal scheduling of the transmission modes over time and investigate the achievable average rate.

System model:

- Half duplex buffer aided diamond relay network and unlimited-size buffers at relay.
- No direct link, one relay can transmit while the other relay is receiving and flat block fading on links.
- CSI is available at all nodes and DPC is employed to cancel inter relay interference.

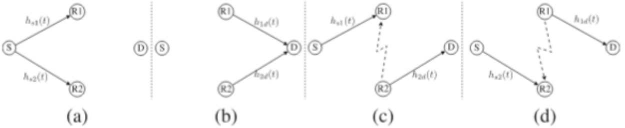


Fig. 1. The four possible transmission modes in the half-duplex diamond relay network are illustrated.

Rate maximization problem

$$\max_{q_k(t),\alpha(t),\beta(t)} \overline{C_{1d}} + \overline{C_{2d}}$$

subject to $\sum_{i=1}^{4} q_k(t) = 1,\ q_k(t) \in \{0,1\},\ 0 \leq \alpha(t), \beta(t) \leq 1$

Contribution:

- Optimal mode selection protocol (*BaD*) to maximize the average transmitted by relays without delay constraints and with DPC coding.
- Delay limited *BaD* protocol
- *BaD* protocol for SIC instead of DPC coding for inter-relay interference cancellation