Joint Power Optimization for Device-to-Device Communication in Cellular Networks with Interference Control

ABSTRACT

- For device-to-device (D2D) communication underlaid in a cellular network with uplink resource sharing, both cellular and D2D pairs may cause significant inter-cell interference (ICI) at a neighboring base station (BS). In this work, under optimal BS receive beamforming, we jointly optimize the power of a cellular user (CU) and a D2D pair for their sum rate maximization, while satisfying minimum SINR requirements and worst-case ICI limit in multiple neighboring cells.
- We solve this non-convex joint optimization problem in two steps. First, the necessary and sufficient condition for the D2D admissibility under given constraints is obtained. Next, we consider joint power control of the CU and D2D transmitters.

CONT…

- We propose a power control algorithm to maximize the sum rate. Depending on the severity of ICI that D2D and CU may cause, we categorize the feasible solution region into five cases, each of which may further include several scenarios based on minimum SINR requirements.
- The proposed algorithm is optimal when ICI to a single neighboring cell is considered. For multiple neighboring cells, we provide an upper bound on the performance loss by the proposed algorithm and conditions for its optimality.
- We further extend our consideration to the scenario of multiple CUs and D2D pairs, and formulate the joint power control and CU-D2D matching problem. We show how our proposed solution for one CU and one D2D pair can be utilized to solve this general joint optimization problem.

EXISTING SYSTEM

- Despite the above results, the ICI due to D2D communication has not been investigated in the existing literature. For a practical system, the ICI caused by both D2Ds and CUs in a neighboring cell should be carefully controlled to not exceed a certain level.
- In addition, due to the challenges involved in the problem, existing power allocation schemes for interference mitigation proposed in the literature are typically heuristics whose performance gap from the optimal cannot be guaranteed.

PROPOSED SYSTEM

The proposed algorithm is optimal when ICI to a single neighboring cell is considered. For ICI to multiple neighboring cells, we provide an upper bound on the performance loss by the proposed algorithm and conditions for its optimality.

HARDWARE REQUIREMENTS

- Processor - Pentium-IV
- Speed - 1.1 Ghz
- RAM - 256MB(min)
- Hard Disk - 20 GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

SOFTWARE REQUIREMENTS

- Tool - Network Simulator-2
- Operating system - LINUX
- Front end - OTCL (Object Oriented Tool Command Language)

REFERENCES

[1] A. Ramezani-Kebrya, M. Dong, B. Liang, G. Boudreau, and S. H. Seyedmehdi, “Optimal power allocation in device-to-device communication with SIMO uplink beamforming,” in Proc. IEEE SPAWC, Stockholm, Sweden, June 2015, pp. 425–429.

[2] K. Doppler, M. Rinne, C. Wijting, C. Ribeiro, and K. Hugl, “Deviceto-device communication as an underlay to LTE-Advanced networks,” IEEE Commun. Mag., vol. 47, pp. 42–49, Dec. 2009.

[3] G. Fodor, E. Dahlman, G. Mildh, S. Parkvall, N. Reider, G. Mikl ´os, and Z. Tur´anyi, “Design aspects of network assisted device-to-device communications,” IEEE Commun. Mag., vol. 50, pp. 170–177, Mar. 2012.