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Heuristic Algorithm for Proportional Fair Scheduling in D2D Cellular Systems

–Jaheon Gu, Sueng Jae Bae, Syed Faraz Hasan and Min Young Chung

Problem: Find a proportionally fair scheduling scheme with a considerably lower complexity to optimize the logarithmic sum rate in D2D network
Optimization function:

$$P = \begin{cases} arg\ max_S \{ \sum_{i_c \in U_c^S} ln[\sum_{k=1}^{K} a_{i_c,k}^{(S)} r_{i_c,k}^{(S)}] + \sum_{i_d \in U_d^S} ln[\sum_{k=1}^{K} a_{i_d,k}^{(S)} r_{i_d,k}^{(S)}] \} \\ for\ \ T = 1 \\ arg\ max_S \{ \sum_{i_c \in U_c^S} ln[1 + \frac{\sum_{k=1}^{K} a_{i_c,k}^{(S)} r_{i_c,k}^{(S)}}{(T-1)\bar{R}_{i_c}}] + \sum_{i_d \in U_d^S} ln[1 + \frac{\sum_{k=1}^{K} a_{i_d,k}^{(S)} r_{i_d,k}^{(S)}}{(T-1)\bar{R}_{i_d}}] \} \\ for\ \ T \geq 2 \end{cases}$$

Constraints:
$a_{i_c,k}^{(S)} \in \{0,1\}\ \forall (i_c, k)$
$a_{i_d,k}^{(S)} \in \{0,1\}\ \forall (i_d, k)$
$\sum_{i_c=1}^{N_C} a_{i_c,k}^{(S)} = 1$ and $\sum_{i_d=1}^{N_D} a_{i_d,k}^{(S)} = 1\ \forall k$
Heuristic algorithm: Solve one to many assignment problem by using Hungarian algorithm iteratively to solve one-to-one assignment problem.
Verification: Complexity vs number of CUEs as the number of carriers are increased
Total data rates vs number of cellular or D2D users.

Mixed mode Transmission and Resource Allocation for D2D Communication.

–Huan Tang and Zhi Ding

Problem: Propose a two step approach for mixed mode allocation and resource allocation to achieve an optimal cellular constrained maximum data rate for the D2D network **Details:**
Non convex cellular rate constraints and binary constraints of subchannel allocation difficult to solve.
Mixed mode allocation and resource allocation are decoupled and optimized independently.
Maximize $\sum_{i=1}^{I} \beta_i \sum_{k=1}^{K} \mu_{ik} \sum_{m=1}^{4} x_{ikm} r_{ikm}^{(D)}$ subject to

$$\sum_{i=1}^{I} \mu_{ik} \sum_{m=1}^{4} x_{ikm} r_{ikm}^{(C)} \geq R_k \quad \forall k \in \mathcal{K}$$

$$\sum_{k=1}^{\mathcal{K}} \mu_{ik} \sum_{m=1}^{4} x_{ikm} p_{ikm}^{(C)} \leq E_i \quad \forall i \in \mathcal{J}$$

$$\sum_{m=1}^{4} x_{ikm} \leq 1, x_{ikm} \geq 0 \quad \forall i \in \mathcal{J}, \forall k \in \mathcal{K}$$

$$\sum_{i=1}^{I} \mu_{ik} \leq 1, \mu_{i,k} \in \{0,1\} \quad \forall k \in \mathcal{K}$$

The algorithm can be implemented distributively with low signaling overhead. D2D link CSI is estimated at each D2D Tx locally. Cellular link parameters of each RB chunk acquired from eNB.

Combinatorial Resource Allocation Using Submodularity of Waterfilling

-Kiran Thekumparampil, Andrew Thangaraj and Rahul Vaze

Problem: Provide theoretical guarantees on the performance of waterfilling based combinatorial resource allocation.

Contribution:

- Show that maximum mutual information of a set of parallel Gaussian channels obtained by water filling is sub-modular.
  A monotonic function $f : 2^U \to \mathbb{R}$ is sub-modular if
  $f(S) + f(T) \geq f(S \cap T) + f(S \cup T) \forall S, T \in 2^U$
- Exploit sub-modularity of waterfilling to show that the greedy algorithms are optimal for resource allocation problems.
- Show that price of anarchy of a basestation allocation mechanism is atmost 2.

Applications

- Uplink OFDMA subcarrier and power allocation of FDMA capacity.
- Downlink basestation association and power allocation.
- Offline base station allocation with selfish users.

ℓ_1 LS and ℓ_2 MMSE based Hybrid Channel Estimation for Intermittent Wireless Connections

–Yasuhiro Takano, Markku Juntti and Tad Matsumoto

Problem: Propose a hybrid channel estimation scheme which makes use of both ℓ_1 LS and ℓ_2 MMSE techniques to achieve a better BER at a lower complexity in intermittent Tx scenario.

System model:

Turbo receiver framework over broadband MIMO wireless channels.

Data is divided into blocks and converted to BPSK symbols to be sent over the channel.

Rx antennas estimate the channel using extrinsic log-likelihood ratio. Channel decoder uses BCJR algorithm.

ℓ_1 **Regularized Multi-Burst Channel Estimation**

$$\hat{\mathcal{H}}_{\ell_1}^{MB}(l) = arg\ min_{\mathcal{H}(l)} \frac{1}{L_M} \sum_{j \in \mathcal{J}_{L_M}(l)} \{\mathcal{L}_t d(j, \mathcal{H}(j)) + \lambda(j)||\mathcal{H}(j)||_1\}$$

Hybrid channel estimation

- Performs ℓ_1 LS and ordinary ℓ_2 MB channel estimation simultaneously.
- Selects better estimate under the Bayesian information criterion.
- Tracking error detected if $BIC(\hat{\mathcal{H}}_{\ell_1}^{LS}(l)) \geq BIC(\hat{\mathcal{H}}_{\ell_2}^{MB}(l))$

Other interesting papers

- Han-Wen Liang, Wei-Ho Chung and Sy-Yen Kuo,“Coding aided K-Means Clustering Blind Transceiver for Space Shift Keying MIMO Systems“.
- Mingchun Chang, Min Dong, Fangzhi Zuo and Shahram Shahbaz Panahi,“Joint Subchannel Pairing and Power Allocation in Multichannel MABC-Based Two-Way Relaying“.
- Richard Demo Souza, Marcelo E.Pellenz, Christian Oberli, Glauber Brante, Marian Verhelst and Sofie Pollin,“Optimizing the Code Rate of Energy Constrained Wireless Communications with HARQ“.
- Raoul F.Guiazon, Kai-Kit Wong and Michael Fitch,“Capacity Distribution for Interference Alignment With CSI Errors and Its Applications“.