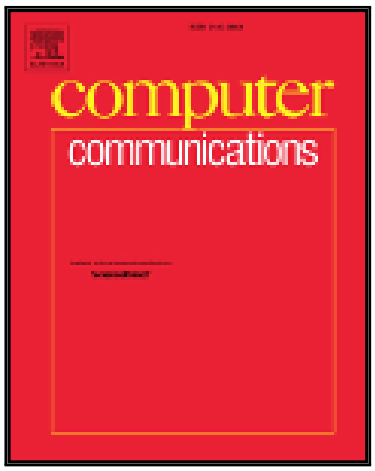

Secondary Users Selection and Sparse Narrow-band Interference Mitigation in Cognitive Radio Networks

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PII: S0140-3664(17)30302-X
DOI: 10.1016/j.comcom.2018.02.020
Reference: COMCOM 5661

To appear in: *Computer Communications*

Received date: 14 March 2017
Revised date: 11 February 2018
Accepted date: 27 February 2018

Please cite this article as: A. Gouissem, R. Hamila, N. Aldhahir, S. Foufou, Secondary Users Selection and Sparse Narrow-band Interference Mitigation in Cognitive Radio Networks, *Computer Communications* (2018), doi: 10.1016/j.comcom.2018.02.020

Secondary Users Selection and Sparse Narrow-band Interference Mitigation in Cognitive Radio Networks

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Abstract

Spectrum scarcity is a critical problem that may reduce the effectiveness of wireless technologies and services. To address this problem, different spectrum management techniques have been proposed in the literature such as overlay cognitive radio (CR) where the unlicensed users can share the same spectrum with the licensed users. The main challenges in overlay CR networks are the identification and detection of the Primary User (PU) signals in a multi-source narrow-band interference (NBI) scenario. Therefore, in this paper, we investigate the performance of an orthogonal frequency division multiplexing (OFDM) overlay CR network with Secondary Users (SUs) and subcarriers selection schemes. Three approaches for SUs and subcarriers Selection named Direct, Distributed and Incremental selection techniques are proposed in this paper to increase the expected signal to interference and noise ratio based on full or partial knowledge of the channel state information (CSI). We also show that Distributed selection techniques provide all the SUs equal chances to be selected without affecting the selection diversity gain. General as well as simplified outage probability expressions are derived and extensive simulations are conducted to evaluate the performance of the proposed techniques and support the theoretical derivations. To accommodate more SUs, a new approach for asynchronous NBI estimation and mitigation in CR networks is investigated. Without any prior knowledge of the NBI characteristics and based on sparse signal recovery theory, the proposed approach allows the PU to exploit the sparsity of the SUs interference to recover it and approach the interference-free limit over practical ranges of NBI power levels.

Keywords: Cognitive network, interference mitigation, OFDM, Narrow-band interference, sparsity, compressive sensing.