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ANUP APREM

SPC Lab
ECE Department
Indian Institute of Science, Bangalore

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Paper 1

Multi-Band Cognitive Radio Spectrum Sensing for Quality-of-Service Traffic

Seung-Jun Kim
Dept. of ECE, University of Minnesota

Guobing Li
School of Electronic and Information Engineering, Xian Jiaotong University

Georgios B. Giannakis
Dept. of ECE, University of Minnesota

Contributions of Paper I

- **QoS Data:** Minimum Fixed Rate Transmission with low outage probability.
- To reduce spectrum sensing time, use Multi-Band(or Parallel) Sensing.
- Sensing at each band could be done by either Fixed Sample Sensing(FSS) or Sequential Probability Ratio Test(SPRT).
- Transmission Rate of CR network also limited by Primary Interference constraints.

Contributions of Paper II

- **Challenge:** Find optimum detector parameter based on the following constraints.
  - False Alarm at each band.
  - Miss Detection at each band.
  - Interference constraints due to miss detection.
  - SPRT: Random Stopping time of the tests.
- **Solution:**
  - Cast as a convex optimization problem.
  - Derive sample size for FSS and SPRT sensing algorithms.

Paper 2

Power Control for Cognitive Radio Networks Under Channel Uncertainty

Emiliano Dall
Dept. of ECE, University of Minnesota

Seung-Jun Kim
Dept. of ECE, University of Minnesota

Georgios B. Giannakis
Dept. of ECE, University of Minnesota

Silvano Pupolin
Dept. of Information Engineering , University of Padova

Contributions of Paper I

- **Model:** Spectrum Overlay Model: Secondary Users reuse the primary spectrum through
  - Accurately estimating CR interference to PU
  - Power Control of CR systems.
- **Difficulties:**
  - Reliability detecting PU transmission and accurately estimating CR-PU channels require considerable effort.
  - Challenging for Passive PU nodes.
  - Uncertainties due to small and large scale fading

Contributions of Paper II

- **Problem:** Maximize a weighted utility function of CR.
- **Solution:**
  - Exploit Statistical Channel of CR-PU link knowledge obtained through imperfect spectrum sensing / Channel Gain Cartography.
  - Optimal Solution via Sequential Geometric Programming.

Paper 3

Cognitive Multiple Access Network with Outage Margin in the Primary System

Behrouz Maham
School of Electrical and Computer Engineering, University of Tehran

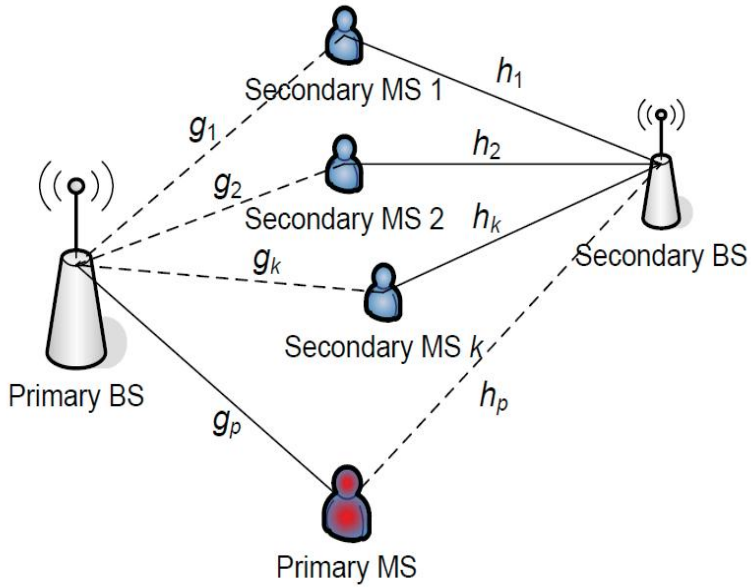
Petar Popovski
Department of Electronic Systems, Aalborg University, Aalborg, Denmark

Xiangyun Zhou
Research School of Engineering, Australian National University, Australia

Are Hjorungnes
UNIK ,University Graduate Center, University of Oslo, Norway

Contributions of Paper I

- **System Model**
  - Single primary link with multi-user uplink CR system.
  - Primary system tolerates an interference margin i.e. Outage Probability or SNR in the primary system at an acceptable value.



- **Problem:** Spectrally efficient operation of the secondary system under interference from the primary system.

Contributions of Paper II

- Secondary Receiver sees a MAC channel due to reception of secondary signal and primary signal. Opportunistic Interference Cancellation(OIC) used to improve secondary data rate.
- **Main Results:**
  - Resource allocation for sum-rate maximization of the secondary rates over a Gaussian MAC.
  - Closed form expressions for the outage probability at the primary user when there are multiple secondary interferes.
  - Set of ergodic capacity bounds and approximations are derived in secondary with rate adaptation using OIC scheme.
  - Power control schemes to maximize the secondary uplink capacity given the outage probability constraint.

Paper 4

Cooperative Spectrum Sensing Technique with Temporal Dispersive Reporting Channels

Angela Sara Cacciapuoti
University of Naple

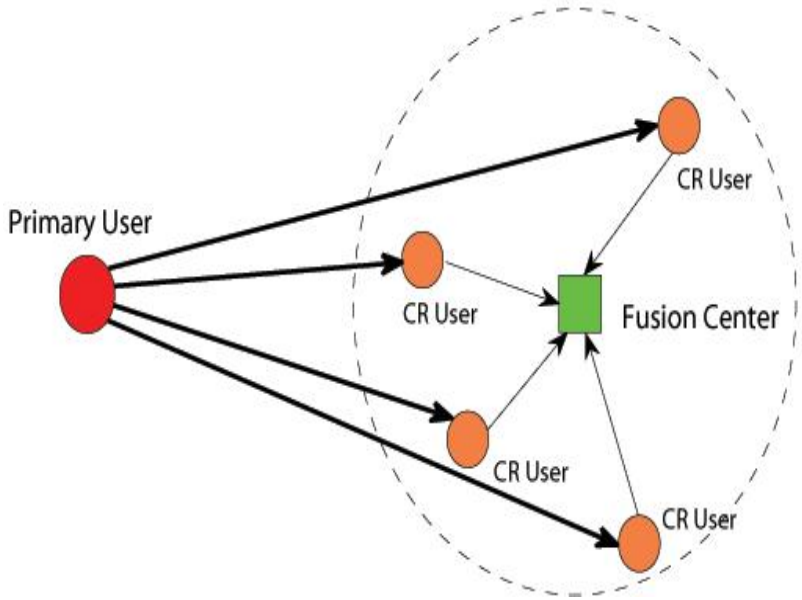
Marcello Caleffi
University of Naple

Domenico Izzo
CNIT, Naples

Luigi Paura
CNIT, Naples

Contributions of Paper I

- **System Model:** Cooperative Spectrum Sensing:
  - Fusion Center(FC) collects and combines the local sensing statistics from each cooperative CR user.
  - Reporting Channels affected by multipath frequency selective fading.



Contributions of Paper II

- **Main Results:**
  - Proposes 2 methods by maximizing the deflection coefficient at the FC.
    - Widely Linear(WL) combining FC Rule
    - Linear(L) Combining FC Rule
  - Closed form expressions of the detection and false alarm probabilities.
  - Numerical results show that WL outperforms the L detector in operative conditions of practical interest.
  - Theoretical Analysis for flat fading also. Under this setting L combining works equally well compared to WL combining.

Other Papers . . . I

- Design of OMC-MAC: An Opportunistic Multi-Channel MAC with QoS Provisioning for Distributed Cognitive Radio Networks
  Satish C. Jha, Umesh Phuyal, Mohammad M. Rashid, Vijay K. Bhargava
- Joint Channel Probing and Proportional Fair Scheduling in Wireless Networks
  Hui Zhou, Pingyi Fan, and Dongning Guo
- Performance of a Fast, Distributed Multiple Access Based Relay Selection Algorithm Under Imperfect Statistical Knowledge
  Virag Shah, Neelesh B. Mehta, and Dilip Bethanabhotla
- Range Estimation in Multicarrier Systems in the Presence of Interference: Performance Limits and Optimal Signal Design
  Yasir Karisan, Davide Dardari, Sinan Gezici, Antonio A. DAmico, and Umberto Mengali

Other Papers . . . II

- A Tradeoff Between Single-User and Multi-User MIMO Schemes in Multi-Rate Uplink WLANs
  Hu Jin, Bang Chul Jung, and Dan Keun Sung