



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكرو فيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

Sparsity Estimation for Cognitive Radio Systems Using Compressive Sensing

A Thesis submitted in partial fulfilment of the requirements of
the degree of

Master of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

by

Jiovana Elia Shouhdy

Bachelor of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

Higher Technological Institute 10th of Ramadan ,

Supervised By

Prof. Salwa Hussein Elramly

Assoc. Prof. Bassant Abdelhamid

Cairo - (2020)



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Statement

This thesis is submitted as a partial fulfilment of Master of Science in Electrical Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Thesis Abstract

Spectrum scarcity is one of the most challenges faced by new wireless technologies. The usage of new spectrum bands is highly required by operators to provide services with high data rates to many users.

Cognitive Radio (CR) is one of the solutions to solve the scarcity of the spectrum band. CR technology enables many users (licensed and unlicensed) to share the same spectrum band at the same time. This share occurs only in the case of no harmful interference between them depending on the strength of the spectrum sensing process. The sensing of wideband is a challenging problem due to its complexity. Thus, Compressive Sensing (CS) is introduced as one of the effective techniques to sense the wideband spectrum for CR system.

Using CS, the wideband status can be recovered using small number of samples much less than Nyquist rate. The wideband has the advantage that it is sparse in nature. Many algorithms are introduced to sense the wideband spectrum using CS. In literature, some papers aim to detect only the number of active licensed users without detecting their locations, i.e., these algorithms calculate the sparsity ratio of the sensed spectrum band only. Other algorithms specify the channels that are occupied by the licensed users. However, they require the prior knowledge of the sparsity ratio which is not practical. Others aim to jointly detect the number of the active bands and their frequencies. The latter is the thesis concern where it is more practical.

In this thesis, a joint, blind, cooperative and non-iterative algorithm is proposed to specify the busy/active channels by licensed users without prior knowledge of the sparsity ratio. The proposed algorithm is based on solving a convex problem to recover the data and using a threshold. This threshold is related to the signal energy. The proposed algorithm determines the sparsity ratio and the active frequencies/channels.

The proposed algorithm is evaluated using MATLAB. The results show good performance to detect the presence of active licensed (primary) users with low probability of false alarm. Moreover, the sensing time of the algorithm is suitable for the CR networks since it satisfies the standard IEEE 802.22.

Key words: Cognitive Radio, Compressive Sensing, Sparsity Estimation.

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