

# Optimal Spectrum-Hole Detection Scheme for Cooperative CRN Using Dynamic Weighted VIKOR

Jayakumar Loganathan, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, India  
S. Janakiraman, Pondicherry University, Pondicherry, India  
Ankur Dumka, Graphic Era Deemed to be University, Chennai, India

## ABSTRACT

In the future, the wireless network environment may suffer due to the unavailability of new spectrum bands. Cognitive radio research considers the current spectrum underutilization and provides a better model for the next-generation wireless environment. Since the implementation of the cognitive radio and its policies is a bigger challenge under static spectrum allocation, i.e., current wireless networks policy, many issues are in front of us to accomplish a better cognitive radio wireless environment. One of the major challenges is a secure transmission and efficient free channel selection. In this research, the authors considered an efficient free-channel selection scheme as objective and derived an integrated approach for free-channel selection with techniques, Dynamic weighted-VIKOR.

## KEYWORDS

Cooperative CRN, Multi-Criteria Decision Making, Spectrum Decision, VIKOR

## 1. INTRODUCTION

Cognitive radio (CR) is a form of wireless communication which consists of a transceiver that is capable of detecting which communication channels are in use and which are not in use and move into unoccupied channels while avoiding occupied ones. Cognitive radio is the most hopeful way for increasing the efficiency of the spectrum by providing opportunistic access to frequency bands to a group of unlicensed users. Increasing demand for internet usage and wireless application, the demand for radio spectrum will be very high in the coming years. Internet traffic has estimated as 100 GB for a day in the year of 1992, the same amount of traffic created per hour in 1997. In 2002, per second network traffic has calculated as 100GB and in 2014, the same traffic achieved in 400<sup>th</sup> of a second. From this study, if the usage of internet forecast for coming years, then 20-25% of the increase will be achieved every year. On the other hand, utilization of spectrum in some of the licensed bands are considerably very less, nearly 30% of the allocated spectrum only utilized on those bands, which is contradictory with the increasing demand of spectrum for various applications (Akyildiz et al., 2006). So, balancing the future requirement of spectrum for wireless applications, effectively licensed spectrum should be utilized for various applications. The cognitive radio network is one of the feasible

DOI: 10.4018/IJEIS.2020010106

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solutions for handling this exponential growth of network traffic in a future radio communication system by exploring underutilized spectrum opportunities (Kolodzy, 2002; Yucek & Arslan, 2009).

A number of researches had been conducted in various levels of CRN so far such as spectrum sensing, spectrum decision, network management, resource management, routing, etc., Spectrum sensing models propose a technique to find opportunities by using Listen Before Talk (LBT) method. Numerous sensing model has already been found, the energy detector is one which considered by most of them. Spectrum decision used to decide better channel with fewer chances of interference for transmission, here also various decision-making schemes from various areas such as game theory, Markovian, statistical prediction models are been considered (Kumar et al., 2017; Zhu et al., 2014; Taherpour et al., 2017; Ali & Homouda, 2017).

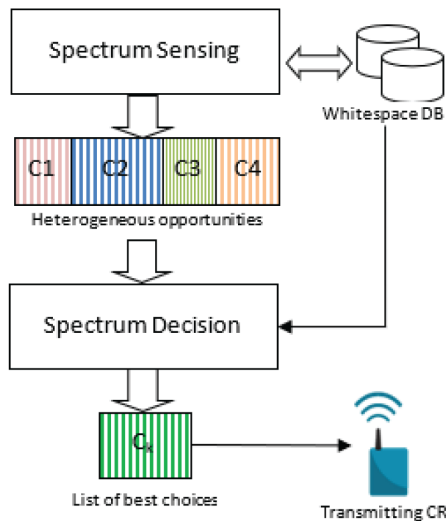
In this paper, we propose a novel spectrum decision making the process for cooperative CRN by using Multiple Criteria Decision making (MCDM) scheme. So far MCDM techniques are successfully used in operation management, decision problems and resource management. Each technique has its own merit and challenges with it. SAW (Kaliszewski & Podkopaev, 2016), TOPSIS (Kumar et al., 2017; Jayakumar et al., 2016; Tian et al., 2010), VIKOR (Liao et al., 2015; Wei & Lin, 2008; Gul et al., 2016), ELECTRE (Yu et al., 2018), PROMETHE (Shaher et al., 2017) are some familiar classical MCDM models. MOORA, ARAS and SWARA are a recent and simple model for making a decision from multiple numbers of alternatives. This paper makes the following list of contribution towards the channel decision model for cooperative CRN:

1. Finalizing the network model for implementing spectrum decision model for cooperative CRN;
2. Proposed spectrum decision-making model using an enhanced version of MCDM;
3. Validated the proposed model with other classical MCDM techniques.

## 2. SPECTRUM DECISION

Among many key tasks of CRN, spectrum decision is the most important task which directly related to the overall performance of CRN (see Figure 1). After completion of spectrum sensing, list of available

Figure 1. Spectrum sensing and decision model for CRN



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