**ON THE PERFORMANCE OF QUICKEST DETECTION SPECTRUM SENSING: THE CASE OF CUMULATIVE SUM**

**[1] S. Haykin, “Cognitive radio: Brain-empowered wireless communications,IEEE J. Sel. Areas Commun., vol. 23, no. 2, pp. 201–220,Feb. 2005.**

Cognitive radio is viewed as a novel approach for improving the utilization of a precious natural resource: the radio electromagnetic spectrum. The cognitive radio, built on a software-defined radio, is defined as an intelligent wireless communication system that is aware of its environment and uses the methodology of understanding-by-building to learn from the environment and adapt to statistical variations in the input stimuli, with two primary objectives in mind: • highly reliable communication whenever and wherever needed; • efficient utilization of the radio spectrum. Following the discussion of interference temperature as a new metric for the quantification and management of interference, the paper addresses three fundamental cognitive tasks. 1) Radio-scene analysis. 2) Channel-state estimation and predictive modeling. 3) Transmit-power control and dynamic spectrum management.

**Summary:**

Learned about the Cognitive radio and three fundamental cognitive tasks.

**[2] B. U. Kazi and G. A. Wainer, “Next generation wireless cellular networks: Ultra-dense multi-tier and multi-cell cooperation perspective,” Wireless Netw., vol. 25, no. 4, pp. 2041–2064, May 2019**.

The next generation wireless cellular network is aimed to address the demands of users and emerging use cases set by industries and academia for beyond 2020. Hence, The next generation 5G networks need to achieve very high data rates, ultra-high reliability, extremely low latency, energy efficiency and fully connected coverage. To meet these demands, ultra-dense networks (UDN) or ultra-dense heterogeneous networks (UDHetNet), millimeter wave (mmWave) and multicell cooperation such as coordinated multipoint (CoMP) are the three leading technology enablers. In this paper, we have made an extensive survey of the current literature on 5G wireless communication focusing on UDN, mmWave and CoMP cooperation. We first discuss the architecture and key technology enablers to achieve the goals of the 5G system. Subsequently, we make an in-depth survey of underlying novel ultra-dense heterogeneous networks, mmWave and multicell cooperation. Moreover, we summarize and compare some of the current achievements and research findings for UDHetNet, mmWave and CoMP. Finally, we discuss the major research challenges and open issues in this active area of research .

**Summary:**

Studied about UDHetNet, mmWave and CoMP, major research challenges and open issues in this active area of research .

**[3]**, “**Y. Ye, Y. Li, G. Lu, and F. Zhou, “Improved energy detection with Laplacian noise in cognitive radio,” IEEE Syst. J., vol. 13, no. 1, pp. 18–29, Mar. 2019.**

Spectrum Sensing (SS) plays an essential role in Cognitive Radio (CR) networks to diagnose the availability of frequency resources. In this paper, we aim to provide an in-depth survey on the most recent advances in SS for CR. We start by explaining the Half-Duplex and Full-Duplex paradigms, while focusing on the operating modes in the Full-Duplex. A thorough discussion of Full-Duplex operation modes from collision and throughput points of view is presented. Then, we discuss the use of learning techniques in enhancing the SS performance considering both local and cooperative sensing scenarios. In addition, recent SS applications for CR-based Internet of Things and Wireless Sensors Networks are presented. Furthermore, we survey the latest achievements in Spectrum Sensing as a Service, where the Internet of Things or the Wireless Sensor Networks may play an essential role in providing the CR network with the SS data. We also discuss the utilisation of CR for the 5th Generation and Beyond and its possible role in frequency allocation. With the advancement of telecommunication technologies, additional features should be ensured by SS such as the ability to explore different available channels and free space for transmission. As such, we highlight important future research axes and challenging points in SS for CR based on the current and emerging techniques in wireless communications.

**Summary:**

Studied the utilisation of CR for the 5th Generation and Beyond and its possible role in frequency allocation. With the advancement of telecommunication technologies, additional features should be ensured by SS

**[4] N. A. El-Alfi, H. M. Abdel-Atty, and M. A. Mohamed, “Sub-Nyquist cyclostationary detection of GFDM for wideband spectrum sensing,” IEEE Access, vol. 7, pp. 86403–86411, 2019.:**

Spectrum scarcity is a challenging problem in wireless communications: high data rates are needed to support 5G new technologies. However, the spectrum is underutilized. To address this problem, cognitive radio (CR) is proposed to exploit the underutilized spectrum. The main requirement for the future CR networks is wideband spectrum sensing, which provides secondary users with the available frequency bands across a wide frequency range. Secondary users should fill these bands without causing interference to licensed users. Thus, new waveforms are proposed for the 5G physical layer. Generalized frequency division multiplexing (GFDM) is considered to be a contender for the 5G new physical layer. The GFDM is a block-based waveform that is suitable for fragmented spectrum scenarios and is designed to overcome the drawbacks of orthogonal frequency-division multiplexing (OFDM) used in 4G. The GFDM is the perfect candidate for 5G and CR technologies. Considering the cyclostationarity properties of modulated signals, we propose an optimized recovery method for the GFDM signals in the wideband regime. By exploiting the signal sparsity, we can recover the spectral correlation function (SCF) of the GFDM from digital samples of the GFDM taken at a sub-Nyquist rate to reduce the sampling time. Furthermore, a generalized likelihood ratio test is applied to the recovered function to detect multiple signal sources and identify the spectrum occupancy. The numerical results show that our method achieves a high probability of detection at a low signal-to-noise ratio (SNR) with robustness in terms of rate reduction in wireless networks.

**Summary:**

Studied about the cyclostationarity properties of modulated signals, optimized recovery method for the GFDM signals in the wideband regime.

**[5] L H. V. Poor and O. Hadjiliadis, Quickest Detection. Cambridge,U.K.: Cambridge Univ. Press, 2008,**

The problem of detecting abrupt changes in the behavior of an observed signal or time series arises in a variety of fields, including climate modeling, finance, image analysis, and security. Quickest detection refers to real-time detection of such changes as quickly as possible after they occur. Using the framework of optimal stopping theory, this book describes the fundamentals underpinning the field, providing the background necessary to design, analyze, and understand quickest detection algorithms. For the first time the authors bring together results that were previously scattered across disparate disciplines, and provide a unified treatment of several different approaches to the quickest detection problem. This book is essential reading for anyone who wants to understand the basic statistical procedures for change detection from a fundamental viewpoint, and for those interested in theoretical questions of change detection. It is ideal for graduate students and researchers in engineering, statistics, economics, and finance..

**Summary:**

Learned about Quickest detection and a unified treatment of several different approaches to the quickest detection problem.