A Novel Idea of Implementing Birth-Death Process to Model SU Transmission in CRN Over MPC

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ABSTRACT

This article proposes a solution to address spectrum scarcity matter by providing birth-death process dealing with a secondary user (SU) transmission over multiple primary channels (MPC) in a cognitive radio network (CRN). By taking advantage of the under-use of spectrum resources of licensed users, CR systems can develop the use of radio spectrum efficiently. The SU must remain in the interweaving performance process and find spectrum gaps before transmission. Furthermore, both expected slots and transmission slots comprise the extended delivery time (EDT) for the secondary user. In order to model the cognitive transmission of the SU on MPC, especially the author has made a birth-death model. This strategy is referred to as an accurate probability density function (PDF) and probability mass function (PMF) of EDT of the secondary transmission for both continuous and periodic sensing cases. In this research, the author also represents numerical and simulation results to demonstrate analysis and mathematical expression.

KEYWORDS

Birth-Death Process, Cognitive Radio, EDT, Markov Chain, PDF, Radio Spectrum

INTRODUCTION

The demand for radio spectrum rapidly increased in today’s wireless communications industry and the cognitive radio (CR) is a promising technology which is developed to overcome these spectrum scarcities. Cognitive radio (CR) is one of the well-known sensing technologies for managing the problem of radio spectrum scarcity in the domain of wireless communication. The cognitive radio (CR) resolves the problem of radio spectrum by permitting unlicensed user (SU) frequency to use of under-utilized (Jiao et al., 2018) primary users (PUs) frequency without effecting the performance of the licensed user (PU) (Dappuri & Venkatesh, 2018). We proposed the model of a birth-death procedure for dealing with several primary users (PUs) for a cognitive transmission, in both non-periodical sensing and periodical sensing. To avoid interference the unlicensed user constantly checks the activities of licensed user for that specific channel. When the primary user comebacks on the transmission of the unlicensed user (SU), the unlicensed user will either change to some other unoccupied channel and keep signal transmitting or halt for an unoccupied channel before transmission, depending upon the licensed user activity of remaining channels. The case of several spectrum handoffs calculated on average extended delivery time (EDT) of a secondary packet in a cognitive radio network with many channels and users (Gupta et al., 2018; Gouda et al., 2018). In this paper, we investigate the birth-death procedure to analyze extended delivery time (EDT) for the unlicensed user (SU) packet transmission across several primary channels; our approach is utilized to gain the exact probability
density function (PDF) and probability mass function (PMF) of the extended delivery time (EDT) of a fixed-size secondary packet. The accuracy of this alternative progress is afterward checked by numerical simulations. To the best of our knowledge, the purpose birth-death procedure to design an unlicensed user (SU) communication throughout many primary channels is totally a novel theme by switching the channel from unlicensed user (SU) to licensed user (PU) when the birth occurred and when the death come it reverse switching from licensed user (PU) to unlicensed user (SU).

BACKGROUND

The chance of successful transmission in cooperative wireless communication on the complex waiting position was studied in (Kandeepan et al., 2011; Li et al., 2015) derived analytical limits in the output and transmission waits of secondary users in the cognitive radio network. Also, (Usman et al., 2015) derived the right formulas of the probability density function (PDF) for the extended delivery time (EDT) of the unlicensed user packet of predetermined duration and encourage utilized this formula to compute mean delay time in the secondary waiting line. As far as we distinguish, (Usman et al., 2015) is the just previous study where exact formulas for the probability density function are derived. Nevertheless, these formulas are partial derivative to just a licensed user channel and an unlicensed user channel. The author analyzes the service time expected to send a packet in an opportunistic spectrum entrance situation, where an unlicensed SU sends a packet utilizing the radio spectrum licensed to a licensed user (Luis et al., 2016). Also (Pla et al., 2019; Ryu et al., 2019) gives various Markovian examples that change the analysis and rating of detection strategies below a wide rate of conditions. The work of a channel by licensed users is designed as alternate normal and busy periods, which are delivered by a Markov level regeneration procedure. In (Lian et al., 2016) suggests a three-dimensional (3-D) multiuser channel representation for stratospheric multipath-fading channel. The birth-death procedure (BDP) is applied to design the non-stationary attributes that scatters “seen” and “unseen” on the array axes. The spatial coefficient of correlation of multiuser high-altitude platform multiple-input multiple-output channel is investigated to his research. In (Zwick et al., 2002) the scene and unseen of multipath elements throughout time is modeled as a birth and death procedure (BDP), as noticed Poisson procedure. This is the first-time the right modeling of spatial and temporal correlations. In every designing phase, route properties altered for granting to the movement of transmitter and receiver. The altering wait times of generation paths afford a naturalistic Doppler behavior of the channel. This technique permits an automated argument extraction for newly surroundings or frequencies. In (Al-Mathehaji et al., 2017), the trouble of propagation in ad hoc cognitive radio networks is demonstrated, present solutions for the trouble are explained and an healthy result for broadcasting grounded on graph theory to relate diverse local topologies is prepared. In our research we also used birth-death procedure (BDP) for the channel switching purpose while birth happen the one or more primary channels (licensed user) become free for unlicensed user means secondary user. Similarly, when death occur the primary channel (licensed user) become occupied and unlicensed user would switching from primary channel (licensed user) to secondary channel (unlicensed user). In Figure 1 shows multiple primary user and secondary user switching procedure as like as birth-death procedure.

BIRTH-DEATH PROCEDURE

A significant sub-class of Markov model with nonstop time variable space is birth and death procedures (BDPs), where the state space is the non-negative integers. These procedures are differentiated by the possessions that if a switching happens, then the switching go in front to an adjoining state. BDPs are commonly utilized as procedures of the increase of biological universes. A significant diversity of dynamics activities demonstrated by lots of species of plants, insects and animals has got induced huge importance in the growth of both biological researches and designing of various mathematical models. Queuing theory is one of the most significant areas of BDPs. It showed to be helpful in a
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