

FEATURE EXTRACTION OF THE RADIO SIGNALS USING ATTRIBUTE REDUCTION OF FORMAL CONCEPTS

JILIN YANG¹, ZHENG PEI², LI ZOU³ AND KEYUN QIN¹

¹Department of Applied Mathematics
Southwest Jiaotong University
No. 111, Sec. 1, Northern 2nd Ring Road, Chengdu 610031, P. R. China
yjl524@163.com; keyunqin@263.net

²School of Mathematics and Computer Engineering
Xihua University
Chengdu 610039, P. R. China
zhengpei@mail.xhu.edu.cn

³School of Computer and Information Technology
Liaoning Normal University
No. 850, Huanghe Road, Shahekou Dist., Dalian 116029, P. R. China
zoulicn@163.com

Received December 2009; revised April 2010

ABSTRACT. Radio signal recognition is an important aspect of radio signal processing. Feature extraction of radio signals is a key of radio signal recognition. In this paper, the formal context is proposed to describe the relation between signals and their features. Therefore, the theory and method of attribute reduction of formal concept lattice can be utilized to extract useful features. Attribute reduction of formal concept lattice based on similarity relation of attributes is discussed. The sufficient and necessary conditions, which are used to justify whether an attribute is the core, relative necessary or absolutely unnecessary, are proposed. All of these can be used to extract the core features of the radio signals. The experimental results show that we can easily and effectively extract useful features of radio signals by the proposed method in this paper.

Keywords: Radio signal processing, Feature extraction, Attribute reduction, Similarity relation, Concept lattice

1. **Introduction.** Nowadays, the radio signals are commonly used for civilian and military aims [1]. With the rapid development of radio-technics, radio signal processing is becoming increasingly important and attentive. At present, the majority of researchers focus on the study of radio signal processing based on classic signal theory, such as automatic modulation recognition (AMR) [2, 3], digital modulation recognition [4, 5], Fourier transform, cosine transform and Hartley transform for radio signal recognition [6, 7].

Monitoring of radio signal plays an important role in radio signal processing, aims of Monitoring of radio signal are to find interfering signals, judge the type of interfering signals, and eliminate interfering signals in order to protect the normal transmission of radio signals. C-band (download frequency band of satellite signals) monitoring is one of the important routine monitorings of radio signal. Once interfering signals (abnormal signals) appear in some frequency ranges, they will affect the normal reception of satellite signals. Therefore, it is particularly important to find the interfering signals accurately and in time. In the majority of the monitoring process, staff members judge and recognize a radio signal based on time, frequency and energy features which are showed by the frequency spectrum of frequency analyzer. It is almost impossible to monitor radio signal