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A NOVEL CACHE REPLACEMENT ALGORITHM FOR COOPERATIVE CACHING IN WIRELESS MULTIMEDIA SENSOR NETWORKS

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Abstract. *In recent years, integrated applications with multimedia devices and wireless sensor networks promoted the evolution of wireless sensor networks, namely wireless multimedia sensor networks (WMSNs). The applications in WMSNs have to focus on both energy saving and application-level quality of service (QoS). Due to the characteristics in WMSNs, such as resource constraints and variable channel capacity, efficiently achieving the application-level QoS in WMSNs is a challenging task. To overcome this challenge, in this paper, we proposed a new kind of pattern named temporal region requesting pattern (TRRP) and a novel algorithm named TRRP-Mine for mining TRRPs efficiently. We also designed a temporal region requesting cost function of cache replacement, abbreviated as TRRC, for the cooperative caching multimedia content in WMSNs. Empirical evaluations under various simulation conditions showed that the proposed method delivers excellent performance in terms of hit rate and the number of replacements.*
Keywords: Multimedia sensor networks, Cache replacement, Temporal region requesting pattern, Data mining

1. **Introduction.** As wireless technologies progressed rapidly [18] and embedded microsensing MEMS technology facilitated wireless sensor networks (WSNs), the applications of wireless sensor network had attracted extensive attention in the past decade. With the capabilities of widespread surveillance, sensor networks are applied to a lot of applications, such as the environmental data collection [7,13], localization system [9] and pervasive health applications [8]. In recent years, the application that integrates the cheap CMOS cameras with microphones over WSNs is becoming a trend, and this kind of WSNs is named Wireless Multimedia Sensor Networks (WMSNs) [1].

The existing studies of WSNs mainly focus on the energy saving problem [10,14]. Nevertheless, the challenges of developing the applications in WMSNs are not only the energy saving but also the quality of service (QoS) [6] issue in application-level. A general network layer metric for QoS is the network latency. The QoS in multimedia content delivery over Internet can be achieved through Diffserv [6] or Intserv [6]. However, such solutions for providing QoS over Internet face the severe bottlenecks due to the limited power and memory space of sensor nodes. An intuitive way to provide QoS in WMSNs is applying the caching technique to sensor nodes. Assume that each sensor node is equipped with a local storage and capable of caching a small number of requests. When a sensor node