

Storage and Retrieval of Multimedia Data about Unique Bulgarian Bells

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INTRODUCTION

The communication and information technologies have, in recent years, been introduced to all areas of public life. The development of services, which give possibilities for maintenance and dissemination of information, obtained from the examination of a national cultural – historical inheritance of the separate peoples is very important and actual.

One of the main aims of the presented article is to propose a Web based approach to managing an audio and video archive for unique Bulgarian bells (Trifonov & Georgieva, 2008a; Trifonov & Georgieva, 2008b; Trifonov & Georgieva, 2009a). Research and identification of several dozen of the most valuable bells in our churches, monasteries and museums has been performed. An audio and video archive is developed by using advanced technologies for analysis, reservation and data protection.

The storage of the collected data about the bells in a database makes suitable conditions for their analyzing with the purpose of extracting the previously unknown and potentially useful information. This is the basic motivation for applying the data warehousing and OLAP (*online analytical processing*) technology on the data about the bells. The main purpose of the system *bgBell/OLAP* (Trifonov & Georgieva-Trifonova, 2012a; Trifonov & Georgieva-Trifonova, 2012b) is to provide a possibility for monitoring and comparing the characteristics of the bells.

The goal of association rules mining is to find interesting associations or correlation relationships among a large dataset, i.e. to identify the sets of attributes-items, which frequently occur together and then to formulate the rules characterizing these relationships. Discovering the constraint-based association rules, introduced in (Fu

& Han, 1995), provides for the user the possibility to determine the format and partially the content of the returned rules. The users have the opportunity to issue the hypotheses on kind of constraints or templates. The system attempts to confirm those hypotheses by searching rules that satisfy the given constraints. The present article contains the description of an application, which discovers constraint-based association rules (Trifonov & Georgieva, 2009b; Trifonov, & Georgieva, 2009c).

BACKGROUND

Applying OLAP technology could solve important issues regarding databases storing information that is obtained from studding our cultural–historical inheritance. According to our research OLAP systems are not being implemented on the databases containing data about the bells. In this sense the proposed system *bgBell/OLAP* is unique. Its purpose is applying OLAP technology to exploring the data obtained from the client/server system for managing an audio and video archive for valuable Bulgarian bells. The developed system allows analyzing the sizes and the sounds of the bells by years, by locations, by creators, by types, etc.

In this article, we consider also discovering the association rules, being a data mining task (Kantardzic, 2003) in which the goal is to find interesting relationships between the attributes of the analyzed data. Once found, the association rules can be used for supporting decision making in different areas. An association rule shows the frequently occurring patterns of given data items in the database.

In numerous cases the algorithms generate a large number of association rules, often thousands or even millions. It is almost impossible for the end users to

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encompass or validate such a large number of association rules, limiting the results of the data mining is therefore helpful. The different approaches for reducing the number of the association rules are proposed. With some of them, only those rules that meet intended criteria are generated.

The constraint-based association rule mining aims to find all rules from given dataset, which satisfy the constraints required from the users. In (Ng, Lakshmanan, Han, & Pang, 1998) an algorithm for quickly discovering the association rules by including the constraints about items in the process for generation of the frequent itemsets, is proposed. By applying the constraints of the items and the combinations of the items, the items are chosen, consisting in the sake of the users, the association rules are generated from the obtained frequent itemsets.

For discovering only the rules corresponding to the specific patterns, in (Fu & Han, 1995) the meta-rules are applied. The format of the interesting rules is defined by using a template, the algorithm generates only these rules, which correspond to this template. In (Kamber, Han, & Chiang, 1997) a method for constraint-based meta-rule-guided mining of association rules, which explores the structure data cube, is proposed.

This article presents an application, which allows the user to set constraints for searched rules and finds

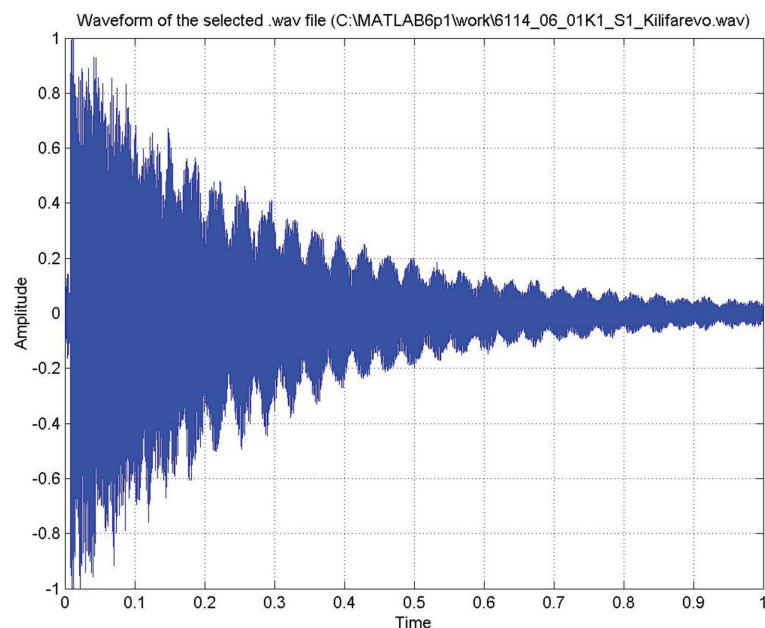
constraint-based association rules. The found correlation relationships from the result of the execution of the realized program reveal properties of the data, as it is at the branching dependencies (Georgieva, 2008), but they station themselves among the frequent common appearance of data items. The application is used for performing the association analysis on the different characteristics of the bells, the information for which is kept in an archive produced for the goal.

CLIENT/SERVER SYSTEM FOR MANAGING AN AUDIO AND VIDEO ARCHIVE FOR UNIQUE BULGARIAN BELLS

The developed client/server system provides users the possibility of accessing information about different characteristics of the bells according to their specific interests. The data of the archive is accessible from (The Bell Project, 2008).

A client application is realized with MatLab (Misiti, Misiti, Oppenheim, & Poggi, 2006; The MathWorks, 2013) for analysis of the sounds of the bells by using various methods for digital signal processing (DSP):

Figure 1. Waveform



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