Chapter 81
Trends in Managing Multimedia Semantics

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ABSTRACT

This paper reviews various efforts to define and capture the semantics of multimedia data. These efforts are particularly relevant to the problem of storing, managing and querying the semantic content of such data. Since there is not yet an accepted solution to the problem of how to represent, organize and manage multimedia data and the related semantics by means of a formal framework, this paper aims at providing some major research trends in this area. The focus is on ontologies, which allow the exchange of semantics of multimedia content between distributed information systems. This paper aims at reporting on recent trends in the development of multimedia ontologies.

INTRODUCTION

Audiovisual resources in the form of still pictures, graphical, 3D models, audio, speech, and video play an increasing pervasive role in our lives, and there will be a growing need to manage all these multimedia objects. This is a task of increasing importance for users who need to archive, organize, and search their multimedia collections in an appropriate fashion.

To cope with this situation, much effort has been put in developing standards both for multimedia data (natural and synthetic (e.g., photography, face animation), continuous and static (e.g., video, image)) and for data describing multimedia content (metadata). The aim is to describe open multimedia frameworks and achieve a reasonable and interoperable use of multimedia data in a distributed environment.

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The development and application of ontologies, as explicit formal knowledge bodies, in the multimedia domain aims at bridging the gap separating the available low-level multimedia descriptors and the noema of the information conveyed by multimedia objects.

The objective of this paper is to report on some recent trends in semantic technologies responding to the challenges of managing and accessing multimedia objects (images, audio, video, 3D material, etc.). After a brief introduction to the role of metadata in the multimedia domain, the need for a common understanding of the semantic relationships between metadata terms from different domains is stressed. The next section highlights the use of ontologies in the representation of the multimedia data, by giving an overview of the most well-known multimedia ontologies. Moreover, guidelines for multimedia ontologies construction are given. The works quoted are by no means exhaustive, but provide some indicative pointers in this direction. Finally, ontology matching is mentioned as "a new vision" of developing multimedia ontologies by reusing available multimedia knowledge resources, and of enabling interoperability between multimedia resources.

METADATA

Metadata are a representation of the administrative, descriptive, preservation, usage, and technical characteristics associated with multimedia objects; they can be extracted manually or automatically from multimedia documents. This value-added information helps bridge the semantic gap, described as: "The lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation" (Smeulders, Worring, Santini, Gupta, & Jain, 2000).

Because of the high cost and subjectivity associated with human-generated metadata, a large number of research initiatives are focusing on technologies that enable automatic classification and segmentation of digital resources. Many consortia are working on a number of projects to define multimedia metadata standards, in order to describe multimedia content in many different domains and to support sharing, exchanging, and interoperability across different platforms. They are distinguished in (Salvetti, Pieri, & Di Bono, 2004):

1. *Standardised description schemes* that are directly related to the representation of multimedia content for a specific domain (like METS, MPEG-7);
2. *Standardised metadata frameworks* that consider the possibility of integrating metadata standards mapped on different application domains, providing rich metadata models for media descriptions together with languages that allow one to define other description schemes for arbitrary domains (like PICS, RDF, MPEG-21).

For example, the vision of MPEG-21 is to define a multimedia framework that enables augmented and transparent use of multimedia resources across a wide range of networks and devices used by different communities. The intent is that this framework will cover the entire multimedia content delivery chain, including creation, production, delivery, personalization, presentation, and trade.

The development of metadata standards will increase the value of multimedia data, which are used by various applications. Nevertheless, there are disadvantages in current metadata representation schemes