A Multi-level Access Control Scheme For Multimedia Database

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1 Introduction

Security of multimedia database systems becomes a critical problem, especially with the proliferation of multimedia data and applications. One of the most challenging issues is to provide a content-based multimedia database access control that efficiently handles different user's access with possible fine-grained restrictions at a specific level of the multimedia data. However, the realization of such a model depends on other related research issues: (a) Efficient multimedia data analysis for supporting semantic visual concept representation; (b) Practical representation of the multimedia database; (c) Effective multimedia database indexing structure for content-based retrieval; (d) Development of a suitable access control.

2 Related Works

Several efforts have been reported in the literature to support a multi-level multimedia access control. Some of these works [CSZ04], [ZH08] aim to extend existing database access control models by providing new access modes beyond the conventional ones (i.e., read, write, execute); when others [EB03], [TH06] propose their own access control model. In both cases, we noticed that the same steps are followed: First, the entire video is segmented in multi-level access unit and stored in a hierarchy structure. Then, an indexing method is applied over the structure. Finally, a video access control model is presented to tell what kind of visual concepts should be detected and which access control rules should be applied on these visual concepts.

However, these approaches face many problems such as: (1) *Space inefficiency;* instead of adapting the user request on the multimedia data, multiple versions are stored in the multimedia database, where each is customized to meet user-based restrictions. (2) *Complexity;* the extraction and the segmentation techniques are done over the entire multimedia data regardless of the constraints in the user profile. The result is a multi-level hierarchical structure, complex for re-assembling the data when requested. Thus,

the time request for a video element becomes so expensive at the run-time due to the time processing of the authorization rules over this structure.

3 Proposed approach

In this work, we intend to present a new scheme that supports a multi-level security protection for multimedia data while considering temporal, spatial and contextual constraints based on restriction extracted from the user profile. The main idea of our work is to avoid an entire segmentation of the video and instead, to gradually treat it by means of a novel and efficient indexing method, as constraints are introduced. Then, these indexes are classified in an efficient hierarchy that maintains segments summaries as defined in MPEG-7. Thereby, when a new constraint is applied over a video, a data mining technique is executed to update the existing indexes by locating the segments containing salient objects. Only segments containing sensitive objects in the frames are stored independently in a blurred form. Then, they are indexed hierarchically so they can replace the corresponding originals one when reading the video. Finally, the access control is done by identifying segment summaries that should be applied to read the document.

From this viewpoint, this scheme remedies to the space efficiency, respectively to the request-time efficiency problem, since only one version of the video is stored in the database and the access to the data is straightforward thanks to the summaries.

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