Retrieval of Multimedia Documents by Imprecise Query Specification

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ABSTRACT

The retrieval process in multimedia document systems is inherently different from the retrieval process in traditional (record oriented) database systems. While the latter can be considered an exact process (records either satisfy the query or not), the former is not an exact process and the system must take into account the uncertainty factor (i.e. the answer is not only "true" or "false" but is often in between them).

Uncertainty is mainly introduced in evaluating how images and text components in documents are relevant to user’s queries. Moreover, it may be useful to give the user some flexibility in specifying the query on multimedia documents (i.e. the "importance" of different parts of the query). The possibility to specify imprecise queries in a system can significantly increase the effectiveness and the precision in the retrieval process on multimedia documents.

This approach is being tested extending the MULTOS system, a prototype system for the storage and retrieval of multimedia documents.
1. INTRODUCTION

A key problem in all application environments where documents have to be managed is the increasing amount of information that is being generated with wide use of documents in electronic form. This amount of data is likely to increase with the introduction of new tools dealing with multimedia documents.

A multimedia document can be defined as a collection of components which may contain different information in form of text, formatted attributes, images and voice. The components can be mixed and inter-related, and they may have an internal structure. As a result, these documents have complex structures which tend to differ from one document to another.

Editors for multimedia document creation and formatting [Hora86] are actually available, while multimedia document exchange is simplified by new tools for multimedia mail exchange [Thom85] and standards for document transmission [ODA85]. Many information systems are currently being developed that address the problem of multimedia document management (e.g. [Gibb87, Chri86]). In this paper we are particularly interested in analyzing the problem of efficient and effective retrieval of these documents.

The retrieval process has different characteristics in Database Management Systems (DBMS) and in Information Retrieval Systems (IRS). Retrieval in DBMSs is based on the exact evaluation of a boolean combination of predicates on attributes. Each attribute has a well defined domain and predicates which can be applied to it. It is possible to exactly determine in a DBMS when the query is satisfied or not. The answer to a query is the set of database records for which the query condition (i.e. the boolean combination of predicates on record attributes) evaluate to "true".

The Information Retrieval approach to document retrieval consists in retrieving all documents whose properties are similar to those present in the query. In the past, IRS research has focused on the problem of retrieving unstructured text documents from large document archives [Salt83]. Text retrieval techniques can be classified in two broad classes: exact match techniques and partial match techniques. The exact match retrieval techniques provide a basic token matching capability in that only the documents that exactly match with the specified query can be retrieved. The partial match retrieval techniques allow to retrieve the documents that match only partially with the query. However the exact match retrieval techniques have some disadvantages [Belk87] since:

a) documents whose representations match the query only partially are missed
b) retrieved documents cannot be ranked in relevance order
c) the relative importance of concepts either within the query or text cannot be taken into account.

These problems can be solved if partial match techniques are used. These techniques are more powerful that the exact match techniques as far as the effectiveness of the query results are concerned.

The IRS approach (better than the DBMS approach) could be applied also to structured multimedia documents. In fact, document retrieval may be viewed, in general, as a process of plausible inference [Rijs86] where the documents which can be plausibly implied by the query are retrieved. For example if D is a