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Toward a model for the representation of multimedia information based on users' needs: economic intelligence approach

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Multimedia information is rich and complex considering its heterogeneous nature: video, audio, text. A representation of this type of information based on its contents and its structure can allow for a high level of precision of description. The relevance of response will be still better if the representation takes into consideration the information needs of users, in particular the uses of these responses. In this study, firstly we present an outline of work relating to indexing and multimedia information representation. Secondly, we will demonstrate our approach of multimedia information representation based on the process of economic intelligence with our stimulated users' needs from multimedia information systems.

Key words: information, multimedia, representation, information needs, economic intelligence, usage context.

1. Introduction

The new information and communication technologies lead to an increase of multimedia information. The Internet, the television, the convergence of these two media and the digitalized archives constitute abundant sources of multimedia information. The problem of availability of information is no longer significant taking into account this quantity of information. We are faced with the difficulty of accessibility to relevant information.

Indeed, access to information was the subject of several research efforts. They are interested in finding relevant information and best response to user requests. Work relating to information systems proposed indexation and representation approaches which took into account the document (its contents, its organization and the characteristics of constituents of multimedia documents). On the other hand the uses of these results of information search are to our knowledge ignored. Our approach of representation of multimedia information considers on the one hand the information needs of user translated into "context of use" and on the other hand the characteristics of the "multimedia information". We propose to integrate the parameters which relate to information use in the representation of multimedia information.

2. Related works

As we have just indicated indexation and representation of multimedia information were the subject of several research. The three approaches used in several work in this area are: low level, high level and structure.

Low level: (or signal level) in this first case, the indexation of multimedia document is generally achieved automatically. The system indexes video through their visual contents. The descriptor known as of "low level" relates to the colour, texture, the form... These descriptors are "indexing elements attributes". To find multimedia information (as response to the request of a user) the system calculates the distances between the basic descriptors most similar to the image requested. A criticism to this approach is related to its low semantic level. This is because descriptors employed to represent the image do not account for the semantic aspect of the image [1] [2] [3] [4].

High level: (semantic approaches) the descriptors consider the history of the multimedia document, the title(s), the legends and its contents. This approach proposes an attachment of a set of descriptors of multimedia contents to the image or the video. These descriptors are of a conceptual level with an aim of measuring the resemblance between the descriptors and corresponding request. The descriptors can take different forms: it can be conceptual (ex: word), symbolic system (ex: diagram) or comparative (ex: another image). The semantic contents of the video for example are represented in layers [5]

Structural level: The third level is structural or cinematographic. The aim is to organize multimedia documents in hierarchical order. Multimedia document is composed of video; which can be seen in turn as sequences, scenes and shot. This organization is just a process of reconstruction of the document. However it is not

completely respected in most cases. As an improvement, Charhad et al [6] reported a “rational structure”. This structure incorporated the structural level and the semantic level. In this case the linear structure of the video does not permit access to semantic information which makes its use ambiguous. This calls for need to carry out a micro segmentation. For each plan it is a question of extracting a key image and segmenting a section of its area. Each area corresponds to a visual entity. Representation is done on these entities.

Indeed, these approaches of representation and indexation of multimedia documents take into account document contents, its organization and the characteristics of these components. On the other hand the users and the eventual use of retrieved information are not considered. We will explain the basis of our conception in the next section.

3. Multimedia information: Rich and complex information

Multimedia information is consistently a composite of images, sound and texts expressed and disseminated using a particular media. It is a set of information involving at least two elements of these three. This type of information draws its richness from the constituents of these three components. Multimedia information is complex considering the characteristics of its components and the type of relation between these components. These components are in their turn made up of sub-elements.

The information needs of users can be related to a document in its totality or a sub-set of the document. For example for a user (cinema teacher), “expert” in the field of cinematography may need information that may be directed to sub-set (sound track, shot...).

In a multimedia information system, a user who is aware of the stakes concerning the information needed and its contexts of use is more probable to find information the most suitable for his information need for better decision-making. Multimedia information as a type of information can help the decision-maker in his decision-making.

The objective of our approach is to facilitate the information search and to help in personalization of the responses suggested by the system. We propose the integration of parameters of users’ informational needs to the multimedia information research system and more precisely in the information representation.

To find relevant information; best responses to requests of the users, we propose an approach of multimedia information representation founded on users’ information needs in perspective of the eventual uses of retrieved information.

4. Integrations of users’ needs attributes into representation

Our approach is based on the process of economic intelligence as presented in 4.1. We try to satisfy users’ information needs by personalizing the answers to their requests. Indeed, this approach considers partly the information needs of potentials users of multimedia information system translated into “context of use” and secondly the characteristics of multimedia information (**Fig. 1**). We presented in section 1 three major approaches used in representing multimedia information. In our case, apart from borrowing from semantic organization and structural organization of multimedia information, we are integrating users need into multimedia information representation.

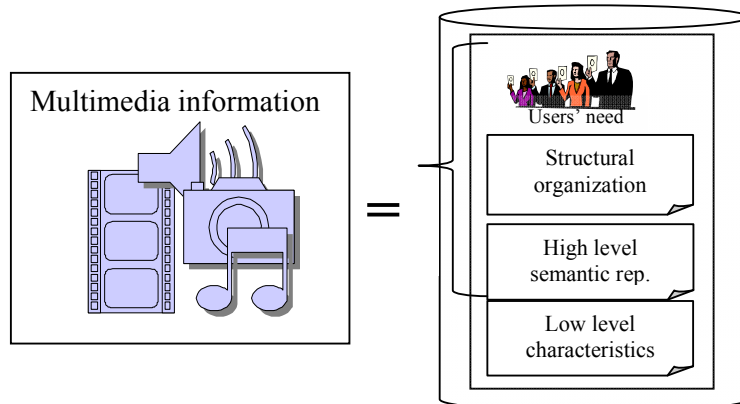


Fig. 1: Our approach in multimedia information representation

4.1 Economic intelligence process

Economic intelligence is considered as “all the coordinated actions of collection, processing and distributing of useful information for the economic actors with the aim of its exploitation. These actions are taken legally with all the guarantees of protection necessary for the protection of the company’s patrimony, in the best conditions of quality, of delay and of cost” [7]. According to David [8], IE process is a process made up of seven principal stages. These stages are presented as:

- a. Identification of a decisional problem
- b. Translation of a decisional problem to a information research problem
- c. Identification and validation of information sources
- d. Collect and validation of relevant information
- e. Processing and analysis of relevant information to produce indicators
- f. Interpretation of the indicators
- g. Decision making and application to the problem identified

The process of economic intelligence is an informational process. Indeed, the process starts with the identification of a decisional problem. This problem is translated into an information search problem. Collected information is processed, analyzed and presented for better decision making and applied to an identified problem.

To meet the information needs of the potential users of an information system we propose a user representation or a user model.

4.2 Information need

Our research application is related to cinematographic corpus. These are the collections of films proposed by the European Institute of Cinematography and Audiovisual (IECA). Our potentials users are: lecturers, students, multimedia producers and socio-economic actors such as mayors, deputies, artists... The information needs for all these users are not the same. In fact, information need corresponds to a lack of information for an individual in a situation. This lack of information prevents the individual from acting in an optimal way in a particular situation"[10]. In case of multimedia information and more specifically audiovisual cinematographic information, the expression of an information need is as complex as the information itself, taking into account the complexity of its contents; (the contents of the multimedia document) which can be divided into several facets. In this respect we think that a information need pre-supposes:

- **An expectation:** a user has his own translation/interpretation of his information need.
- **A usage, (the use of this information):** The user has certain intentions which guide his information need. The information will be used for a precise goal, in a particular context. To find relevant information to his needs, a user defines one or more context determination. An informational need is relative to a precise context. As stated before, our approach of multimedia information representation considers on the one hand the information user needs translated into “context of use” and on the other hand the characteristics of the “multimedia information”. The uses are in line with usage contexts. These contexts can be integrated into an information research system as multimedia information representation parameters. We can summarize our approach as follows: the representation of information is a function of the users’ information needs and these needs are functions of the context of usage or their future uses.

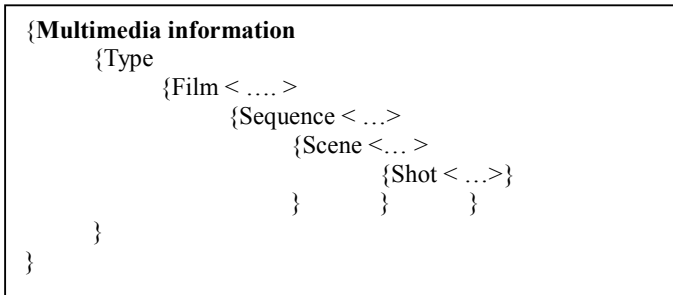
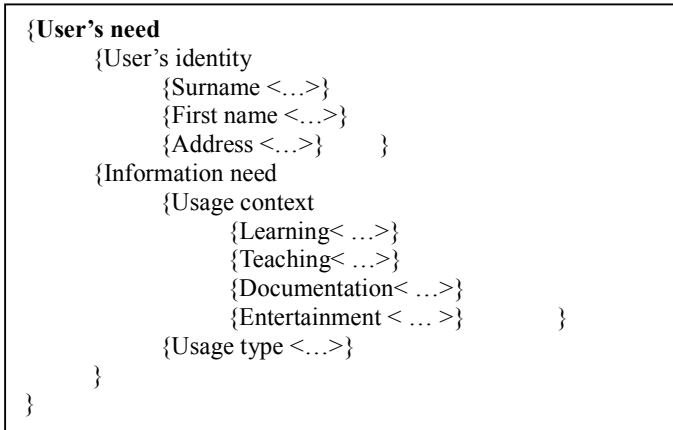
4.3 Context of use

As stated above the contexts of use of information are translations of users’ information needs. To identify the contexts of use of the information retrieved by the user, we first identified the user information needs, determined the possible uses of the retrieved information, and we classified these uses. After the classification, we studied and analyzed these contexts and we defined suitable contexts of use. We were able to differentiate four contexts of use: Learning Context, Teaching Contexts, Documentation Context and Entertainment Context. By identifying potential / possible context of later uses of information, the user will be able to precisely find the information which best meets his needs. These contexts are detailed in the next section.

The information usage contexts above are that contexts that we have chosen to illustrate our proposals on multimedia information representation.

4.4 Multimedia information representation model

Our model of multimedia information representation is expected to take into accounts user's information needs that are translated into information usage contexts. In order to show the relationship between the user's information need, we first present how we view the representation of the user's information need as a user model.



We present briefly the attributes of the two models as follows:

User's identity: User's identity can include surname, first name, postal address, activity and qualifications.

Information needs: Information need is obtained from the **usage context** of retrieved information. This context is seen from four perspectives: Learning, Teaching, documentation and Entertainment

Learning: This takes into account an activity that may be directly related to learning and task resolution. For example, multimedia documents may be used to understand knowledge evolution in cinematography, or mastering technical production of audiovisual document, presentation and reproduction of multimedia documents. In this case, the students learn some "technicalities" related to multimedia production and presentation using multimedia documents.

Teaching: This can be considered in relationship to a user-teacher. Teachers can prepare their courses, enhance their courses or support their courses with the use of multimedia documents. For example, it is not uncommon to see courses delivered with the use of specialized multimedia software like PowerPoint.

Documentation: Activities involving information archiving using multimedia documents are implied in this case.

Entertainment: One of the most active areas of the use multimedia document is in entertainment. It is practically impossible to enumerate all the developments in this area. There are numerous devices that are being produced today to meet the needs of multimedia usage in this area.

Usage type: We are interested in knowing how frequent a multimedia document is being used related to context of use. The use may be repetitive or occasional.

Multimedia information: This parameter corresponds to detail the possible attributes for representing multimedia information. In our case, we identified multimedia information type as series, television, news, film, clips, advertisement, announcements, etc...

Each of these multimedia information types was considered in detail. For example, a “film” can be considered as a set of sequence, scene, shot. We also look at the details of some of these sub-divisions. In the case of “Shot”, it is further considered in detail as image type, sound type, etc... We believe that the multimedia information representation should evolve with the user’s information needs. For example, the model should be able to integrate new attributes.

5. Implementation

Our work is implemented using METIORE system. This is a system of information research system which can manage various types of document. This system is an implementation of information access model EQUA²te [10] (Explore, Query, Analyse, and Annotate). METIORE makes it possible to obtain the co-occurrences of several values of attributes in the database. The user has the possibility of selecting several attributes which are posted in the form of hierarchy. The system allows a cross analysis of the values of these attributes. Relating this model with our work, a user can “explore” a multimedia database to see its composition. He may be interested in knowing all the “films” that were used as teaching aid. A user may even “Query” a multimedia database for the occurrence of a particular “shot” in the database. A user may also cross-analyse some attributes against defined values.

6. Conclusion

Taking into account the diversity of the user’s information needs and the complexity of multimedia information, we proposed our approach for multimedia information representation inspired by user’s information needs which accounts for the complexity of the document. We believe that this approach will make it possible on the one hand to identify the user’s information needs through the contexts of use of the results of information search and to describe as detailed as possible the multimedia document. With a representation of multimedia information which is based on the user’s needs, the response to requests of the user can be made more relevant.

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