User Interface for efficient querying in picture DBS

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Introduction

Increasing complexity of queries on the one side and UI limitations of new technologies (e.g. handheld devices) on other enforce new flexible and dynamic querying methods development. Experimental system for testing UI for efficient querying in picture DBS was built. New approach applied. This approach, based on a richer (than MPEG-7) picture description defined in XML allows more efficient querying.

UI for searching in picture DBS - XSL pipeline

The XSL transformation pipeline was designed to handle the problem of efficient querying. There are three types of transformations in XSL pipeline (see Fig. 1): **1.** transformation into internal format (for better querying - step 1 in Fig. 1); **2.** "new information derivation" transformation (for modifying query definition - steps 2 and 3 in Fig. 1); **3.** output transformation (for query result visualization and export to other data formats - step 4 in Fig.1). These transformations are specified by XSL. The use of XSL sheets helps the user to specify more complex queries (modifying queries - step 2 in Fig. 1) and reduce the number of interactions needed for successful querying (pre-defined XSL sheets see below). This advantage enables this method to be used in environment with limited UI (handheld devices, impaired people, etc.). For more details about implementation of the picture description creator and browser software applications see http://www.cgg.cvut.cz/Research/bis/.

Due to the application of XSL sheets for data transformation the experimental system can also be effectively used for testing new data formats based on XML (e.g. MPEG-7).

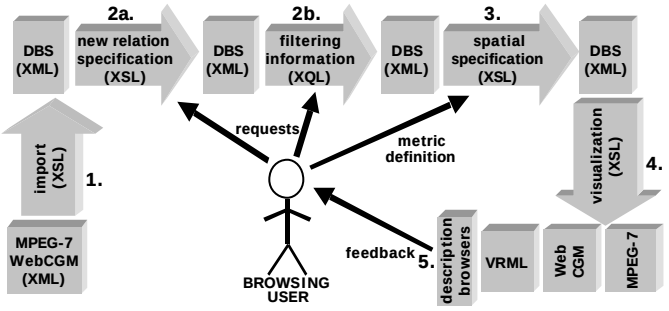

Fig. 1. XSL pipeline

Our new approach enables to pre-define XSL sheets. Pre-defined XSL sheets can be then easily used for specification of very complex queries in substantially simpler way (see Fig. 2). The simplicity of query specification is in practice very important mainly in application areas where user input is strongly limited (handheld devices - mobile phones, PDA). Mobile user for example can specify a complex request by simply choosing from pre-defined queries (XSL transformations). This dramatically reduces number of necessary interactions. Also the set of XSL sheets can be dynamically extended. The possibility to define sets of transformation sheets and to build from these sheets user defined transformation pipelines leads to a very dynamic and user tailored UI for querying.

Searching in picture description - method demonstration

In the following example we will demonstrate advantages of using relations among objects. We will show that this approach gives more precise search results.

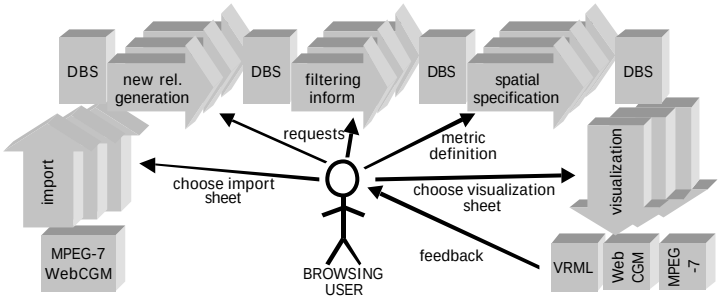

Fig. 2. Pre-defined dynamically changing XSL pipeline

Let us have the following set of pictures:

1. A man is herding a flock of sheep.
2. A man is walking into the mountains with a horse carrying his baggage.
3. A man is tilling a field. A cow is pulling a plow.
4. A man is tilling a field. A horse is pulling a plow.
5. A man is sitting in front of the tent. There is also a horse running in the background.

We have specified the following queries:

A. Find a man in relation to an animal.
B. Find any object in relation to a horse.
C. Find a man in direct relation with a horse.
D. Find a man having any relation to any object, which is pulled by an animal.
E. Find a man who is pulling a plow.

In the following table you can find brief comparison of two approaches to searching in pictures specified above: (a) using objects and relation among them, (b) using object only for picture specification. The numbers in the result columns defines serial numbers of pictures matching a particular query. Column "Difference" indicates difference between a search using relations and a search not using relations (Reduction/Enlargement means that the number of pictures found by our algorithm is less/greater then by a traditional algorithm).

Query id	Result using relations	Result without using relations	Difference
A	1,2,3,4	1,2,3,4,5	Reduction
B	2,4	2,4,5	Reduction
C	2	2,4,5	Reduction
D	3,4	query can't be defined*	Enlargement
E	-	3,4	Reduction

* The query is too complex to be defined only by keywords.

Table 1: Search results and comparison

Analyzing these results in the table we can say that search results based on our method fit more precisely to the meaning of the queries. Without using relations we obtain as a result too many pictures (query A, B, C, E) or the query can not be specified (query D).

Future work

In the near future we will focus on the problem of visualization of large information spaces (represented by picture DBS). In the XSL pipeline (see Fig. 1) it is step 3 - "adding visual information to non-visual description" and step 4 - "visualization of information". Particular attention will be paid to visualization in a 3D environment.

References

[MPEG] MPEG-7 from ISO/IEC JTC1/SC29/WG11 2000: http://mpeg-7.com/inf/

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