

Users Requirements in Audiovisual Search: A Quantitative Approach

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Abstract. This paper reports on the results of a quantitative analysis of user requirements for audiovisual search that allow the categorisation of requirements and to compare requirements across user groups. The categorisation provides clear directions with respect to the prioritisation of system features from the perspective of the development of systems for specific, single user groups and systems that have a more general target user group.

1 Introduction

A key component for the “business model” that allows the significant investment in restoration, conservation and digitisation of audiovisual content is to enable its access. The data quantities that audiovisual archives are dealing with on the one hand, and the needs for content descriptors that vary depending on the access requirements of different user groups on the other hand, force archives to re-evaluate their annotation strategies and access models. Advanced search technology on top of automatic content analysis and social tagging strategies plays an important role in these access models but its implementation can only be successful provided that it aligns well with user needs.

In this paper we zoom in on the requirements that users have when they engage into searching an audiovisual archive using advanced search technology. Typically, user requirement studies use qualitative methods (e.g., [2]), transaction log analysis (e.g., [4]) or investigated specific parts of a system such as browsing interfaces for a digital library consisting of videos [8]. Although qualitative user studies provide valuable insights into the diversity of requirements specific to users, content features or system parts, it is usually difficult to translate the results directly into guidelines that help development and implementation. Therefore, we deploy a *quantitative* approach that allows us to categorise user requirements according to different user groups and to prioritise the implementation of system features for each group. We anticipate here on the assumption that each group may require its own specific implementation of the system.

In order to structure the needs of different groups of users and allow a quantitative comparison of groups, we use the so-called “concept mapping” method [11,5] that combines a structured data collection approach with various types of data analyses such as multidimensional scaling (MDS) [7] and hierarchical cluster analysis (HCA) [3]. Concept mapping has been applied to a wide range of topics, such as the needs analysis for social recommendation system [10], defining the concepts of mobile learning [1] and the evaluation and design of digital libraries [9]. This paper reports on this quantitative approach.

2 Method

Concept mapping consists of two phases: first, the idea generation phase, followed by the sorting and rating of the ideas. In the idea generation phase, participants are asked to provide their individual ideas –also referred to as “statements”– about a particular topic. In our study those statements represent requirements. In the sorting and rating phase, participants are provided with the statements generated by all of the participants. The task is then to order the statements, e.g., on the basis of importance as perceived by the individual participant of the study. In addition, participants are instructed to group statements into categories and provide for each category a meaningful label, i.e., a textual description of the category. The criteria for categorising statements are left to the participant.

When different groups of participants are selected to take part in the study –e.g., based on gender or profession–, appreciation of statements and correlations between groups of statements can be compared across these groups.

For our study we slightly change the standard procedure of the concept mapping method. Instead of asking participants to generate ideas on audiovisual search, we use a list of 71 “ideas” collected in previous requirements studies [6] on audiovisual search in interview sessions, group elicitation sessions using mock-ups, and on-line surveys focusing on the different user groups. The reason for following this approach is that we estimate that by leaving the generation of statements to the participants, we run the risk of ending up with a sparse list of statements due to the unfamiliarity of participants with audiovisual search. By introducing the main concepts of audiovisual search and showing participants mock-ups and prototype systems, this unfamiliarity issue could be solved during earlier studies, but such an approach is logistically not feasible for the concept mapping study.

We translated the 71 requirements from the interview and elicitation sessions into comprehensive statements. As it is important that the statements are self-explanatory and unambiguous for individuals that are not acquainted with audiovisual search technology, we convert the technically oriented formulation of requirements into a form that is understandable for non-experts.

2.1 User Groups and Participants

We differentiate into three groups –broadcast professionals, academic researchers and journalists, and home users– based on a study on use scenarios and user goals (targets) related to the use of audiovisual access technology that took place in the course of the earlier requirements studies mentioned above. Within the group that we label as media professionals we identify broadcast professionals, focusing on searching for relevant audiovisual content for *reuse*. As the target goal of the academic educators (*educate*) may include targets from both the journalist group (*investigate*) and academic research group (*research*) we leave out academic educators. The target for the home users we label as *entertainment/edutainment*.

In total 47 representatives from each of the three user groups take part in the concept mapping study. For the broadcast professionals group, we invited 15 individuals, 14 scholars from the humanities and 3 journalists represent the “academic researchers

and journalists” group and a total of 15 home users matching a pre-defined profile – familiarity with computer work (using applications such as Facebook and YouTube) but without any background knowledge on audiovisual search technology– participate.

2.2 Rating Procedure

We use a web-interface to present the statements in random order and tell the participants that the statements were generated by asking potential users the following trigger question: *What would you like from a system when you are searching for videos?* We then ask the participants to categorise the statements according to perceived similarity, providing them with the following instructions: first read through the complete list of statements; then, categorise the statements by either creating a new category for a statement, or moving a statement to an already created category; make sure that every statement is put somewhere; finally, label each category with a description that represents the category as good as possible.

Participants are free to sort the statements into as many groups as they like although they are informed that in most cases using 10-20 groups should work out well. After sorting the statements, we ask the participants to rate each of the statements according to *desirability* on a scale between 1 and 5 where 1 means undesirable and 5 means very desirable.

3 Results

3.1 Requirements Categorisation

Using the category labels created by participants in combination with an analysis of the keywords that are present within the statements, we identify 10 categories of user requirements, listed in the left column of Table 1.

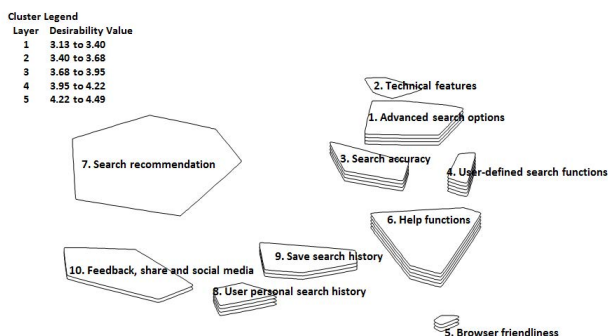
In Figure 1 the 10 categories are visualised with labels for the individual categories. The amount of layers (e.g., one layer for the category “Search recommendation” and three layers for “Search accuracy”) give a visual indication of the desirability of the statements in the particular categories.

The average rating for each of the categories is provided in the right column of Table 1. The category *User-defined search functions* has only four statements but each statement is rated high so that it achieves the highest overall rating. This suggests that this category of requirements is very important for system development. When we look at the statements connected to this category, it is interesting to note that from a technical point of view these requirements relate to different aspects of search: ordering of results, application of filters and the use of Boolean operators during search. This suggests that during system development the implementation of these requirements should not be addressed in isolation.

The high ranking of the category “Help functions” also stands out. When looking at the individual statements of this category however, we see that the category label may be misleading. With “Help functions” one may expect system functionalities within this category such as represented by the statement: “The system should include a help

Table 1. Categories and their average rating

Category	Average Rating
User-defined search functions	4.49
Help functions	4.30
Advanced search options	4.13
Search accuracy	3.99
User personal search history	3.95
Browser friendliness	3.74
Save search history	3.73
Feedback, share and social media	3.60
Search recommendation	3.31
Technical features	3.13

**Fig. 1.** Visualisation of a 10-category map with category labels. The layers give a visual indication of the average desirability rating for that category.

manual that explains how to use the system”. However, the requirements in this category rather point to a smooth, clear and transparent functioning of the system: results that load quickly, being able to view and navigate through the videos, transparent about filters that are active, alternatives for spelling mistakes, consistent results for a query, a clear and user-friendly interface, and of course also guidance for using the system via manuals.

In the light of the discussion about the re-evaluation of annotation strategies and access models in audiovisual archives, the high ranking of requirements related to “Advanced search functionalities” is interesting. The statements in this category indicate that users are eager to make use of complex search strategies for searching, are interested in alternative access-points to the collections such as persons (who is speaking, who appears) and events, and are willing to deploy alternative types of annotations such as speech transcripts. However, according to the category labelled with “Technical features” users seem to have less interest in searching on the basis of annotations that are often associated with technical metadata such as shot types, camera movement and black and white versus colour.

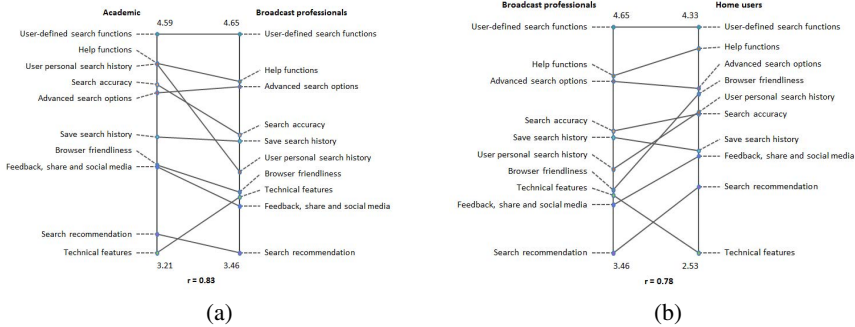


Fig. 2. Comparison of requirement category ranking of academics/journalists vs. broadcast professionals (a) and of broadcast professionals vs. home users (b)

3.2 User Group Comparison

To compare the ranking of requirement categories across the identified user groups we compute the correlation of requirements categories between groups. Figure 2 (a) shows for the academic researchers and the broadcast professionals the average desirability of requirement categories. Although the correlation between the two groups is relatively high ($r = 0.83$) it is clear that some categories are ranked rather differently, such as the category “User personal search history” that is highly desired by the academics group and less by the broadcast professionals. In contrast and as expected, broadcast professionals are more interested than academics in searching the more technical features of videos.

Similarly, Figure 2 (b) illustrates how broadcast professionals compare with home users with respect to the ranking of requirement categories. The correlation between these two groups is again relatively high ($r = 0.78$). The most notable differences between the groups are the substantially higher rating of browser friendliness (e.g., working on various brands and on mobile devices) and personal search history (e.g., saving search histories) by home users, and again the higher preference for searching technical information with the broadcast professionals.

4 Conclusion and Future Work

In this paper we report on the results of a quantitative analysis of user requirements for audiovisual search. We apply a method referred to as concept mapping to structure requirements that were obtained using a combination of qualitative requirement studies, and compare these across three types of users: home users, academic researchers and journalists, and broadcast professionals.

The analysis provides us with a ranked list of 10 categories defined by users that give clear directions with respect to the prioritisation of system features from both an individual and a multiple user group perspective. For example, the study reveals the relative importance for all user groups of three aspects of a search system: (i) the proper handling of basic search functions such as Boolean search, filtering and result presentation,

(ii) the clear, smooth, consistent and transparent functioning of the system as a whole, and (iii) the availability of advanced search options with alternative access-points to the collections.

With respect to the comparison of different user types, we found that broadcast professionals compare better with academics and journalists than with home users, and that a category such as *Technical features* are typically desired by broadcast professionals. On the other hand, a category such as *Help functions* is more desired by home users and academics compared to broadcast professionals.

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