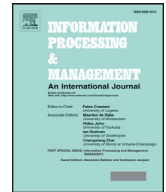


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Finding cultural heritage images through a Dual-Perspective Navigation Framework[☆]

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ABSTRACT

With the increasing volume of digital images, improving techniques for image *findability* is receiving heightened attention. The cultural heritage sector, with its vast resource of images, has realized the value of social tags and started using tags in parallel with controlled vocabularies to increase the odds of users finding images of interest. The research presented in this paper develops the Dual-Perspective Navigation Framework (DPNF), which integrates controlled vocabularies and social tags to represent the aboutness of an item more comprehensively, in order that the information scent can be maximized to facilitate resource findability.

DPNF utilizes the mechanisms of faceted browsing and tag-based navigation to offer a seamless interaction between experts' subject headings and public tags during image search. In a controlled user study, participants effectively completed more exploratory tasks with the DPNF interface than with the tag-only interface. DPNF is more efficient than both single descriptor interfaces (subject heading-only and tag-only interfaces). Participants spent significantly less time, fewer interface interactions, and less back tracking to complete an exploratory task without an extra workload. In addition, participants were more satisfied with the DPNF interface than with the others. The findings of this study can assist interface designers struggling with what information is most helpful to users and facilitate searching tasks. It also maximizes end users' chances of finding target images by engaging image information from two sources: the professionals' description of items in a collection and the crowd's assignment of social tags.

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1. Introduction

Image search has been an important problem in the area of information access. Over the years, museums, news archives, and other key stakeholders established and perfected two ways of helping users to find relevant images – keyword-based search and metadata-based search. Yet, the rapid rise of online sharing of digital images challenges both approaches. While keyword-based search is still popular as demonstrated by Google image search,¹ extracting relevant keywords to describe

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¹ <https://www.google.com/imghp?hl=en&tab=wi>.

an image has become increasingly more problematic since many images are now published online without any textual descriptions.

Classical image metadata (known as subject headings in the museum context) supports both search and browsing (e.g., faceted browsing) but requires significant manual generation effort that is a challenge for large-scale image collections. It is still difficult for automatically generated metadata to match the quality of that created by professional indexers. At the same time, professionally generated metadata suffers from the classic *indexer-user mismatch problem*: non-professional end-users usually perceive items in a different manner than professional indexers. As a result, it has become increasingly difficult for the majority of end-users to find even properly processed and indexed images. The growing volume of content combined with the pressures of time, money, and competition means that the need to improve techniques for *findability* (Morville, 2005) of images is now becoming a critical issue.

In this context, social tagging has emerged as an alternative crowd-powered mechanism to generate textual descriptors that bring out the *aboutness* of the images so that effective and efficient browsing and keyword-based access to images can be achieved. *Aboutness* indicates the subject or topic that an item refers to from a user's perspective (Fairthorne, 1969). Different users with different perspectives may generate different descriptors for *aboutness*. In this study, we use aboutness to capture the main concept(s) expressed in an image. It can be the most significant characteristics of the image, such as the theme, the main character(s), the obvious attributes, and so on.

The diversity of input sources and the engagement of end users in the process of image description give modern social tagging systems tremendous power to assist users in finding images. Yet, tag-based access has its own problems, such as the lack of structure, semantic ambiguity, and wrong assignment, which may decrease the accuracy of the aboutness represented by social tags.

It is easy to see that components of both the metadata-based and tag-based approaches to image access have their own merits, which is why our paper develops a hybrid approach, Dual-Perspective Navigation Framework (DPNF), that includes both experts' and general users' descriptors to represent more comprehensive *aboutness* of an item. We argue that this hybrid approach can increase the completeness of the *aboutness* from diverse points of view and enhance the item's *findability*.

The cultural heritage sector, with its vast resource of images, has realized the value of social tags and proposed the integration of folksonomies and controlled vocabularies for increasing the odds of users finding items of interest (Hayman & Lothian, 2007; Rolla, 2009; Steele, 2009). However, the majority of the research on integrating experts' annotations and social tags has focused on how to utilize controlled vocabularies to structure folksonomies, which are taxonomies created by multiple users (Peters, 2009). A smaller thread, known as the multiple interface approach (McGrener, Baecker, & Booth, 2002), explored the idea of using both professional index terms and social tags independently, but in parallel with one another, by offering multiple types of navigational support for users' various information needs.

By contrast, the approach presented in this paper focuses on a true integration of these two *aboutness* descriptors to facilitate resource finding. That is, tags and metadata are integrated in our approach in such way that they reinforce their strengths without changing their nature or forcing users to choose one means over the other. Our DPNF approach is an interface-level integration of tag-based and metadata-based information access mechanisms.

DPNF utilizes the mechanisms of faceted browsing and tag-based navigation in its design of seamless interaction between experts' subject headings and public tags to maximize information scent (Pirolli, 2007) and facilitate the image search. Users are able to start their search via a traditional keyword query, a specific subject heading, or a tag, then progressively narrow down the search results using both subject headings and tags. The presence of hierarchical facets of subject headings and a flat cloud of tags allows users to search with more flexibility and to specify their interests more precisely using the structure of different types of information descriptors. To assess whether DPNF does, in fact, support efficient and effective user-oriented image finding, we performed a controlled user study, which is reported in this paper.

The remainder of the paper is organized as follows: Section 2 reviews the related work, including the applied background theories and relevant research in the area of image finding; Section 3 introduces our approach – the Dual-Perspective Navigation Framework (DPNF); Section 4 demonstrates our research process including our data collection, system design, and experimental design, the research tasks involved, and the procedure of the user study; Section 5 discusses research results; and Section 6 offers a discussion with a further analysis. Section 7 concludes the important findings of this research.

2. Related work

2.1. Background theories

Aboutness of a document is a term coined by Fairthorne (1969), which indicates the subject or topic described in the document, and can be expressed by assigned or extracted index descriptors. Aboutness is known to be hard to capture accurately (Hjørland, 1992), and Maron and Studies (1977) provided an operational definition in relation to search behavior: S-about (subjective aboutness), O-about (objective aboutness), and R-about (generalized objective aboutness for a specific community). In the image finding domain, several studies (Armitage & Enser, 1997; Hollink, Schreiber, Wielinga, & Worring, 2004; Jørgensen, 1998) have explored the importance of image descriptions from different perspectives. Our DPNF model is situated within the broader context of the aboutness paradigm. It suggests that both experts' and general users' descriptions can provide the dual-perspectives of aboutness, which can then be integrated into an interface to support image finding. Although information retrieval based on the aboutness of a document may use the title, description, keywords, headings,

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