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Visualizing OPAC subject headings

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Abstract

Purpose – This paper aims at providing a robust, user-friendly and efficient navigation procedure in an online library catalog that is based on semantic information encapsulated within subject headings.

Design/methodology/approach – The paper describes an interactive navigation procedure inside an online library catalog based on semantic information. The proposed approach is presented through a web-based, prototype application following the most recent trends of the semantic web such as AJAX technology and the web ontology language – OWL for encoding semantics.

Findings – According to the proposed method, a GUI interface exposes the hierarchy of the subject headings employed within an OPAC, as well as all stated relations between such headings, as links that the user can follow, effectively traversing the ontology and formulating at the same time the actual query to the underlying OPAC. This act of interactive navigation through the library's assets aids searchers in accurately formulating their queries, by offering broader or narrower concepts for selection or indicating alternative or related concepts they might be initially unaware of. The augmented exposition of inter-relations between concepts provides multiple paths for information retrieval and enables searchers to fulfill their information needs in a faster, more efficient and intuitive manner.

Practical implications – The paper includes implications for the development of modern, semantic web applications focused on the library domain. The novel approach of visualizing subject headings could be further extended to visualize a number of other conceptualizations of the library domain.

Originality/value – This paper fulfils an identified need to take advantage of the "hidden knowledge" existing within the library domain but, for a number of reasons, is never exposed to the library users.

Keywords Information retrieval, Libraries, Online catalogues, Subject heading lists

Paper type Conceptual paper

Introduction

Nowadays, libraries across the world employ online public access catalog (OPAC) systems in order to facilitate quick access to their content (Leeves *et al.*, 1994). Such content refers to a registry of information entities considered as library material such as books, computer files, magazines, etc. Many times, information entities within a library are well described in various ways through the employment of semantic-enabled technologies such as thesauri, controlled vocabularies, etc.

As far as information retrieval is concerned, however, most of the times OPACs do not take advantage of the expressiveness of information deriving from such technologies and remain antiquated browsing interfaces relying on static structures with crude search tools useful only for locating specified materials (Bennett, 2006). Thus, the graphical user interface (GUI) seems to prevent users from exploiting the functionality deriving from the employment of such technologies.

The proposed paper aims at providing a robust, user-friendly and at the same time efficient navigation procedure in an online library catalog that is based on semantic information. Instead of relying on a static, predefined hierarchical navigation structure, which forces users to follow certain paths, the proposed navigation procedure relies on

a dynamic, interactive graph-based structure. Such a structure may be encoded in a variety of semantic-aware technologies implementing subject-based classification (Garshol, 2004) such as thesauri, taxonomies, ontologies, etc. The ultimate goal of the navigation procedure is to guide users in locating useful information as accurately and efficiently as possible. In order to demonstrate the functionality of the proposed navigation procedure, a prototype system has been developed, which refers to an ontology-based, information retrieval application integrated within a typical OPAC

The origin of semantics

Semantics have been in the neighborhood for quite some time now, long before the emergence of library-related tools such as thesauri or ontologies. The knowledge management (KM) community has produced considerable work aiming at instructing machines on how to comprehend the semantics of information that they possess, in order to develop software capable of managing knowledge instead of plain information.

Despite the initial promising results, however, things did not evolve the way most members of the KM community anticipated. Mapping human behavior and wisdom proved to be particularly complex and subjective among KM researchers. Consequently, mostly monolithic systems and theories have been developed, all featuring certain advantages but also drawbacks when compared against each other. The point is that the absence of collaboration between the members of this community and the inherent heterogeneity of the resulting products, prevent the wider dissemination and establishment of very significant findings.

Such diversity is inherited to the library domain where semantic – aware technologies (e.g. thesauri, controlled vocabularies, etc.) do not seem to be based on well-accepted standards. More specifically, the existence of standards for defining the general principles upon which such technologies should be based (ISO 2788:1986 (ISO, 1986), ISO 5964:1985 (ISO, 1985)), does not seem to be enough to ensure semantic interoperability between applications and between applications and their users. There is limited interoperability between tools and digital resources employing different thesauri (Doerr, 2001). The lack of standardization in a more technical level is perhaps the most important reason why such technologies despite their vast capabilities in expressing information, so far do not seem to be popular among the members of the library community.

The advent of the semantic web (Berners-Lee *et al.*, 2001) could be considered as a movement towards the right direction as far as the library domain is concerned. The diversity, bulkiness and chaotic nature of the web forced the web community to rely on standards for the foundation of this environment. In this context, the semantic web provides the necessary technological infrastructure for the development of semantic-aware library services.

The next section describes an interactive navigation procedure inside an online library catalog based on semantic information. The proposed approach is presented through a web-based, prototype application following the most recent trends of the semantic web such as AJAX technology and the web ontology language – OWL for encoding semantics.

Library catalog browsing application

This approach will be presented through a prototype web application, the goal of which is to provide accurate navigation and thus efficient information retrieval over a typical online library catalog. This is accomplished by exposing existing semantic (metadata) information in an intuitive and at the same time user-friendly fashion.

The building block of the proposed approach is the employment of ontologies. Specifically, as illustrated in Figure 1, users interact with the online library catalog through the prototype application that is based on an AJAX-powered web GUI. The online library catalog is managed by a software module named "semantic catalog manager," capable of integrating semantic information obtained through ontologies (i.e. helper ontologies) with existing information provided by the various bibliographic databases that constitute the deriving online library catalog.

Based on the aforementioned architecture, the prototype application is able to provide interactive, guided navigation over an online library catalog based on semantic criteria. It is also important to notice that users are in control of the navigation procedure at all times. The application's main components and their corresponding functionality are explained in detail in the following sections.

Helper ontologies

Helper ontologies are capable of modeling the various concepts existing within the library domain (e.g. subject headings) together with their relationships. This way, helper ontologies broaden the information space that is typically provided through traditional online library catalogs.

The information space may also contain multilingual, non-standard and user-preferred terms, which are difficult or even impossible to store into a typical library catalog.

Bibliographic database

Every library consists of one or more specialized databases containing information about specific collections. Each database is essentially an electronic catalog to journal or magazine articles, containing citations, abstracts and often either the full text of the articles indexed, or links to the full text or simple bibliographic information to such resources.

The proposed application provides keyword terms as entry points to the information retrieval service of the underlying bibliographic database. The selection of the terms is based on semantic criteria. Specifically, users traverse the semantic structure visualized by the proposed GUI (see section below). This navigation process results in a set of semantic-flavored keyword terms that correspond to the users' information needs. Such terms are then transparently fed into the information retrieval service through the "semantic catalog manager" that will be described in the following section.

The semantic catalog manager

The semantic catalog manager provides the core functionality of the prototype application. Such a module acts as a mediator between the underlying helper ontologies
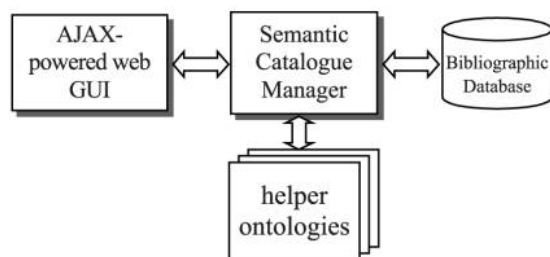
Figure 1.
Architecture of the
prototype application

and the AJAX-based web GUI. Specifically, it is the manager's responsibility to populate the GUI with information deriving from the helper ontologies in an appropriate fashion. Moreover, the semantic catalog manager receives user requests from the GUI and transforms such requests into semantically rich keyword terms. Such terms will be eventually directed to the database's search facility. This is accomplished by replicating the terms to the traditional search interface. Eventually, users will be presented with search results as provided by the search facilities.

From the user's point of view, the semantic catalog manager aids in transparently selecting the most appropriate keyword terms for the quest of knowledge within the library's information space. Such a task is accomplished through the integration of semantically rich structures (i.e. ontologies) with traditional online library catalog's search facilities.

AJAX-powered web GUI

The web interface empowering the semantic navigation within the online library catalog employs a number of visual widgets:

- A ClassBox (an example is shown in Figure 2), representing a thematic subject heading (corresponding to a class within the helper ontology). Such a widget contains the relationships in which the subject heading is involved (e.g. narrower meaning, broader meaning, etc.). The user, via the familiar hyperlink interface, may select a relationship and observe the subject headings (corresponding to classes within the helper ontology), which are linked with the initial subject heading through the selected relation. This way, user navigation can be performed all the way down to the bottom of the hierarchy. Subject headings may also list the alternative (non-preferred and multilingual) equivalences of a term, facilitating this way user-oriented navigation.

- A ContextMenu (an example is shown in Figure 3), which lists the subject headings that are related through the selected relation to the initial subject heading represented as a ClassBox. The ContextMenu is activated by clicking on a relation within a ClassBox. Such relations exist within helper ontologies as "properties" linking two different concepts.

  The ability to navigate according to the relations within the ContextMenu instead of a mere hierarchical path, is the true strength of our proposed interface.

- An interconnecting LinkLine together with an appropriate description of the relation, employed to denote the relation between two adjacent ClassBoxes. The

Figure 2.
A ClassBox example
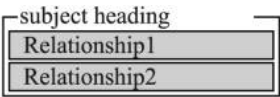
Figure 3.
A ContextMenu example
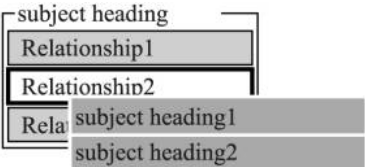
LinkLine conveys such information via its label and positioning, depending on the selection of the user.

Implementation details

The prototype system is a web-based application hosted at the library of the Ionian University, available at http://195.251.111.53/server/entry/index.html The underlying ontology refers to a subset of the well-known Library of Congress authorized subject headings collection, available at: http://authorities.loc.gov/ It is encoded in OWL format in conjunction with the rdf and rdfs namespace. The "semantic catalogue manager" component is implemented in Python 2.4 and the GUI is based on javascript employing various XMLHttpRequests.

Finally, Greek translations of the employed subject headings are available.

Conclusions

This paper introduces an innovative navigation procedure applicable to online library catalogues. According to the proposed approach, users are able to semantically navigate the digital assets within a library collection based on a dynamic, interactive graph-based structure. The graph-based structure is essentially an ontology that models the subject headings and the corresponding relations of the collection's digital assets.

Users are able to semantically explore the underlying collection without having to know the exact subject headings that are being employed to describe the individual assets. Additionally, the bilingual interface assists users that are unaware of the formal (usually in English) terminology that is usually employed to express the original subject headings (i.e. LSCHs). Moreover, the proposed application can be easily integrated to any existing OPAC system. The only requirement is that the subject headings within the ontology should be synchronized with the actual subject headings used within the OPAC. Finally, the employment of most recent advances in web development renders the proposed application as very appealing to average library users.

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