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Dynamic faceted navigation in decision making using Semantic Web technology

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ABSTRACT

Categorization in the decision making classifies decision makers' experiences about the world and provides a guide to reach a goal. This implies that dynamically providing categories reflecting the given decision context gives a great enhancement in decision quality. This study discusses the dynamic category selection under the Semantic Web environment, focusing on an implementation of a decision support system, the dynamic facet navigation system working with an ontology. Predefined fixed categories are provided to refine search results to evade use of complex queries and tedious review of search results, but they often output insensible information because of never reflecting the difference in search results. This paper proposes a dynamic category selection mechanism by using the total gain ratio under a given ontology, and a reordering scheme for resulted categories. It proves the validity of the proposed approach with a statistical analysis lastly.

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1. Introduction

Consumers face decision making in their everyday lives to find their products of interest such as when shopping in the supermarket and choosing their magazines from a variety of periodicals. Nowadays their decision making has gotten more difficult because of the product specificity and the consumer preference variation from mass customization in modern production. This burden of comparing the vast number of different products to find the proper demands to decision makers requires good strategies that ease the difficulty in their decision process. Since decision making commands gathering data and developing alternatives together with conceptual grouping, categorization is one of the fundamental and important approaches in decision process—as in cognitive processes such as language acquisition, learning, prediction, production, and inductive reasoning [1]. Amos Tversky's decision making process, elimination by aspects [2], says that decision making compares all alternatives by aspects; it chooses an aspect; any alternatives without that aspect are eliminated; it repeats this process with as many aspects as needed until there remains only one alternative. With the interpretation of Tversky's decision process, decision makers group alternatives as categories—also called *facets*—and scope down to the alternatives in the relevant categories in their decision process. Categories, as the abstraction of decision maker's experience in the world, hence have two roles: a category integrates alternatives into a general description toward a decision-making goal, and provides an instructional manual for inferences to guide for the goal [3]. The conceptual system of decision making therefore depends on construction of categories and their selection.

This paper focuses on a dynamic categorization—called *faceted navigation* in literature. The topic of the paper is, in particular, facet selection/ordering using the total gain ratio, applied to a movie search engine working with an ontology. Based on our initial work [4], this study focuses on implementing a dynamic faceted navigation system, as a decision support system, which groups results based on search context using the Semantic Web technology. The current state of search systems requires users to review long lists of items from search results laboriously. A conventional solution to its alleviation is the provision of refining fixed categories. Search engines provide categories that classify items in a search result into several groups, and users may refine their searches by selecting a category value more relevant to what they want to find. A fundamental problem residing in this approach is that refining categories are predefined and fixed regardless of the difference in search results. Considering human decision making, faceted navigation should dynamically evolve and provide relevant information by contextual grouping, but due to lack of contextual knowledge, fixed category systems do not fit on the condition. Fixed categories may provide insensible information. For example, IMDB[1], an online database on films, has fixed categories in the fixed order such as "Refine By Type", "Refine By Provider", "Refine By Top Titles", "Refine By Top Names", "Refine By Genre" and "Refine By Payment Model" (Fig. 1). Querying "CBS videos" to its search engine produces all videos provided by "CBS", but in this case the category "Refine By Providers" becomes superfluous

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[1] http://www.imdb.com (2012).

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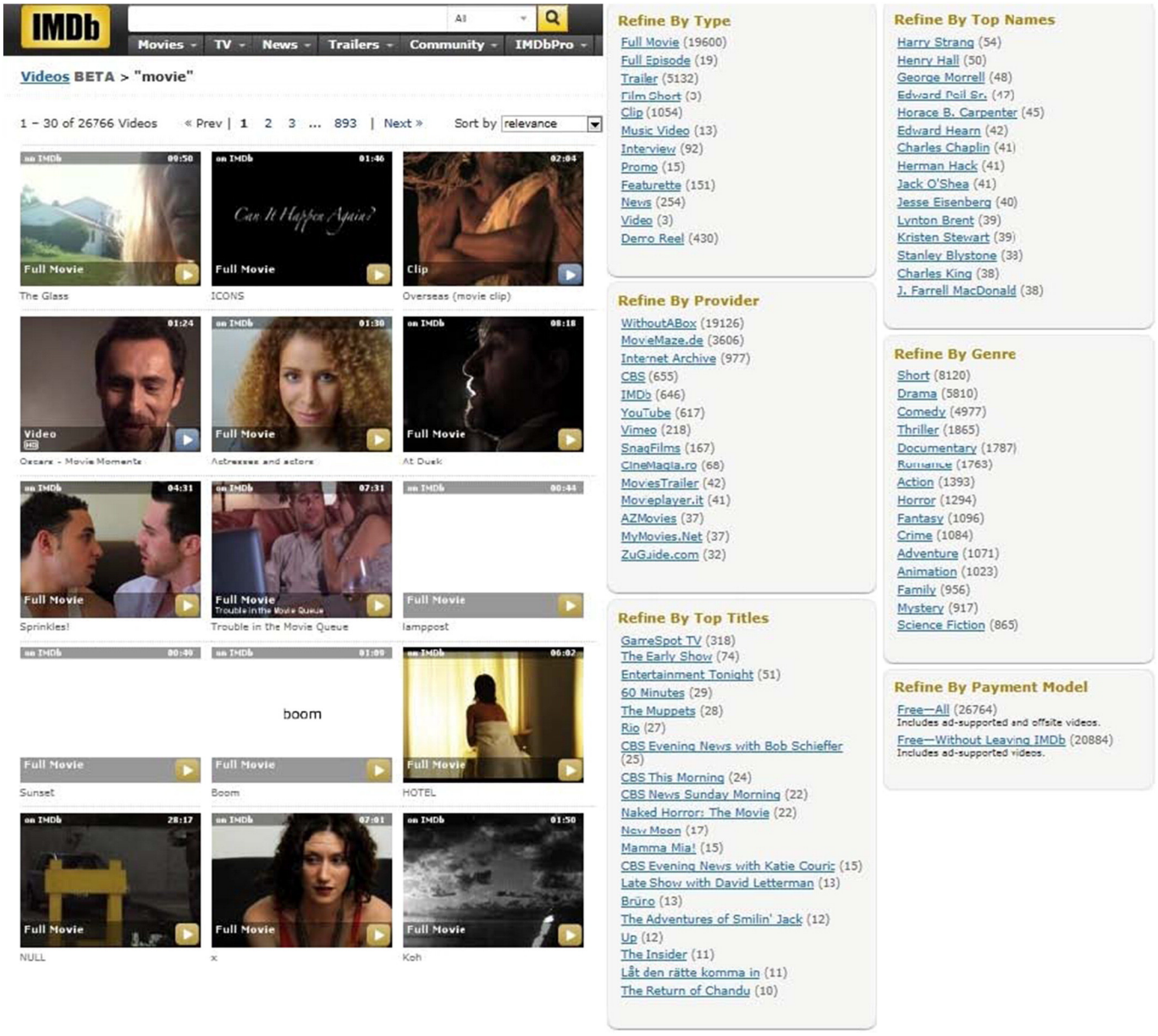

Fig. 1. Fixed categories in IMDB.

and insensible. The combination of free queries and facet selection asks for dynamic generation of facets.

The dynamic category selection is conceivable because the system is based on an ontology which makes meanings of instances and their properties understood by the system. Using the information from the ontology, the selection is attained by the measurement of the relevancy of the properties. Items resulted in a query search hence are structured with their associated properties. For example, if a search result has a book "The Old Man and the Sea", it has properties in a book ontology such as "Author", "Publication Date" and "Publisher" (Fig. 2).

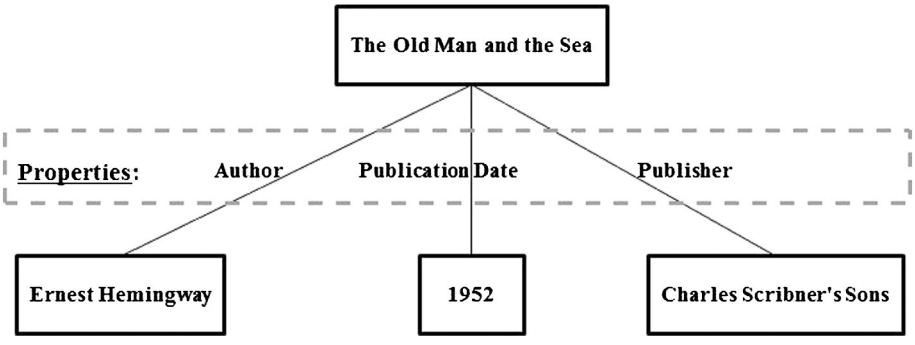

Fig. 2. Properties of a book.

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