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ITB11379

This chapter appears in the book, *Managing Multimedia Semantics*, edited by Uma Srinivasan and Surya Nepal

Chapter 12

The Role of Relevance Feedback in Managing Multimedia Semantics: A Survey

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ABSTRACT

Relevance feedback is a mature technique that has been used to take user subjectivity into account in multimedia retrieval. It can be seen as an attempt to bridge the semantic gap by keeping a human in the loop. A variety of techniques have been used to implement relevance feedback in existing retrieval systems. An analysis of these techniques is used to develop the requirements of a relevance feedback technique that aims to be capable of managing semantics in multimedia retrieval. It is argued that these requirements suggest a case for a user-centric framework for relevance feedback with low coupling to the retrieval engine.

INTRODUCTION

A key challenge in multimedia retrieval remains the issue often referred to as the "semantic gap". Similarity measures computed on low-level features may not correspond well with human perceptions of similarity (Zhang et al., 2003). Human perceptions of similarity of multimedia objects such as images or video clips tend to be semantically based, that is, the perception that two multimedia objects are similar arises from these two objects evoking similar or overlapping concepts in the users mind. Therefore different users posing the same query may have very different expectations of what they are looking for. On the other hand, existing retrieval systems tend to return the same results for a given query. In order to cater to user subjectivity and to allow for the fact that the user's perception of similarity may be different from the system's similarity measure, the users need to be kept "in the loop."

Relevance feedback is a mature and widely recognised technique for making retrieval systems better satisfy users' information needs (Rui et al., 1997). Informally, relevance feedback can be interpreted as a technique that should be able to understand the user's semantic similarity perception and to incorporate this in subsequent iterations.

This chapter aims to provide an overview of the rich variety of relevance feedback techniques described in the literature while examining issues related to the semantic implications of these techniques. Section 2 presents a discussion of the existing literature on relevance feedback and highlights certain advantages and disadvantages of the reviewed approaches. This analysis is used to develop the requirements of a relevance feedback technique that would be an aid in managing multimedia semantics (Section 3). A high-level framework for such a technique is outlined in Section 4.

RELEVANCE FEEDBACK IN CONTENT-BASED MULTIMEDIA RETRIEVAL

Broadly speaking, anything the user does or says can be used to interpret something about their view of a computer system; for example, the time spent at a Web page, the motion of their eyes while viewing an electronic document, and so forth. In the context of content-based multimedia retrieval we use the term relevance feedback in the conventional sense, whereby users are allowed to indicate their opinion of results returned by a retrieval system. This is done in a number of ways; for example, the user only selects results that they consider relevant to their query, the user provides positive as well as negative examples, or the user is left to provide some sort of ranking of the images. In general terms, the user classifies the result set into a number of categories. The relevance feedback module should be able to use this classification to improve subsequent retrieval. It is expected that several successive iterations will further refine the result set, thus converging to an acceptable result. What makes a result "acceptable" is dependent on the user; it may be a single result (the so-called "target searching" of Cox et al. (1996)). On the other hand, "acceptable" may mean a sufficient number of relevant results (as when the users are performing a category search).

Intuitively, for results to approximate semantic retrieval, the relevance feedback mechanism should understand why users mark the results the way they do. It should ideally be able to identify not only what is common about the results belonging to a