

Capturing knowledge of User Preferences: Ontologies in Recommender Systems

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ABSTRACT

Tools for filtering the World Wide Web exist, but they are hampered by the difficulty of capturing user preferences in such a dynamic environment. We explore the acquisition of user profiles by unobtrusive monitoring of browsing behaviour and application of supervised machine-learning techniques coupled with an ontological representation to extract user preferences. A multi-class approach to paper classification is used, allowing the paper topic taxonomy to be utilised during profile construction. The Quickstep recommender system is presented and two empirical studies evaluate it in a real world setting, measuring the effectiveness of using a hierarchical topic ontology compared with an extendable flat list.

Keywords

Ontology, recommender system, user profiling, machine learning

INTRODUCTION

The mass of content available on the World-Wide Web raises important questions over its effective use. With largely unstructured pages authored by a massive range of people on a diverse range of topics, simple browsing has given way to filtering as the practical way to manage web-based information – and for most of us that means search engines.

Search engines are very effective at filtering pages that match explicit queries. Unfortunately, most people find articulating what they want extremely difficult, especially if forced to use a limited vocabulary such as keywords. The result is large lists of search results that contain a handful of useful pages, defeating the purpose of filtering in the first place.

Recommender Systems Can Help

Now people may find articulating what they want hard, but they are very good at recognizing it when they see it. This

insight has led to the utilization of relevance feedback, where people rate web pages as interesting or not interesting and the system tries to find pages that match the interesting examples (positive examples) and do not match the not interesting examples (negative examples). With sufficient positive and negative examples, modern machine learning techniques can classify new pages with impressive accuracy.

Obtaining sufficient examples is difficult however, especially when trying to obtain negative examples. The problem with asking people for examples is that the cost, in terms of time and effort, of providing the examples generally outweighs the reward they will eventually receive. Negative examples are particularly unrewarding, since there could be many irrelevant items to any typical query.

Unobtrusive monitoring provides positive examples of what the user is looking for, without interfering with the users normal activity. Heuristics can also be applied to infer negative examples, although generally with less confidence. This idea has led to content-based recommender systems, which unobtrusively watch users browse the web, and recommend new pages that correlate with a user profile.

Another way to recommend pages is based on the ratings of other people who have seen the page before. Collaborative recommender systems do this by asking people to rate explicitly pages and then recommend new pages that similar users have rated highly. The problem with collaborative filtering is that there is no direct reward for providing examples since they only help other people. This leads to initial difficulties in obtaining a sufficient number of ratings for the system to be useful.

Hybrid systems, attempting to combine the advantages of content-based and collaborative recommender systems, have proved popular to-date. The feedback required for content-based recommendation is shared, allowing collaborative recommendation as well. A hybrid approach is used by our Quickstep recommender system.

This work follows the tradition of over 30 years of knowledge acquisition. Knowledge acquisition above the normal workflow is intrusive and counterproductive. We present a system with a low level of intrusiveness, driven by

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