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News@hand: A Semantic Web Approach to Recommending News

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Abstract. We present News@hand, a news recommender system which applies Semantic Web technologies to describe and relate news contents and user preferences in order to produce enhanced recommendations. The multi-domain portability, the multi-media source applicability, and the addressing of some limitations of current recommender systems are the main benefits of our proposal.

Keywords: recommender systems, semantic web, ontologies, personalisation, user modelling, group modelling, RSS.

1 Introduction

With the advent of the World Wide Web, people nowadays not only have access to more worldwide news information than ever before, but they can also obtain it in a more timely manner. Online newspapers present breaking news on their websites in real time, and users can receive automatic notifications of them via RSS feeds.

RSS is a free way to promote a site without the need to advertise or create complicated content sharing partnerships, and an easy mechanism for the users to be informed of the latest news or web contents. However, the increasing volume, growth rate, ubiquity of access, and the unstructured nature of the contents challenge the limits of human processing capabilities. It is in such scenario where recommender systems can do their most, by scanning the space of choices, and predicting the potential usefulness of news for each particular user, without explicitly specifying needs or querying for items whose existence is unknown beforehand.

However, general common problems have not been fully solved yet, and further investigation is needed. For example, typical approaches are domain dependant. Their models are generated from information gathered within a specific domain, and cannot be easily extended and/or incorporated to other systems. Moreover, the need for further flexibility in the form of query-driven or group-oriented recommendations, and the consideration of contextual features during the recommendation processes are also unfulfilled requirements in most systems.

In this work, we present News@hand, a system that makes use of Semantic Web technologies to recommend news. The system supports different recommendation models for single and multiple users which address several recommender systems limitations. The exploitation of meta-information in the form of ontologies that describe items and user profiles in a general, portable way, along with the capability of inferring knowledge from the semantic relations defined in the ontologies, are the key aspects of the system.

Section 2 presents the architecture, functionalities and recommendation models of News@hand, referencing previous works that have more detailed explanations and evaluations, and section 3 emphasises the benefits of our proposal.

2 News@hand

News@hand combines textual features and collaborative information to make news suggestions. However, as opposite to previous systems, it uses a controlled and structured vocabulary to describe the news contents and user preferences [7]. For this purpose, it makes use of Semantic Web technologies. News items and user profiles are represented in terms of concepts appearing in domain ontologies, and semantic relations among those concepts are exploited to enrich the above representations, and enhance recommendations.

Figure 1 depicts how ontology-based item descriptions and user profiles are created in News@hand. Like other systems [1][10][13], news are automatic and periodically retrieved from several on-line news services via RSS feeds. The title, summary and category of the retrieved news are then annotated with concepts (classes and instances) of the system domain ontologies. Similarly to other approaches [1][2], a TF-IDF technique is applied to assign weights to the annotated concepts. A total of 17 ontologies have been used for the first version of the system. They are adaptations of the IPTC ontology[1], which contains concepts of multiple domains such as education, culture, politics, religion, science, technology, business, health, entertainment, sports, etc.

News@hand follows a client/server architecture, where users utilise a web interface to receive on-line news recommendations, and update their preferences. Thanks to the novel AJAX technology, a dynamic graphical interface allows the system to automatically store all the users' inputs, analyse their behaviour with the system, update their preferences, and adjust the news recommendations in real time. As done in [8], explicit and implicit user preferences are taking into account, via manual preferences, tags and ratings, and via automatic learning from the users' actions.

Deriving benefit from the semantically annotated news items, the defined ontology-based user profiles, and the knowledge represented by the domain ontologies, a set of recommendation algorithms are executed. Specifically, News@hand offers personalised, context-aware [14], group-oriented [6], and multi-facet [4][5] recommendations.

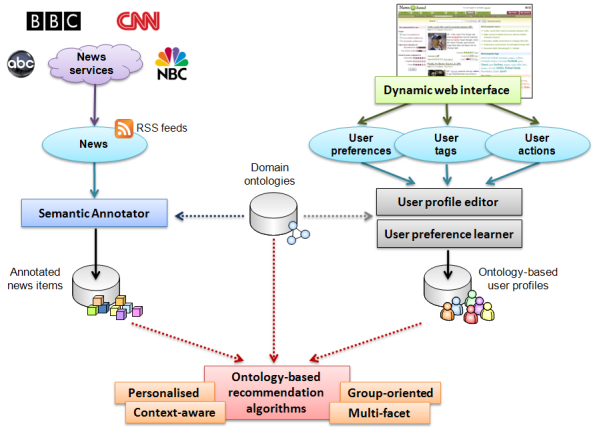

Figure 1. Item descriptions and user profiles acquisition in News@hand

Figure 2 shows a screenshot of a typical news page in News@hand. The news items are classified in 8 different sections: headlines, world, business, technology, science, health, sports and entertainment. When the user is not logged in the system, she can

[1] IPTC ontology, http://nets.ii.uam.es/neptuno/iptc/

browse any of the previous sections, but the news items are listed without any personalisation criterion. She can only sort them by their publication date, source or level of popularity. On the other hand, when the user is logged in the system, recommendation and profile edition functionalities are enabled, and the user can browse the news according to her and others' semantic preferences in different ways. Like in other approaches [1][2][3], short and long term preferences are considered. As done in [9], click history is used to define the short term concepts, and similarly to [13], the resultant ranks can be adapted to the current context of interest.

In the middle of the screen, apart from its title, source, date, summary, images, and link to the full article, additional information is shown for each news item. Those terms appearing in the item that are associated to semantic annotations of the contents, the user profile and the current context are highlighted with different colours. A global rating is shown in a 5-star scale, and two coloured bars indicate the relevance of the news item for the user profile and the context. The user has the possibility of view and add comments, tags and ratings to the article, following the ideas presented in [11][12]. On the left side of the screen, the user can set the parameters she wants for single or group-oriented recommendations: the consideration of preferences of her profile, of her contacts, or of all the users, the degree of relevance than the concepts of the profile and the context should have, and multi-criteria conditions to be fulfilled by the user evaluations. Finally, on the right side of the screen, general social information such as the most popular news, the most popular tags and the top users is shown.

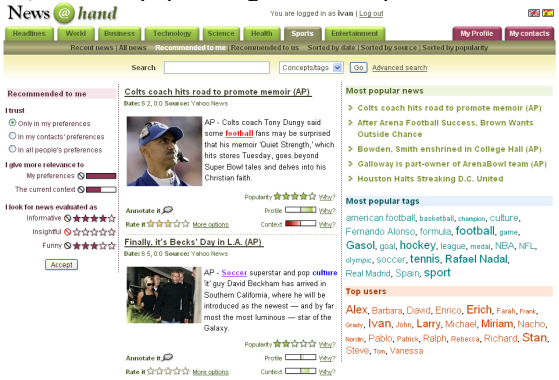

Figure 2. Screenshot of news recommendations in News@hand

3 Benefits of the proposal

News@hand supports multiple recommendation functionalities, and addresses some of the limitations in current recommender systems:

- *Domain dependency*. The use of ontologies and Semantic Web standards to represent user profiles and news items makes it possible to easily incorporate new domains into the system, and export the obtained knowledge to other applications.
- *Restricted content analysis*. Our annotation mechanism allows the distribution and exploitation of metadata from different multimedia sources, such as texts, videos, or audios.
- *Content overspecialisation*, *cold-start*, *portfolio* and *sparsity*. The extension of user preferences and item features through ontology properties enable the detection of further co-occurrences of interests between users, and finds new interests, available for recommendations.

- *Gray sheep*. The proposed hybrid models compare user profiles at different semantic interest layers, enabling further possibilities to find relations between users.
- *Group-oriented recommendations*. The vector-based preference description facilitates the combination of multiple profiles to generate a shared profile for a group of users.
- *Context-aware recommendations*. Under the ontology-based knowledge representation, we define the notion of semantic runtime context, which we apply to provide recommendations according to the user's current interests.

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