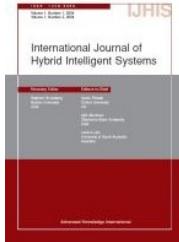


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Many efforts have been done to tackle the problem of information abundance in the World Wide Web. Growth in the number of web users and the necessity of making the information available on the web, make web recommender systems very critical and popular. Recommender systems use the knowledge obtained through the analysis of users' navigational behavior, to customize a web site to the needs of each particular user or set of users. Most of the existing recommender systems use either content-based or collaborative filtering approach. It is difficult to decide which one of these approaches is the most effective one to be used, as each of them has both strengths and weaknesses. Therefore, a combination of these methods as a hybrid system can overcome the limitations and increase the effectiveness of the system. This paper introduces a new hybrid recommender system by exploiting a combination of collaborative filtering and content-based approaches in a way that resolves the drawbacks of each approach and makes a great improvement over a variety of recommendations in comparison to each individual approach. We introduce a new fuzzy clustering approach based on genetic algorithm and create a two-layer graph. After applying this clustering algorithm to both layers of the graph, we compute the similarity between web pages and users, and propose recommendations using the content-based, collaborative and hybrid approaches. A detailed comparison on all the mentioned approaches shows that the hybrid approach recommends the web pages which haven't been yet viewed by any user, more accurately and precisely than other approaches. Therefore, the evaluation of the results reveals that the novel proposed hybrid approach achieves more accurate predictions and more appropriate recommendations than each individual approach.

Keywords

Content-based approach, collaborative filtering approach, hybrid approach, fuzzy clustering

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A fuzzy co-clustering approach for hybrid recommender systems

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Abstract. Many efforts have been done to tackle the problem of information abundance in the World Wide Web. Growth in the number of web users and the necessity of making the information available on the web, make web recommender systems very critical and popular. Recommender systems use the knowledge obtained through the analysis of users' navigational behavior, to customize a response to the needs of each particular user or group of users. Most of the existing recommender systems use either content-based or collaborative filtering approaches, which are difficult to make use of, due to some weaknesses in them after one to be used, as each of them has both strengths and weaknesses. Therefore, a combination of these methods as a hybrid system can overcome the limitations and increase the effectiveness of the system. This paper introduces a new hybrid recommender system by exploiting a combination of collaborative filtering and content-based approaches in a way that resolves the drawbacks of each approach and creates a great balance over the two types of algorithms in terms of accuracy of each individual approach. We introduce a new fuzzy clustering approach based on particle algorithm and create a two-layer graph. After applying the clustering algorithm to both layers of the graph, we compute the similarity between web pages and users, and propose recommendations using the content-based, collaborative and hybrid approaches. A detailed comparison on all the mentioned approaches shows that the hybrid approach recommends the web pages which haven't been yet viewed by any user, more accurately and precisely than other approaches. Therefore, the evaluation of the results reveals that the novel proposed hybrid approach achieves more accurate predictions and more appropriate recommendations than each individual approach.

Keywords: Content-based approach, collaborative filtering approach, hybrid approach, fuzzy clustering

1. Introduction

The World Wide Web has become one of the most important communication tools and information retributive source. Due to massive influx of information on the Web, it is necessary to have a mechanism for information among distributed information sources. Admittedly, it is essential to predict the users' needs in order to improve the usability and user retention of a web site. Recommender systems are proposed to fulfill this aim in order to personalize the online information based on the user's desires.

Techniques used for recommender systems are alternative, user-centric, and promising approaches to undertake the problem of information overload, by adapting the content and the structure of the websites, also collecting the knowledge from the analysis of the users' access behavior [4]. Recommender systems satisfy the needs of users without explicit choice being made by them.

In general, the recommender systems focus on the process of recognizing web users or objects, accumulating information with respect to users' favorites or interests, as well as adapting the services to satisfy the

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