Integrating Quality Criteria in a Fuzzy Linguistic Recommender System for Digital Libraries

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ITQM 2014

3-6 JUNE 2014, Moscow

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Introduction

- Web: Main source of information generation and transmission.
- We focus on an academic environment: University Digital Libraries (UDL).

Information Access Problems

- Need for automatic search systems and access to the information in the Web:
  - Recommender Systems (RecSys): They aid users in the information access process through prediction and item recommendation that can be interesting for them → users' profile.

Introduction

- Main problem in the Web: exponential and uncontrolled:

information

users

- Consequence: the users of UDL still having serious difficulties to access to relevant information.

Introduction

Proposed solution

- We split the process of generating recommendations in two phases:
  1. Indentify relevant resources.
  2. Identify valid resources from a quality point of view.

- Hybrid recommendation → *Switched hybrid RecSys*: To alternate between a content-based scheme and a collaborative one depending on the number of existing ratings.
- To add the Re-ranking module which combines the estimated relevance degree with the quality of the item.
- To adopt a multi-granular fuzzy linguistic modeling.

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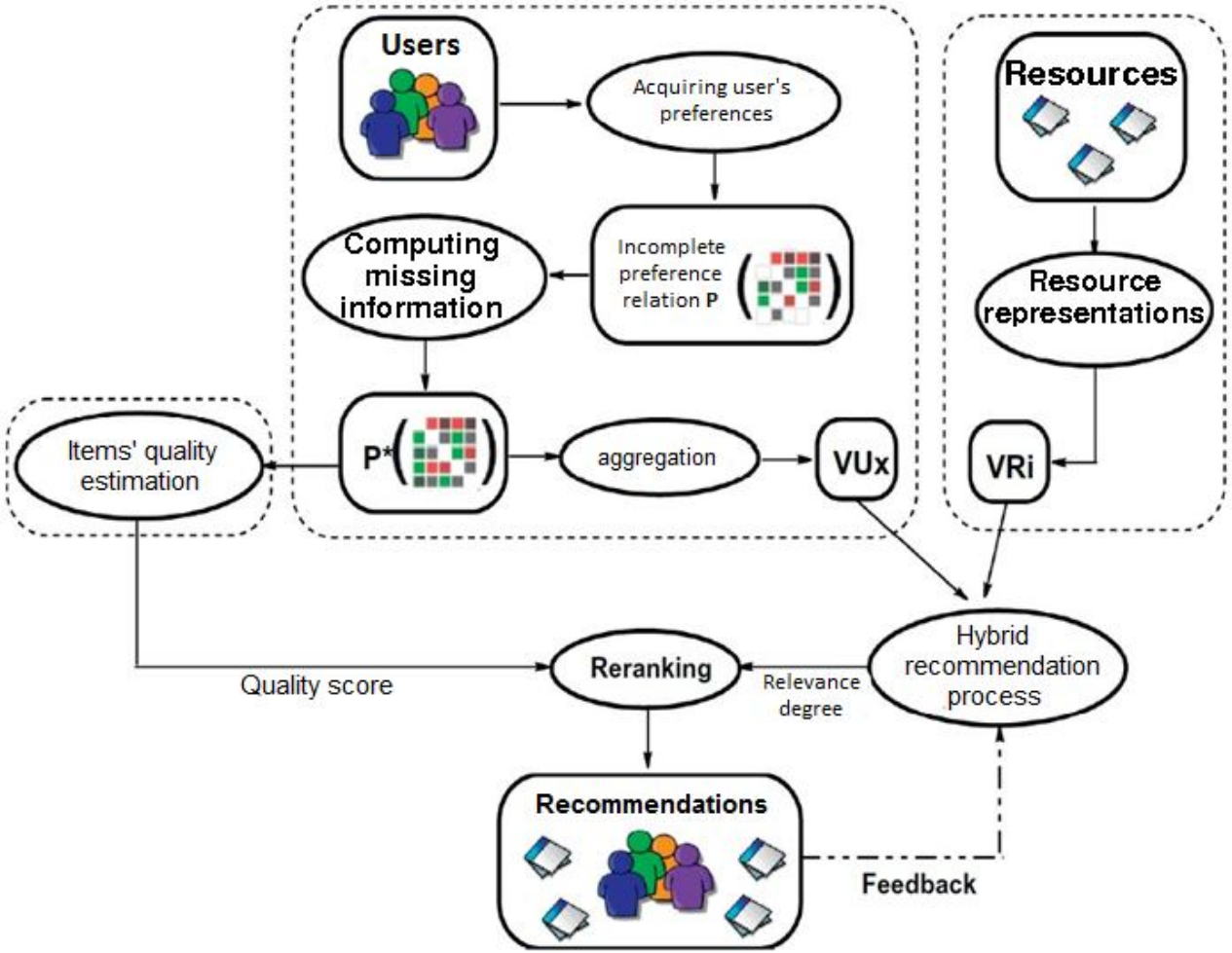
Description of the proposed system



Proposed system : representation of Information

- We use different sets of labels selected from a linguistic hierarchy.
- Concepts assessed:
  1. Relevance degree of a discipline with respect to a resource scope, which is assessed in S_1.
  2. Similarity degree among resources or among users, which is assessed in S_2.
  3. Predicted relevance degree of a resource for a user, which is assessed in S_3.
  4. Satisfaction degree expressed by a user to evaluate a recommended resource, which is assessed in S_4.
  5. Preference degree of a resource regarding another one, which is assessed in S_5.
- We use 5 labels to S_1 y S_5, and 9 to S_2, S_3 y S_4.

Proposed system : representation of Information

Resources representation

- To represent the resource scope, we use a **vector model**.
- We use a classification of by 25 disciplines.
- A resource *i*, is represented as:

$$VR_i=(VR_{i1}, VR_{i2}, \ldots, VR_{i25})$$

- where VR_{ij} (S_1 labels) shows the importance degree of discipline *j* regarding to resource scope *i*.

Proposed system : representation of Information

User profiles

1. To acquire **users' preferences** over the 5 most representative resources.
   - It is enough for users to provide a row of the relation and the system will complete the relation (S_5 Labels).
2. To calculate user **resource preference degrees** over each considered resource → arithmetic mean.
   - Now we can obtain the **user preference vector** as the aggregation of vectors representing selected resources characteristics, weighted through preference degrees.

Proposed system : Recommendation scheme

Hybrid scheme

- It allows us to face the cold start problem.
- Similarity measures: standard *cosine measure*, but defined in a linguistic context (S_2 labels).

- *Content-based* approach: when a new resource is inserted.
- Collaborative approach: when a new user is inserted.

- Then, the relevance of a resource for a user is estimated (S_3 labels).

Proposed system : Quality estimation

- Idea: If a resource is usually preferred over others that show a certain quality.

Probability of this resource be preferred over other having been selected

- At the stage of completing the incomplete preference relations we count the number of times a resource *i* is chosen to be shown among the outstanding resources, (s_i) is the total of times the resource *i* has been selected and the total number of times *i* has been preferred over other (p_i):

$$q(i) = p_i / s_i$$

- Advantages: It avoids to collect additional information about users and to increase the complexity.

Proposed system : Reranking

- We aggregate the estimated relevance with the quality score obtained.
- We use a multiplicative aggregation and we normalize it in the range of the label set S_3.

- Advantages: ease of application and good results obtained.

Proposed system: Feedback

- The activity of generating recommendations is completed with this phase.

- Users provide the system with their satisfaction ratings about the items received (S_4 labels).

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Conclusions

- We have addressed the recommendations process from two perspectives:
  1. Find relevant resources.
  2. Resources of good quality.
- We have presented a hybrid fuzzy linguistic recommender system applied to a UDL.
- We performed online studies → satisfactory results.

- Future works:
  - Techniques for automatic resource representation.
  - Incorporate new techniques in the recommendation process.


Any question?