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Recommender Systems for Educational Institutions

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Abstract: In this study, we discuss the process of developing a Recommender System for Educational Institutions (RSEI). We considered the application domain of the Educational Institutions and examined the algorithms and architectures pertaining to recommender systems. We discuss the dependencies and present a methodology for developing RSEI. The same can be applied, at very early stages of RSEI development. We have considered the economic factors that affect the design of RSEI based on cost and availability of information. We have also discussed the common approaches available for development of recommender systems and focused them to RSEI.

Key words: Recommender systems, artificial intelligence, software design, knowledge base, content based filtering, collaborative filtering

INTRODUCTION

Recommender systems help as decision guides, aiding users in making decisions based on their personal taste. These systems are web based applications and help the customers in decision making and product selection (Resnic and Varian, 1997). Recommender systems usually provide information and opinion about the items that they recommend. The information provided by recommender systems may be about items, critics or opinions, average user ratings and personalized ratings. We frequently depend on others experience and recommendations when confronted with a new field of expertise, especially when we are not having the broad knowledge of all facts. We trust that real world needs the recommender system suggestions and we can extend this technique to Educational Institutions. Design of recommender systems highly depend on Artificial Intelligence (AI) techniques and hence designers and developers of these systems not only face the common problems of software design, but also face the problems associated with AI applications and implementation.

While designing the recommender systems we need give provision for:

- Defining the problem domain and its characteristics.
- The system must have the ability to accept the inputs given by the user, which are either in explicit or in implicit form (Resnic *et al.*, 1994).
- Ratings submitted by the users are among explicit inputs whereas the URLs visited by a user and time spent on reading a web site are among possible implicit inputs.
- User's likes and dislikes should be formed from the inputs received and should be represented in a matrix form or as a data structure combining both content and rating information.
- The computational resources available for the recommender component.
- The system should be developed based on filtering techniques and compute the recommendations.

Information about courses, curriculum, research and facilities in the field of education is mainly physical and available on the web. Information about the educational institutions with richer descriptions enables the students, parents and people to make their choices more efficiently and scientifically. As consequence, the complexity of these descriptions is growing and benefits of the Internet may be used. Users choose their institutions among various channels and compare the institution offerings critically. The students of today are very demanding and have complex, multi-layered ambitions over educational programs. These ambitions are often experienced in educational institutions and demand both perfection and planning. Hence, offers from educational institutions, should be multi-optional and of high quality.

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FILTERING TECHNIQUES AND RSEI

Educational Institutions information search is a complex and dynamic process and more prevalent now a days, calling for modern means of decision-making. RSEI attempts to focus the educational institutions by providing the users with information and suggestions to facilitate their decision making process. Using these systems, we assume that a user's need and constraint can be mapped into a specific set of alternatives from which the user will be able to choose. Common approaches for building a user profile and computing recommendations are Collaborative Filtering (CF), Content Based Filtering (CBF).

- CF systems find similar users to a target user by comparing users' opinions of items. Many CF systems compute similarity between users, by comparing vectors rating using Karl Pearson Coefficient correlation, cosine similarity and other similar techniques (Melville *et al*., 2002). In general CF model facilitates the users to provide ratings for the items they have experience before (Breese *et al*., 1998). Then the user for whom the recommendations are computed is matched with other users in the system. Finally, predictions for the items that the active user has not yet rated, but the neighbors have rated are computed and these items are presented to the user for decision making. As educational institutions usually have a high number of items-of-interest and user votes on items, collaborative filtering usually attempts to do some modifications to be used in this RSEI application domain. However, there are numerous ways for computing and using user similarity in educational institution applications.
- Content based information filtering selects the right information for users by comparing representation and searching information to representations, of contents, of user profiles which express interests of users (Baudisch, 1999). In this technique first we gather content data about the items. Secondly we ask the user to provide some rating based on some scale. Next we compile a profile of the user using the content information extracted from the user and rating information provided by the user. Finally we rank the items according to their scores and present them to user in order. While developing RSEI we have to college data from users and compile the data and store the same in a matrix from for further processing.
- Knowledge based filtering: These systems rely on an explicit representation of knowledge, usually as collections of statements, ontology or other forms of rule systems (Herlocker *et al*., 2000). Knowledge-based recommender systems may be developed even when :
  - The absence of a start up problem since ratings are not required
  - The fact that they do not place additional cognitive load in the form of a requirement for user ratings, which makes them ideal for the casual user (Burke, 2001).
- Knowledge-based filtering faces problem of model construction and may require a significant amount of knowledge engineering effort. Sometimes these models are more difficult to adopt and extend. Since RSEI applications requires reasoning or inference, choosing the knowledge-based approach allows the developers to benefit from the software components, knowledge representation and rules devised for the system in general. Fuzzy rules and fuzzy logic also help in building knowledge base (Martinovska, 2002).
- Demographic based recommendations: Demographic information can be used to identify the types of users that like a certain object. Demographic recommender systems utilize user attributes, classified as demographic data, in order to produce their recommendations (Pazzani, 1999). Demographic based approaches use descriptions of the people rating to learn a relationship between a single item and the types of people like that object. While applying to demographic filtering to our RSEI information on the name, age, sex, place, education, designation, rating about a particular institution may be generated as demographic clusters for appropriate recommendations and suggestions.
- Hybrid systems-Hybrid systems can merge any combination of the above methods and metrics (Popescuil *et al*., 2001). Number of clustering algorithms and filtering algorithms are used in Hybrid systems before combining and computing ratings. We have established some basic approaches to the recommending problem and we suggest that the hybrid approach is the rich and heterogeneous information domain. While suggesting we have considered the different attributes of Educational Institutions entities, which may be essential for a RSEI (like student preferences, courses, curriculum, faculty, research facilities, infrastructure facilities, examination procedures, sports facilities, placement opportunities, etc.). In Fig. 1 we have explained a recommender component architecture sketch, which combine all the methods in a hybrid system.

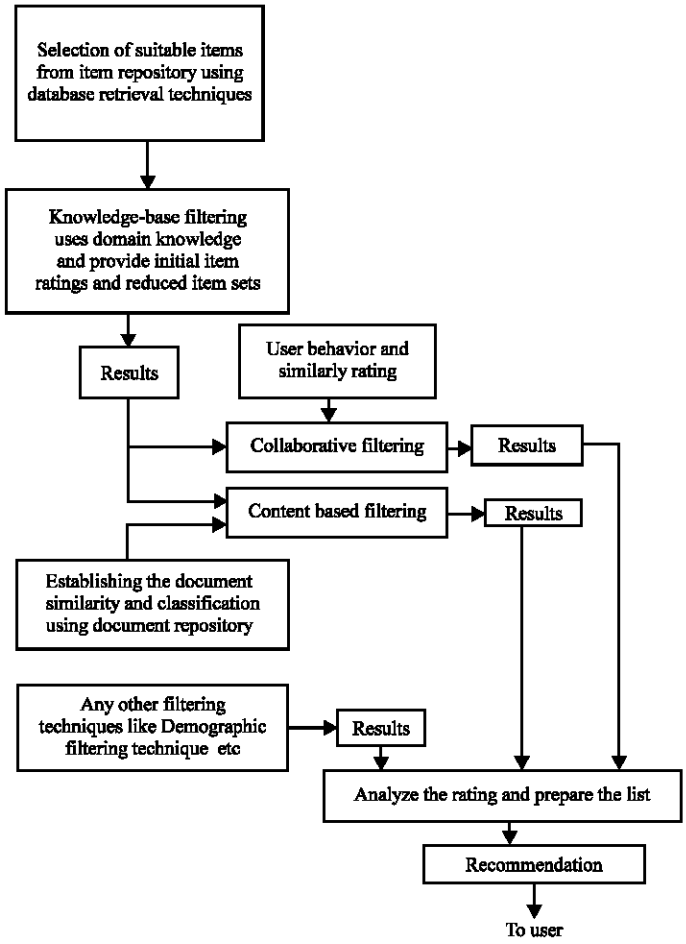

Fig. 1: Basic components of suggested recommender system

DATA BASE DESIGN

Database design and selection for RSEI it is easy to develop and maintain. Selection of items can be performed easily and with few resources, making it a good method for initial design of database. One of the important factors that we need to consider is acquisition and maintenance cost of data for designing and developing the recommender system. Data and information about the educational institutions is available for free or at a low price. RSEI should make use of the World Wide Web as an open, cheap and extensive source of information (Harper *et al*., 2005). After obtaining these documents, they can be classified for different regions, financial groups, activities and other form of categories. User can then specify their interest in categories provided by the system and the system can directly supply them with the best matching documents, thus recommending the offers harvested from the web.

We have designed a response form which will help the uses to contribute their ranks and is as shown in the Fig. 2. We have also designed three tables namely: Sheet table which will help us to store the basic information supplied by the user in the response sheet and the structure is as shown in the Fig. 3 a, b. Rank table ranks given by the user in response sheet and the structure is as shown in Fig. 3 b and college table-information about the colleges and structure is as shown in Fig. 3c.

The design of recommender system approach depends on the information sources and interest on various objects, used by the system. Some of the sources will be easily available and some of them are very costly. We know that all basic recommending approaches are applicable to education domain and heterogeneity of this domain naturally favors the use of hybrid recommenders. For RSEI we may identify the following steps: First initial selection of items has to be obtained based on the simple database interactions. Next knowledge based filtering

RESPONSE FORM
FOR
RECOMMENDER SYSTEMS FOR EDUCATIONAL INSTITUTIONS
(Focused to Arts and Science Colleges in Chennai, India)
Sheet No 43

1. Name : (Optional)

S	.	R	A	J	A	S	E	K	A	R	A	N							

2. Qualification (please select)

1. SSLC	2. HSC	Degree	3. PG	4. M.Phil	5. Ph. D	6. Engg.	7. Doctor	8. Any other

3. Age 40 years

4. Place of Residence __15__
(Chose from the list, which is nearer to your residence)

Your can specify the Rank from 0 to 9 (0 is considered is lowest rank and 9 as highest rank)

Sl No	Name of the Collage	Faculty	Class rooms	Library facilities	Lab facilities	NCC /NSS	Rotary club	Sports facilities	Canteen facilities	Transport facilities	General administration
1	Asan Memorial collage	7	8	5	6	8	9	5	6	6	6
2	Anna Adarsh collage	7	6	5	5	9	8	5	6	6	6
3	The New collage	8	7	7	8	8	7	8	9	8	7
4	Madras Christian	6	8	7	7	8	9	8	8	8	7
5	Women's Christian	8	6	8	8	8	7	7	6	8	7
6	Presidency Collage	6	7	7	7	9	6	7	6	8	9
7	SIVET	6	7	5	5	6	7	7	7	8	7

Next page

Fig. 2: Response form

3a: Sheet table

Shtno	Name	Age	Qualification	Residence

3b: Rank table

Shtno	Collage name	Faculty	Classroom	Liberary	Lab	nss	Rotary	Sports	Canteen	Transport	Admin

3c: Collage table

College name	Address 1	Address 2	Address 3	Pin code	Phone	Fax

Fig. 3: (a) Sheet table, (b) Rank table, (c) College table

technique may be used for providing ratings or for further reduction of item set. Knowledge base filtering allows the designers and developers to make use of the explicit domain knowledge. Finally we may use Collaborative filtering and content based filtering methods or any other filtering technique to obtain ratings and these rating can be merged to obtain a single value. These filtering techniques allow the designers and

RECOMMENDER SYSTEMS FOR EDUCATIONAL INSTITUTIONS
(Focused to Arts and Science Colleges in Chennai, India)

PREFERENCE FORM

Please specify your preferences

1. Your Age: 35
2. Place of Residence: 22
   (Choose from the list, which is nearer to your residence)
3. Qualification 6

1	2	3	4	5	6	7	8
SSLC	HSC	PG	M.Phil	Ph.D	Engg	Doctor	Any other

4. Your preferences

Sl no	Facility	Preference you specify
1	Facult	7
2	Class rooms	6
3	Liberary	7
4	Lab facilities	8
5	NSS	4
6	Rotary	4
7	Sports	6
8	Canteen	5
9	Transport	8

SUBMIT

Fig. 4: Preference form

RECOMMENDER SYSTEMS FOR EDUCATIONAL INSTITUTIONS
(Focused to Arts and Science Colleges in Chennai, India)

Based on the preferences you have specified and submitted to the system following educational institutions are recommended

Rank	Name of the college	Address	Phone no.
1	The New college	87, Peters Road Royapettah Chennai	28351269
	MD. Sathak college	Medavakkam Road Sholinganallur Chennai.	24502676
3	Guru Nanak college	Velachery Main Road Chennai.	22444621

Exit | GO BACK TO PREFERENCE FORM

Fig. 5: Recommendation form

developers to incorporate the domain knowledge. We have developed an application, which will accept the user preference and produces the recommendations for RSEI. Figure 4 shows the preference to be filled by the user. Based on the preference specified by the user the system will suggests its recommendations which is shown in Fig. 5.

CONCLUSION

After an initial analysis, we have concluded that we can make beneficial use of AI techniques like database design and selection, content based recommendations, user profiling, integrating groups of users with similar interests and integrating the domain knowledge and expertise. Content based filtering allows making use of education domain information to add content to the overall inference process. RSEI allows integrating groups of users with similar interest, domain knowledge and expertise. We know that the educational domain is based on heterogeneous collection of information. Economic criteria are a major issue for all applications regardless of application domain. We conclude that hybrid approaches to the recommending problem for RSEI are very well suited.

REFERENCES

Baudisch, P., 1999. Joining collaborative and content-based filtering. In interacting with recommender systems. Online proceedings of the Chi workshop.

Breese, J.S., D. Heckerman and C. Kadie, 1998. Empirical analysis of predictive algorithms for collaborative filtering. In 14th Conf. Uncertainty in Artificial Intelligence, (Madison, W.I., 1998), Morgan Kaufmann, pp: 43-52.

Burke, R., 2001. Knowledge-based recommender systems. In Encyclopedia of library and information science, Vol. 69.

Harper, F., X. Li, Y. Chen and J. Konstan, 2005. An economic model of user rating in an online recommender systems.

Herlocker, J., J. Konstan and J. Riedl, 2000. Explaining collaborative filtering recommendations. In CSCW.

Martinovska, C., 2002. A fuzzy-based approach to user model refinement in adaptive hypermedia systems. In adaptive Hypermedia and Adaptive web-Based systems, Springer, pp: 411-414.

Melville, P., R.J. Mooney and R. Nagarajan, 2002. Content-boosted collaborative filtering for improved recommendation. Proceedings of the 18th National Conference on Artificial Intelligence.

Paul Resnick, Neophytos Iacovou, Mitesh Suchak, Peter Bergstrom and John Riedl, 1994. Grouplens: An open architecture for collaborative _ltering of netnews. In Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work, pp: 175-186 (ACM Press).

Pazzani, M., 1999. A frame work for collaborative, content based and demographic filtering. Artificial Intelligence Review.

Popescuil, A., L. Ungar, D. Pennock and S. Lawrence, 2001. Probabilistic models for unified collaborative and content-based recommendations in sparse-data environments.

Resnic, P. and H.R. Varian, 1997. Recommender systems. Commun. ACM., 40: 56-58.

Robin Burke, 2004. Hybrid recommender systems: Survey and experiments. User Modeling and User Adapted Interactions.