

Service-Oriented Consumer Behavior Analysis and Recommendation Model Research

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Abstract: In order to describe the user's needs of personalized preference and optimize recommendation effect of service, a model of user preference analysis and service recommendation based on service reputation evaluation is proposed. Service-oriented consumer behavior analysis and recommendation model research, taking the multi-dimensional reputation index of service as the analysis object, can be compatible with various forms of service reputation evaluation. The rationality and effectiveness of the model is verified by comparing and analyzing the experiment results of actual service data.

1. Introduction

With the deepening application of service-oriented concept, more and more enterprises or individuals, as service providers, deploy services, commodities, and IT components as services on network, and support service consumption by a unified interface or a standardized interaction model. As the service network rapidly develops, the core task of recommendation system is to help users evaluate the objects that are unknown and varied.

2. Service-oriented Consumer Behavior Analysis and Recommendation Model Analysis

According to the comprehensive literature review, related research discussions, and opinions of marketing experts, a preliminary understanding is formed: (1) the process of consumers purchasing commodities and services. When a consumer purchases through a website, he or she typically goes through the process of information browsing-query-comparison-intention-decision-experience-evaluation. (2) the process of trust life cycle. Trust affects the decision-making behavior of consumers. The process of consumers' trust in the website includes: initial trust before the first purchase – satisfaction after first purchase-continuous trust after purchase - repeated purchase or leave due to distrust. (3) the process of service quality and satisfaction. The convenience, speed, ease of service provided by the enterprise website, whether it meets the individualized needs of the customer or not will affect the consumer to perceive quality of service, and form an attitude of satisfaction or dissatisfaction with the service of the electronic supplier website, thereby affecting the purchase decision of consumer.

2.1 Application of Personalized Recommendation System

Various recommendation systems have been widely used in various websites on the Internet, and different personalized recommendation systems can provide different functions for users. For instance, a travel recommendation system is usually introduced to users by a travel agency or a tourist attraction management agency to increase their income. E-commerce, social networking, movies and video, music, reading, location-based services and other fields have used the recommendation system to provide users with information recommendation services. Typical systems are shown in Table 1. The following describes some personalized recommendations.

Table 1 Personalized Recommendation Typical Application Fields

Field	Website
Online Shopping	Amawn,eBAY,Taobao,Dangdang,etc.
Movies and Videos	Netflix,Youtube.Hulu,MovieIens,etc.
Music	Pandora,CDNOW,Last.iin,etc.
Social Network	Facebook,Twitter,LinkedIn,Sina Weibo, Douban, etc.
Reading	GoogleReader,Xianguo,Flipboard,etc.
Location-based Service	Foursquare,etc.

The development of personalized recommendation system is inseparable from the application of recommendation system. Data of market research shows that the recommendation system of Amazon website can make the sales conversion rate as high as 60% under certain circumstances. The recommendation system combines a variety of methods to recommend services to users. The recommended methods are as follows:

Table 2 Recommendation Mechanism

Recommended Module	Recommendation Mechanism
Your Recommendation	Based on the Historical Behavior of Users on the Site
Other Users Buy	Based on the Historical Behavior of Similar Users on the Site
Bookstore Gift Ideas	Commodity -based Content Characteristics
User Comment	Based on the Historical Behavior of Similar Users on the Site
Purchase Circle	Based on the Historical Behavior of Similar Users on the Site
Amazon Express	Commodity-based Content Characteristics

The cached result calculated by Online is calculated again by a more complicated algorithm and updated to put into the cache. Nearlin is the link between the two systems connecting Online and Offline. Because the Offline system tends to mine long-term and massive user behavior logs, it will consume a lot of computing resources and time. Therefore, these results will be delivered to the Online system via the Nearline system.

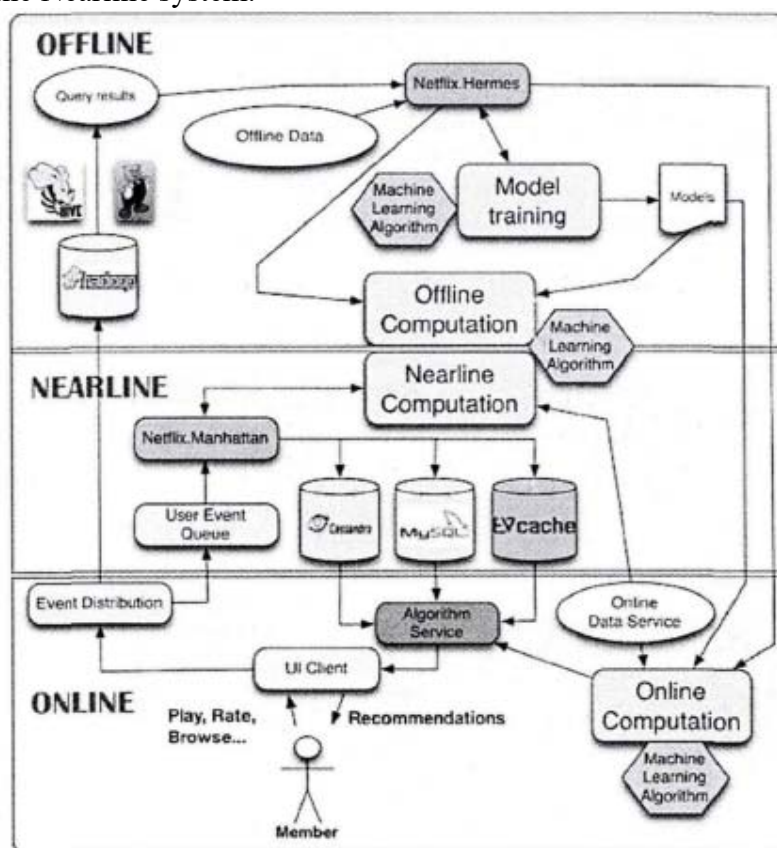


Figure 1 Netflix's Online-Nearline-Offline Mixed Recommendation System

Table 3 Recommendation Mechanism

Personalized Service System	Data Source	Model Representation of Users
ResearchIndex	Information Provided by Users	Explicit Creation
BroadVision	Registration Information of Users	Static Information Representation of Users, Explicit Creation
PersonalWebWatcher	Direct Hyperlink to the Document Page	Vector Representation based on Weighted Keyword, Implicit Creation
IfWeb	Feedback of Users	Representation based on Weighted Semantic Web, Explicit Creation
InfoScope	Reading Behavior of Users	Implicit Creation
Syskill&Webert	Direct Hyperlink to the document page	Vector Representation based on Weighted Keyword, Implicit Creation
Anatagonomy	browsing behavior and feedback of users	Vector Representation based on Weighted Keyword, Explicit Creation
CiteSeer	The Behavior of the User Browsing the Page and	A Collection of Files Representation, Explicit or Implicit Creation
Letizia	The Behavior of the User Browsing the Page and	Vector Representation based on Weighted Keyword, Implicit Creation
SELECT	User Browsing Behavior Information	Vector Representation based on Weighted Keyword, Explicit Creation
PVA	User Browsing Log Information	Personal View Representation of a Type Hierarchy,
SIFT	User Explicit Feedback	Vector Representation based on Weighted Keyword, Explicit creation
GroupLens	User Feedback and Browsing Page	Vector based on Keyword Placed in the Database, Explicit

2.2 Recommended Method based on Collaborative Filtering

2.2.1 User-based Collaborative Filtering

User-based collaborative filtering believes that if some users' evaluation of some recommended items is relatively close, then they can be considered to have similar desires, that is, user sets close to the interest preferences of target users. And then based the rating of these users for the recommended item, the target user's rating of the unrated recommended item is predicted. Figure 2 shows an example of the user-based collaborative filtering method. After being given a target user U1, a calculation, based on the user's historical interest preference, is made to get the neighbor user U3. And then the commodity P4 that the user U3 likes will be recommended to the user U1.

Table 4 Recommendation Mechanism

User Item	Commodity P1	Commodity P2	Commodity P3	Commodity P4
User U1	√		√	
User U2		√		
User U3	√		√	√

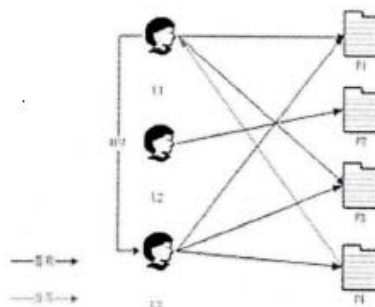


Figure 2 User-based Collaborative Filtering Schematic Diagram

2.2.2 Item-based Collaborative Filtering

The basic principle of item-based collaborative filtering is similar to user-based collaborative filtering. This method considers that if most users provide similar evaluation for recommendation items, the target users will do so. That is to say, many users prefer a movie, so it is very likely for other users to prefer the movie. Figure 3 shows an example of item-based collaborative filtering. For the commodity P1, according to the historical preference of all users, the user who likes the commodity P2 will like the commodity P3, then the commodity P1 and the commodity P3 can be considered to be similar, and if the user U3 likes the commodity P1, the possibility that the user U1 also likes the commodity P3 will be concluded.

Table 5

User Item	Commodity P1	Commodity P2	Commodity P3	Commodity P4
User U1	√		√	√
User U2	√	√		√
User U3	√		√	Rrecommendation

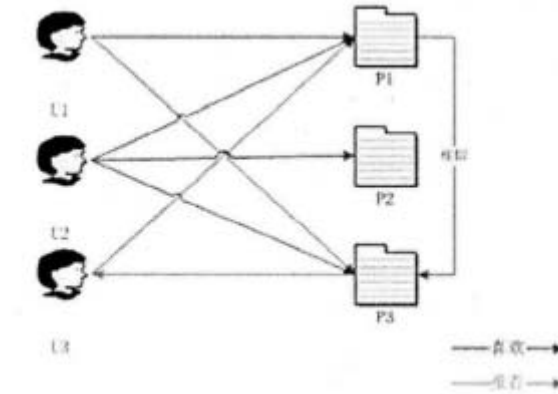


Figure 3 Item-based Collaborative Filtering Schematic Diagram

$$sim_{ij} = \cos(i, j) = \frac{\vec{r_i} \cdot \vec{r_j}}{\|\vec{r_i}\|_2 \times \|\vec{r_j}\|_2} = \frac{\sum_{u \in U_{ij}} r_{ui} \cdot r_{uj}}{\sqrt{\sum_{u \in U_i} r_{ui}^2} \sqrt{\sum_{u \in U_j} r_{uj}^2}}$$

Cosine similarity: The item's score is regarded as mx1 dimension vector. The similarity among items is calculated by the cosine of the angle between the item's scoring vectors. The smaller the angle is, the higher the similarity is. The similarity calculation formula of cosine vector is as follows:

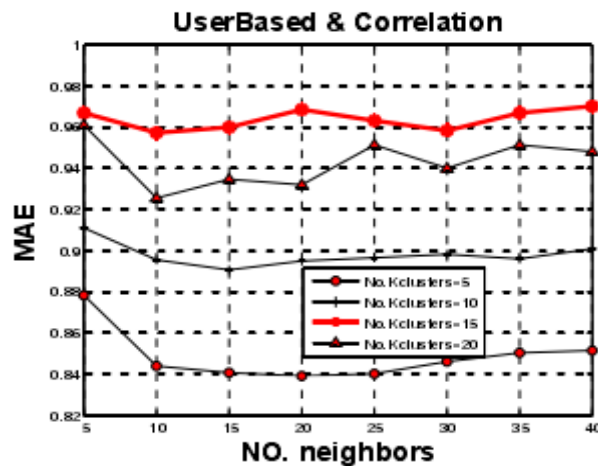


Figure 4 Collaborative Filtering-based User Similarity MAE

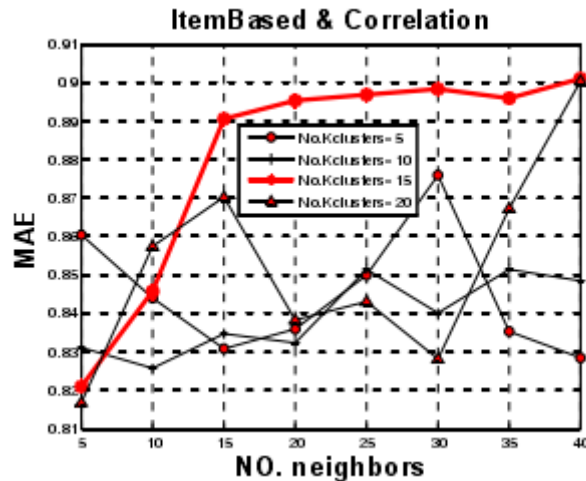


Figure 5 Collaborative Filtering-based Item similarity MAE

3. Service-oriented Recommendations

(1) Commodities strategy centered on consumers' needs. In the large network environment, Alibaba, with the increasing number of potential users, analyzes the feedback of consumers through relevant technologies and compares similar commodity on the market. The whole process needs to be centered on the needs of consumers, because the success or failure of commodities ultimately depends on the satisfaction of consumers.

(2) Pricing strategy based on consumers' behavior. With network technology develops, the Internet and information are closely linked. The pricing of each enterprise will be affected by the network. Consumers' awareness of price is significant for the correct pricing of enterprises. To formulate a reasonable and scientific price, enterprises must cooperate with all parties. Only when a reasonable pricing target is determined, the enterprise shall try to offering commodities or services to consumers at a lower price.

(3) Sales channel strategy which is convenient for consumers. New online marketing brings possibility of direct transactions between producers and consumers. Of course, the network requires a complete system, such as ordering function, payment function and delivery function so as to form a business service empire that integrates business flow, logistics, capital flow, and information flow.

(4) Effective communication strategies with consumers. Network marketing must pay attention to the promised service, but also properly handle customer complaints, which require effective communication. Alibaba Group believes that it is necessary to establish a responsible corporate citizenship role model. Active, sincere and friendly communication with consumers strengthens consumers' trust, increase consumer tolerance, and thus increase satisfaction and loyalty of consumers.

4. Conclusion

Identifying the potential needs of users and helping users quickly find services that match their preferences is an important part of service network operations. The credibility of the recommendation is enhanced when the responsiveness of the system is improved and the multi-dimensional reputation indicators of the service are considered. Finally, the rationality, convergence and accuracy of the model are verified by comparison experiments of numerical examples analysis and prediction accuracy of real data.

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