A HYBRID SYSTEM FOR PERSONALIZED CONTENT RECOMMENDATION

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ABSTRACT

As electronic commerce has penetrated into the publication business, personalized content recommendation has drawn much attention in recent years for automated informational service. In prior literature, several studies have used the concepts of content-based filtering or collaborative filtering to recommend books, articles, and news, among other media. However, either of these methods has limitations, and different content domains may have various needs in making recommendations. To address this gap, we design a hybrid system and apply it to the recommendation of research articles. Our method has the merits of both content-based and collaborative filtering. More importantly, such a hybrid solution is effective in addressing the problems of handling new users and new papers. These problems cannot be solved easily by conventional recommendation approaches, such as K-Nearest Neighbors and (KNN) and Frequent-Pattern Tree (FP-tree). The performance of our proposed system was evaluated in an experiment on published JECR papers to show superiority over benchmarks. Overall, this study makes contributions to information systems (IS) and electronic commerce literature and practice, and suggests that a hybrid solution as presented by our proposed system could better serve readers of academic journal to enhance service quality and user satisfaction.

Keywords: Personalized content recommendation; Hybrid methods; Recommendation systems; Cold start.

1. Introduction

As electronic commerce prevails in recent years, an increasing demand exists for automated informational service, which spreads from physical products to online content such as music, movies, news, and academic articles. The popularity of social media and e-publishers has rapidly increased the volume and value of online content. Under such a trend, personalized content recommendation has become necessary in recent years [Barrett et al. 2015; Panniello et al. 2016]. In IS studies, personalization generally refers to the process of employing data mining techniques to analyze individual user's profile in order to tailor subsequent material for individual customer [Liang et al. 2006; Liang et al. 2012]. The recommendation of personalized content is not a trivial task, because it requires a specifically designed mechanism for identifying and ascertaining various preferences from different users on various content items. Such a mechanism then filters different items' relative priorities to be recommended accordingly. Thus, personalized content recommendation refers to the action of making suitable content suggestion to individual users on the basis of information retrieval and filtering [Liang et. al. 2006].

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In prior literature, several methods have been proposed for recommending books, articles, and news, among other media. A majority of these existing solutions were based on expert ratings, user-generated feedback, and crowd sourcing (popularity) to offer a prioritized list of recommended content for each individual reader [Schafer et al. 2001; Wan & Fasli 2010; Chandrashekhar et al. 2011; Hu et al. 2011; Liang et al. 2012; Piramuthu et al. 2012; Li & Karahanna 2015; Chen et. al. 2015; Son 2016; Ku et al. 2016; Wei et al. 2017; Gupta et al. 2017; Zhang & Piramuthu 2018]. However, problems remain when existing solutions are applied to real-world recommendation requests. For instance, it is often infeasible to have many experts classify ever-increasing content. In addition, people may be reluctant to provide feedback that can be used for future content recommendation. Crowd sourcing also has its limitations. For example, when scholars look for academic papers, popular papers may not be the most relevant ones for readers with specific topics in mind. In view of such limitations, a combination of multiple methods may be more useful for enhancing the overall performance of content recommendation.

Toward this end, we propose a hybrid personalized content recommendation system by cross-pollinating the content-based and collaborative filtering in this study. We focus on the recommendation of research papers. Many publishers put research papers online for paid download. After the enactment of the Budapest Open Access Initiative [BOAI 2002], there are more than one million research papers available for free access, and this amount is increasing rapidly every year (see Fig. 1). Hence, personalized recommendation of relevant research papers has become a challenging task as global research output has grown exponentially over the past decade [Jinha 2010]

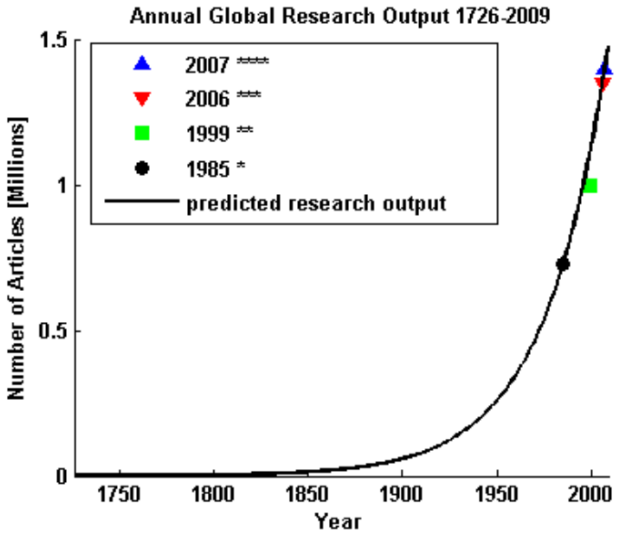

Figure 1. Global research output trends (Jinha 2010)

Finding relevant research papers is a problem for most scholars. Although some journals have provided the service of recommending relevant literature, the quality of recommendation is often not very high. A few prior works with focus on using either content-based filtering or collaborative filtering to make recommendations have been reported, such as Liang et al. [2008] and Lee et al. [2013]. As these methods have limitations, it is desirable to find a method for better applicability. In this research, we develop a method that combines the K-Nearest Neighbors (KNN) and Frequent-Pattern Tree (FP) algorithms to enhance recommendation quality and avoid problems in existing methods such as the cold start problem in collaborative filtering. Our method is evaluated empirically to show its superiority over the benchmark.

The organization of the paper is as follows. Related literature is reviewed in the next section. Our proposed recommendation system is described in Section 3, and experimental findings are reported in Section 4. We conclude this paper in Section 5 with a discussion of contributions, implications, and future research directions.

2. Literature Review

2.1. Recommendation Systems

A recommendation system is targeted at filtering out irrelevant information, identifying user preferences, and providing personalized suggestions that fit user interests [Sarwar et al. 2000; Schafer et al. 2001; Liang et al. 2006; Cheung et al. 2003; Liang et al. 2008; Jiang et al. 2010; Li and Chen 2013; Li and Karahanna 2015; Chen et. al. 2015;

Son 2016; Wei et al. 2017; Zhang and Piramuthu 2018]. Prior studies have investigated the application of recommendation systems in various areas to offer personalization in products, services, and content provision. Table 1 lists a number of selected studies in different domains.

Table 1. Applications of recommendation systems

Areas	Recommending Items	Related Studies
Electronic commerce	Merchandise, Products, etc.	Sarwar et al. [2000] Kim & Kim [2001] Linden et al. [2003] Kim et al. [2008) Wang & Wu [2012] Palopoli et al. [2013) Li and Karahanna [2015] Zhang & Piramuthu [2018]
Media	Videos, Audios, etc.	Christakou et al. [2007] Bobadilla et al. [2012] Wei et al. [2016] Wei et al. [2017]
Social networks	Friends, Partners, etc.	Li et al. [2014]
Content	News, Books, etc.	Liang et al. [2008] Lee & Chen. [2013] Wen et al. [2012] Chen et. al. [2015]

The most important objective of a recommendation system is to help reduce information overload [Liang et al. 2006]. To this end, the most common approaches include content-based filtering and collaborative filtering [Resnick et al. 1994; Resnick & Varian 1997; Adomavicius & Tuzhilin 2004; Liang et al. 2008; He et al. 2010]. Each approach has advantages and limitations. In general, content-based filtering is very effective when individual customer preferences are known and can be predicted by such attributes. For example, a movie recommendation system may collect "must-have" movie attributes, such as preferred movie genres or favorite movie stars, by explicitly asking the user or implicitly analyzing previous viewing behavior, and then creating a consumer preference match to generate a recommendation based on these attributes.

The content-based filtering approach has a major constraint in that it is not always feasible to obtain individual customer preferences or identify proper product attributes for matching user preference. For example, it is not unusual that some customers have no clear idea of what movies they prefer even though they intend to watch movies. They may want to browse before making a selection. Collaborative filtering is different from content-based filtering in that it does not rely on known preferences of individual customers. In a situation in which a customer's preference is unknown, the collaborative filtering approach makes recommendations based on revealed preferences of a specific group of consumers. The central idea of collaborative filtering is consumer clustering. Consumers or items in the same cluster often share similar behaviors or attributes. For example, based on historical movie-watching records of a user's friends, it is possible to recommend movies to the user, even though no movie preference data of the user is available. This is because friends may share similar interests. This is also known as user-based collaborative filtering. A typical example occurs with online retailers that recommend products to consumers based on "customers who bought this item also bought the following…." Collaborative filtering is beneficial in judging preferences when a large amount of consumer transaction data are available, but limited when previous transaction data are not adequate. A typical case is called "cold start" in which no prior transaction record of the customer is available (e.g., a brand new product). Theoretically, a new product without prior transaction data will not be recommended. Table 2 offers a summary of major advantages and limitations of the two major approaches.

2.2. Hybrid Approaches and Content Recommendation

In order to mitigate the limitations of individual approaches (Table 2), considerable hybrid approaches have been proposed. Generally, hybrid approaches are more capable of relaxing the constraints in individual approaches [Balabanovic and Shoham 1997]. For example, almost all of individual approaches are unable to make recommendation for new users or new items. On the other hand, many hybrid approaches are able to benefit from using auxiliary or alternative information sources to mitigate such a limitation [Balabanovic & Shoham 1997; Basilico & Hofmann 2004; Li et al. 2005; Zhang et al. 2010; Lika et al 2014; Lee & Lee 2014; Jiang et al. 2015; Wei et al. 2016; Soni et al. 2017; Gupta et al. 2018; Hassannia et al. 2019]. However, this does not mean that the existing hybrid

approaches are perfect and do not have any potential limitations. For example, a majority of the existing hybrid approaches are reliant on the assumption that review, tagging, or user-generated rating are available for establishing user-preference profiles (Table 3), but this assumption often may not be held for the readers of academic journals, research articles, etc.

Table 2. Comparison of content-based and collaborative filtering

	Content-Based Filtering (CBF)	**Collaborative Filtering (CF)**
Advantages	* Domain knowledge is unnecessary. * Communities, feedback, raters, and so forth, are unnecessary.	* Domain knowledge is unnecessary. * Dealing with content data is unnecessary. * Identifying user preferences is unnecessary. * Easily implemented.
Limitations	*Requires considerable content data, many item attributes, and so forth. *Requires identifiable user preferences. *Does not work for new users, items, and so forth (cold start problem).	*Requires communities, feedbacks, ratings, and so forth. *Does not work for new users, new feedbacks, new ratings, and so forth (cold start problem).

Table 3. Examples of the existing hybrid approaches and their potential limitations

The existing studies	Recommending targets	Hybrid approaches	Potential limitations
Balabanovic & Shoham [1997]	Web pages	Combining individual user's rated web page topics and multiple users' rated web page topics	Only a small number of web page topics could be predefined. Many users do not leave any ratings for any web page.
Basilico & Hofmann [2004]	Movies	Combining individual user's rated movies and multiple users' rated movies	Many users do not leave ratings for any movie.
Zhang et al. [2010]	Web pages	Combining individual user's tagged web pages and multiple users' rated web pages	Many users do not tag any web page or leave any ratings.
Lika et al [2014]	Movies	Combining individual user-generated preferential movie attributes and multiple users' rated movies	Only a small number of preferential movie attributes could be predefined. Many users do not leave ratings for any movie
Lee & Lee [2014]	Songs	Combining domain experts' knowledge and multiple users' rated songs	Domain experts are rare and their specialized knowledge may lack diversity.
Jiang et al. [2015]	Products	Combining individual user's product reviews and multiple users' rated products	Many users do not leave either their reviews or ratings for any product.
Wei et al. [2016]	Movies	Combining individual user's tagged movies and multiple users' rated movies	Many users do not tag movie or leave any ratings.
Soni et al. [2017]	Movies	Combining individual user's movie reviews and multiple users' rated movies	Many users do not leave either their reviews or ratings for any movie.
Gupta et al. [2018]	Songs	Combining individual user's preferential key words and multiple users' selected items	Many users have no ideas of what their preferential song key words would be
Hassannia et al. [2019]	Tour packages	Combining individual user's preferential tour package attributes and multiple users' selected items	Only a small number of preferential tour package attributes could be predefined. Many users do not leave ratings for any movie

Moreover, a suitable application domain is another key to developing a successful hybrid recommendation system. For example, recommending movies or songs is certainly different from recommending research papers, especially when user-generated rating and comment are not available. In the prior literature of content recommendation, Liang et al. [2008] propose a semantic-expansion approach based on the content-based filtering approach. Moreover, Lee et al. [2013] propose a method based on collaborative filtering. In other words, these proposed approaches are essentially individual approaches and thus very vulnerable to the problem of new users and new items—i.e., the cold start problem [Huang et al., 2004].

As a result, the challenges of how to develop a hybrid personalized content recommendation system and cope with the cold start problem remain open research questions in prior literature. Specifically, these challenges involve recommending research papers to first-time users. Such users do not have any previous usage records and thus it is hard to build user-preference profiles to find matching articles. In the same vein, another challenge pertains to recommending new research papers, because no prior records would be available for showing the joint usage of these newly added articles and other existing articles.

To bridge these gaps, we develop a hybrid recommendation approach and use it to recommend personalized research papers, articles, and so forth.

3. The Proposed Hybrid Recommendation System

In this section, we describe a hybrid recommendation system (HRS) for personalized recommendations of research papers. This system is capable of managing new users and new papers that cannot be handled by content-based filtering or collaboration-based filtering alone. The inability of existing systems to manage new users or new papers results from a lack of prior records or means of tracking, and represents an extreme case of the "data sparsity" problem in information retrieval [Schein et al. 2002]. However, both user profiling and item profiling in any recommendation system has to depend on the collected data that includes attributes associated with users and items.

For processing new users, our system tracks web navigation behaviors to profile each anonymous reader. This method has been employed for implicitly detecting user preferences in many contexts, such as web news and articles [Liang 2006; Wen et al. 2012]. Regarding the new item issue, our system uses key words and machine learning to build the profile of each new paper.

Specifically, we combine the K-Nearest Neighbors (KNN) machine-learning algorithm and the Frequent-Pattern Tree (FP) machine-learning algorithm in our recommendation system to benefit from both the collaborative and content-based filtering approaches. The KNN is a non-parametric method for unsupervised grouping, and it is very efficient at sorting very large quantities [Matsatsinis et al. 2007; Wang et al. 2012; Lee et al. 2013]. The FP is also a very powerful method in sorting out association rules. Basically an extension of the Apriori algorithm, the FP can provide a better association performance due to its tree structure [Han et al. 2000]. Briefly stated, the integration of navigation behaviors, grouping (KNN), and association (FP) is the main feature of our hybrid recommendation system for providing personalized recommendations of relevant articles.

Our proposed system procedure includes ten steps detailed in the following section and illustrated in Figure 2. Numbers in Figure 2 are the corresponding steps, respectively.

Step 1: Paper collection

New research papers are found and stored in our database. This operation is the input module of the system and independent of the rest of the procedure.

Step 2: Key word identification and frequency calculation

For every paper in the database, the system extracts key words and calculates their frequency. The system uses the normalized term frequency and inverse document frequency (TF-IDF) to represent the key words of a paper [Han et. al. 1998; Koutsias 2000].

$$\frac{tf_{x,y}\,(\log\frac{N}{df_x})}{\sqrt{\sum_{x=1}^{n}(tf_{x,y}\,(\log\frac{N}{df_x}))^2}}$$

$tf_{x,y}$: The frequency of key word x in paper y

df_x: The number of paper containing key word x

N: Total number of paper

n: Total number of key word

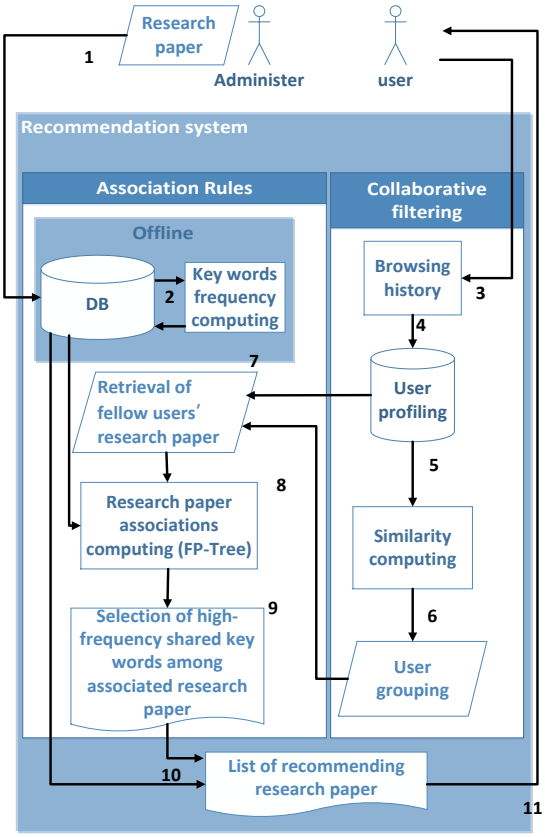

Figure 2. Architecture of the proposed hybrid recommendation system

Step 3: Usage behavior recording
The system records the browsing history of all users (previous papers that users have browsed).

Step 4: User profiling
We use the browsing history to build up each user's profile. The following browsing data are used: the material that the user read (e.g., paper ID, journal ID, views, reading time, and download times) and where the user came from (e.g., IP address). This is the minimum information that users would make available when accessing any online research paper.

Step 5: Similarity calculation
We then use the attributes collected in Step 4 and the Pearson method [Herlocker et al. 1999] to compute the similarity between users' profiles as follows:

$$\frac{\sum_{i=1}^{n}(x_i - \overline{x_i})(y_i - \overline{y_i})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x_i})^2 (y_i - \overline{y_i})^2}}$$

x_i: The value of attribute *i* associated with a specific user *x*

y_i: The value of attribute *i* associated with a specific user *y*

n: The total number of attributes

$\overline{x_i}$: The average of overall attributes' value associated with the user *x*

$\overline{y_i}$: The average of overall attributes' value associated with the user y.

Step 6: User grouping
KNN is used to group users with high similarity into clusters. These clusters are the basis for recommendations.

Step 7: Relevant paper retrieval
Based on the user profile, the system retrieves papers that were browsed by users of the same cluster as candidates for recommendations (i.e., the system assumes that users in the same cluster share similar browsing interests).

Step 8: Candidate paper analysis
After identifying candidate papers, the system applies FP to generate the associations between different key words and store them in the database.

Step 9: Selection of papers for recommendation
Based on the result from Step 8, the system selects candidate papers with a higher score than the predetermined threshold for recommendation.

Step 10: Display recommendation list
Finally, the system shows its selected papers to the user.

4. Empirical Evaluation

In order to evaluate the performance of the hybrid approach, an empirical study was conducted.

4.1. Research Site and Data

We used the JECR (*Journal of Electronic Commerce Research*) (http://www.jecr.org/) as our research site. In other words, we deployed our proposed system on the JECR and conducted an experiment. The JECR is a prestigious academic journal in which researchers and professionals publish their research papers on electronic commerce theories and applications. Figure 3 shows a sample screen. In this experiment, 278 JECR research papers were randomly selected, and our system generated 14,881 key words as content attributes.

Figure 3. The main webpage of JECR.

4.2. Experimental Design

The experimental subjects were graduate students (PhD and master's students) at three universities in Taiwan. Although none of the students had prior research publications, they were in various stages of completing their master theses or dissertation research. Hence, they were motivated and experienced in finding relevant research papers. Moreover, these recruited students had to take at least one course in electronic commerce or mobile commerce. This was to ensure that they had adequate background knowledge to understand and read the selected papers for the experiment.

Two benchmark systems were used to compare with the proposed hybrid system: the collaborative filtering system that uses the K-Nearest Neighbors (KNN) algorithm and the content-based filtering system that uses the Frequent-Pattern Tree (FP-tree) algorithm.

4.3. Evaluation Metrics

In this study, we use the interest ratings provided by the subjects to measure the performance of the three systems under study. In prior literature, two different approaches have been adopted to measure the performance of recommendation systems [Sarwar et al. 2000]. One is from the technical perspective. For example, in evaluating the computational performance of different prediction results, the precision rate, the recall rate, or a combination of the

two (e.g., f-measure) are often used [McLaughlin & Herlocker 2004]. The second is from the user perspective. For instance, a stream of studies used the interest ratings provided by experiment participants to measure whether users were satisfied with the recommended items [Liang et al. 2006; Liang et al. 2008; Li et al. 2014]. Since user interests and satisfaction are the ultimate goal for personalized recommendation to achieve and the main purpose of this research, it is adopted as our performance measure. It is also practically common in many EC websites and suggested in prior publication (e.g., [Mudambi & Schuff 2010]). In this study, we thus adopt the interest ratings as the evaluation metrics.

4.4. Experimental Procedures

The experiment was composed of 60 participants in the first stage and 30 participants in the second stage. At the beginning of the first stage, subjects were asked to read their task instructions and turn in reports 40 minutes later. The instructions included finding papers that were interesting or helpful in the areas of electronic commerce and mobile commerce on the experimental website. They were allowed to use a dictionary website if necessary. Their reports were to include the research papers they found, as well as the reasons the particular papers were chosen. The purpose of this step was to build a usage database that was important for future recommendations.

In the second stage, 30 participants were randomly selected from the original 60. Each was given six recommended research papers to read. These papers were among those chosen in the first stage and recommended by the three recommendation systems—i.e., the KNN, the FP, and the HRS. The KNN and FP are the experiment benchmark systems while HRS is our proposed hybrid system. However, the participant did not know which paper was recommended by which system.

The 30 participants were asked to read the 6 papers and rate them based on their interests on a Likert scale from 1 (least useful) to 7 (most useful). Samples are presented in the Appendix. Participants' input was then analyzed.

4.5. Analysis and Results

Results from the experiment, in the form of average performance ratings and their standard deviation (S.D.), are shown in Table 4. As shown, the mean performance rating of the hybrid system (HRS) is 5.35, which is superior to the ratings of both benchmark systems (e.g., the FP is 4.7 and the KNN is 4.5, respectively).

Table 4. Performance comparison of three systems

Systems	**Mean Performance Rating**	**S.D.**	**pair t-test**	
HRS	5.35	.97512	**Difference**	**t-value**
FP	4.7	1.1188	0.65**	0.0115
KNN	4.5	1.28654	0.85**	0.002

In addition, we use pairwise t-test to examine whether performance differences among the systems are statistically significant. We test HRS vs. FP and HRS vs. KNN, respectively. Table 4 (pair t-test) shows the result: both performance differences are significant at the .05 level. That suggests that our proposed hybrid system is superior to both benchmarks.

5. Concluding Remarks

This study proposes a hybrid content recommendation system and reports on its application to research paper recommendations. The hybrid system was proven to be better than two popular recommendation approaches—content-based filtering and collaborative filtering. An experiment was conducted on papers published in the *Journal of Electronic Commerce Research* to see whether the hybrid system can be more effective at locating suitable research papers for graduate students in a literature search for their theses research. The result shows that papers recommended by the hybrid system rated significantly better than those recommended by the two benchmark systems that use content-based filtering or collaborative filtering alone in making recommendations.

Our main contributions are as follows. First, we have designed a hybrid approach for content recommendation that synthesizes features of both the content-based and collaborative filtering approaches. In a way, the general idea of combining the content-based and collaborative-filtering approaches wouldn't be regarded very novel, since several prior studies seem to have presented so [Balabanovic & Shoham 1997; Basilico & Hofmann 2004; Li et al. 2005; Zhang et al. 2010; Lika et al 2014; Lee & Lee 2014; Jiang et al. 2015; Wei et al. 2016; Soni et al. 2017; Gupta et al. 2018; Hassannia et al. 2019]. However, this study is fundamentally distinctive from such prior studies. For example, this study is focused on recommending research-oriented content, while those prior studies all have their particular research themes and their proposed solutions may hardily be applied to improving research paper recommendation quality.

Moreover, this study proposes a solution to address the "cold start" problem in recommending new research paper to new user. This signifies that this study is particularly valuable to the literature of recommending personalized

research paper. This study uses a real-world data set (i.e., JECR data set) to evaluate the proposed solution performance as compared with the contemporary benchmarks. Our findings contribute significantly to the knowledge of academic paper recommendation. In other words, although the idea of a hybrid method is not new, our research develops its own unique means to handle a challenging personalized content recommendation problem. Therefore, considerable future research, academic journal publishers and readers may all benefit from this study.

Lastly, since the proposed hybrid approach is aimed to matching online user with his or her preferred content, this study would be very helpful to those online academic journal publishers, open-access paper providers, etc. for improving their service quality. This study is not only relevant to recommending research paper but also pertaining to cross-pollinating the contemporary content-based and collaborative filtering approaches for further mitigating the information overload problem. This problem has affected considerable user's subscribing or purchasing decisions in cyberspace. Thus, this study would have a positive and significant impact on the EC (Electronic Commerce) research filed.

This study also has its limitations. One is that we do not have a strong theory to tell why a hybrid approach is more likely to offer better recommendations. Although this is beyond the scope of this study, we suspect that it is because the hybrid approach is more efficient at detecting a user's latent preferences. More comprehensive studies could be conducted to explore this issue in the future.

In conclusion, this study shows very useful findings that are relevant to both IS research and practice in personalized content recommendation systems, design science, and so forth. For example, academic journals that consider improving their perceived value (e.g., [Ku et al. 2018]) may adopt the proposed hybrid approach to enhance their services to users.

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Appendix A – A Sample Recommendation Used in the Experiment

The following paper are our recommending paper for you. Please evaluate their usefulness on the basis of your research interest in mobile commerce as what you reported to us (i.e., the experiment in the first stage). The evaluation scale is from 1 to 7 (1: least usefulness, 7: most usefulness).

THE IMPACT OF SECURITY AND SCALABILITY OF CLOUD SERVICE ON SUPPLY CHAIN PERFORMANCE

Abstract:
Cloud computing introduces flexibility in the way an organization conducts its business. On the other hand, it is advisable for organizations to select cloud service partners based on how prepared they are owing to the uncertainties present in the cloud. This study is a conceptual research which investigates the impact of some of these uncertainties and flexibilities embellished in the cloud. First, we look at the assessment of security and how it can impact the supply chain operations using entropy as an assessment tool. Based on queuing theory, we look at how scalability can moderate the relationship between cloud service and the purported benefits. We aim to show that cloud service can only prove beneficial to supply partners under a highly secured, highly scalable computing environment and hope to lend credence to the need for system thinking as well as strategic thinking when making cloud service adoption decisions.

✓Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4		5	6	7

The Role of Mass Customization in Enhancing Supply Chain Relationships in B2c E-Commerce Markets

Abstract:
Traditional supply chain management utilized traditional media and channels to link firms in linear inefficient relationships. The advent of electronic commerce over the Internet Protocol-based network has facilitated new relationships for connecting with new supply chain partners, thereby significantly increasing the quantity and quality of inter-organizational information flows. These information flows are theoretically evaluated using the principles of information quality dimensions, information asymmetry, and "information moments." In addition, a new breed of market makers, or information intermediaries, is defining new functional relationships between the different players. Three distinct emerging marketspaces are presented, along with an analysis of each one's informational dimension. First, the direct channel between manufacturers (or digital content providers) and consumers is enabling mass-customization, and is influencing the demand forecasting and inventory management functions. Second, the ad-serving industry is presented to portray the nature of emerging forms of supply chain relationships for digital goods. Third, the forces behind the creation of vertical portals, or "portals," are evaluated. These serve as integrators of moments of information from a supply chain perspective. Each of these three marketspaces is evaluated with respect to information quality dimensions, information asymmetry, and information moments (touchpoints). Emerging trends are discussed, such as combinatorial auctions and the role of intelligent agents and data mining in supply chain management. Finally, the impact of these new supply chain information flows on industries and macroeconomic conditions is discussed.

✓ Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4	5	6	7

The Implications and Impacts of Web Services to Electronic Commerce Research and Practices

Abstract:
Web services refer to a family of technologies that can universally standardize the communication of applications in order to connect systems, business partners, and customers cost-effectively through the World Wide Web. Major

software vendors such as IBM, Microsoft, SAP, SUN, and Oracle are all embracing Web services standards and are releasing new products or tools that are Web services enabled. Web services will ease the constraints of time, cost, and space for discovering, negotiating, and conducting e-business transactions. As a result, Web services will change the way businesses design their applications as services, integrate with other business entities, manage business process workflows, and conduct e-business transactions. The early adopters of Web services are showing promising results such as greater development productivity gains and easier and faster integration with trading partners. However, there are many issues worth studying regarding Web services in the context of e-commerce. This special issue of the JECR aims to encourage awareness and discussion of important issues and applications of Web Services that are related to electronic commerce from the organizational, economics, and technical perspectives. Research opportunities of Web services and e-commerce area are fruitful and important for both academics and practitioners. We wish that this introductory article can shed some light for researchers and practitioners to better understand important issues and future trends of Web services and e-business.

✓ Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4	5	6	7

APPLYING GENETIC ALGORITHM TO SELECT WEB SERVICES BASED ON WORKFLOW QUALITY OF SERVICE

Abstract:
Due to the rapid development of Web technologies, Internet applications increasingly use different programming languages and platforms. Web services technologies were introduced to ease the integration of applications on heterogeneous platforms. The quality of Web services has received much attention as it relates to the service discovery process. However, less work has been done on issues related to the quality of composite services. This study uses the selection model along with the concept of workflow quality of service (QoS) in order to improve the quality of service performance of current Web services in the discovery process. It also uses a selection model as the foundation for selecting Web services, conducting simulations to measure the overall workflow QoS performance when implemented in sequence. However, optimal solutions to service composition selection require exponential time in the number of services. We therefore apply genetic algorithm to quickly find the best-fitting service composition. Finally, we score and sort each service composition based on the service requesters' preferences towards QoS. The results of the experiment show that considering workflow QoS in selecting service composition improves the actual QoS performance. At the same time, using genetic algorithm to optimize the service composition provides an improvement in the solution time.

✓ Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4	5	6	7

A Customer Loyalty Model for E-Service Context

Abstract:
While the importance of customer loyalty has been recognized in the marketing literature for at least three decades, the conceptualization and empirical validation of a customer loyalty model for e-service context has not been addressed. This paper describes a theoretical model for investigating the three main antecedent influences on loyalty (attitudinal commitment and behavioral loyalty) for e-service context: trust, customer satisfaction, and perceived value. Based on the theoretical model, a comprehensive set of hypotheses were formulated and a methodology for testing them was outlined. These hypotheses were tested empirically to demonstrate the applicability of the theoretical model. The results indicate that trust, customer satisfaction, perceived value, and commitment are separate constructs that combine to determine the loyalty, with commitment exerting a stronger influence than trust, customer satisfaction,

and perceived value. Customer satisfaction and perceived value were also indirectly related to loyalty through commitment. Finally, the authors discuss the managerial and theoretical implications of these results.

✓ Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4	5	6	7

The Influence of Culture on Consumer-Oriented Electronic Commerce Adoption

Abstract:
Consumer-oriented electronic commerce is a global phenomenon. However, while online transactions are readily accepted by consumers in some countries, in others consumers seem to be less accepting. This paper uses innovation adoption theory in combination with literature on culture and information technology to examine the question of whether culture influences consumers' intentions to purchase goods or services online. A multi-country survey was conducted to gather data in order to empirically investigate this question. Results indicate that national culture does influence intentions to purchase online. In addition to the direct impact, the influence of culture is also mediated by e-commerce beliefs.

✓ Your evaluation of the paper (1: least usefulness, 7: most usefulness)

1	2	3	4	5	6	7