Comparative Study of Web Personalization Techniques in Ecommerce

Rajesh R. Gawali[*], Dr. Shivaji D. Mundhe[#]

[*,#]*Sinhgad Institute of Management and Computer Applications, Pune*

[1]rajeshgawali2009@gmail.com, [2]drsdmundhe@rediffmail.com

Abstract----**Because of Internet, there is a dramatic growth of data available on the World Wide Web. Therefore E-commerce makes use of Web Personalization tool to reduce information overload and create customer loyalty. Even though interest is growing in personalized systems, it is difficult to implement such a system. This is due to many business-critical issues must be considered before the appropriate personalization techniques can be identified.**

In this paper I present importance of Web personalization for web site, Web site is very effective method because it can be easily accessed by the peoples all over world, Hence these sites contains huge data, Web personalization will speed up the process of finding required information/item. As there are number of aspects and techniques in development of Web personalization system. The paper also highlights the comparative analysis of techniques used in Web Personalization for the Ecommerce.

Keywords - **Web personalization, E-commerce, World Wide Web**

I. INTRODUCTION

1.0 ECOMMERCE

Commerce is the exchange of something of value between two entities. That "something" may be goods, services, information, money, or anything else the two entities consider to have value. Commerce is the central mechanism from which capitalism is derived. Electronic Business which is commonly referred to as e-business, which is the utilization of Information and Communication Technology (ICT) in conduct business on the Internet, not only buying and selling but also servicing customers and collaborating with business partner. Electronic business methods enable companies to link their internal and external data processing systems more efficiently and flexibly, to work more closely with suppliers and partners, and to better satisfy the needs and expectations of their customers.

E-Commerce, Electronic commerce or e-commerce refers to a wide range of online business activities for products and services. Ecommerce consists of the buying and selling of products or services over electronic systems such as the Internet and other computer network.

Benefits to Organizations:

- Market expansion to national and international markets
- Reduced cost of creating, processing, distributing, storing and retrieving paper based information
- Reduced inventories.(Just - in – time manufacturing)
- Automated business processing
- Cost-effective document transfer
- Reduced time to complete business transactions, speed-up the delivery time
- Improved customer service.
- Increased productivity
- Reduced transportation Costs

1.1 CHALLENGES TO ECOMMERCE

Ecommerce can change the economies of the developing nations. It can integrate them to the global market which in turn improves and strengthens the economic well-being of these nations. However, the practice of Ecommerce in these nations is in its early stages and there are also major challenges that can hold back its growth. Challenges in the Indian market include:

1. India has limited English speaking population.
2. PC costs and broadband costs are still high.
3. Government not supportive of ecommerce sector.
4. Lack of talent in the sector.

Some of the major barriers at present are:

- Not sure of product quality
- Cannot bargain/negotiate
- Not sure of security of transactions / Credit card misuse
- Need to touch and feel the product
- Significant discounts are not there
- Have to wait for delivery
- Fear of trusting things online.

Some of the infrastructural barriers responsible for slow growth of ecommerce in India are payment collection, logistics, vendor management and taxation.

II. WEB PERSONALIZATION

Personalization is a process of gathering and storing information about site visitors, analysing the information,

---

---

and, based on the analysis, delivering the right information to each visitor at the right time. It is a key technology needed in various e-business applications, such as:

- Managing customer relationships
- Targeting advertisements and promoting products
- Managing marketing campaigns
- Managing Web site content
- Managing knowledge
- Managing personalized portals and channels

ELEMENTS: Although each application area may need tailoring, especially in the areas of user interface and data collection, the core elements for personalization, depicted in Figure 1, are quite similar.

A: Identify site visitor

B: Retrive visitors profile

C: Select content that matches visitors preferences

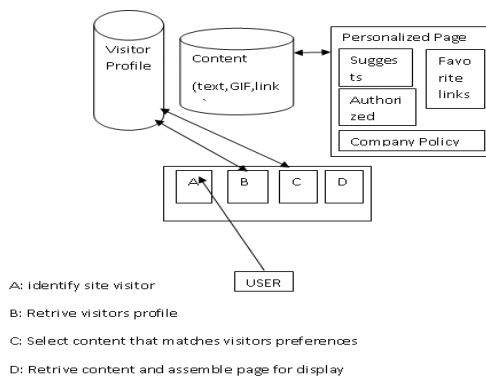D: Retrive content and assemble page for display

Figure 1. Elements of a personalization system

Personalization has gone through different phases. Initially, personalization was used to keep the visitor on the site, exploring more of the site, which provided opportunities to advertise and promote products. The next phase attempted to increase how much money a visitor spent at each visit by offering more expensive or related products. Today, personalization is increasingly used as a means to expedite the delivery of information to a visitor, making the site useful and attractive to return to. Custom pricing, customized content, targeted marketing, and advertising are more advanced personalization methods that require sophisticated data mining. These methods rely on personalized Web pages and deliver business value by enabling site owners to determine how and when to change site content. However, dynamically building such pages requires additional resources and may affect overall system performance. Minimizing

the impact of these pages requires a personalization engine that is scalable to handle a large number of requests, a large and complex content space, and the collection of customer information.

Web personalization is a strategy, a marketing tool, and an art. Personalization requires implicitly or explicitly collecting visitor information and including that knowledge in your content delivery framework to manipulate what information you present to your users and how you present it. Personalization helps in increasing visitor response or promoting customer retention.[6]

Strong customer relationships are important to the success of e-commerce business. That's why the e-commerce personalization is the feature of e-commerce. This feature of e-commerce software is based on better understanding of customers shopping behaviour and preferences. This automated system logs customers complete transaction history, including purchases made, WebPages visited and products browsed, Later, can use this information to develop specific promotions and other special offers to a particular customer or groups of customers with the same preferences and behaviour.

Simply having an interactive infrastructure of e-commerce store is not enough. Providing buyers with an incentive to purchase complementary products and services is how the e-commerce personalization feature works and encourages prospective customers to go through with their purchases and make repeat ones.

Today's most successful e-commerce sites routinely experience transaction closure rates in the range of 8 to 10 percent of visits, with the average across all of e-commerce pegged at a dismal 2.8 percent. Bounce rates frequently exceed 50 percent, and customer engagement with most sites is so low that customer loyalty is virtually nonexistent.

Some of this can be attributed to everyone's use of the web as a tool for research that ultimately leads to purchasing the best deals online or at brick and mortar establishments, where store conversions are in the 40-plus percent range. However, the primary reason for the failure of online retailing to convert customers at acceptable rates is because historically, e-commerce websites have been a one-size-fits-all proposition.

For example, the majority of e-commerce websites contain a user interface, content, and presentation that remain static for every visitor. This occurs even though we

---

intuitively know individuals have unique motivations and communication preferences. Shoppers rely on different information and different types of websites when making a buying decision.

New web personalization technologies dynamically alter sites in real-time to provide a customized experience for every visitor to an e-commerce site. Such software identifies an individual's preferences, and then delivers on-the-fly adjustments that make each customer feel the site was built just for him. The visitor feels instant rapport with the site, resulting in a deeper level of engagement and dramatically higher conversions.

The next level of web personalization technology departs significantly from earlier technologies by not identifying customers based on demographics, purchase history, or statistical information, such as "40 percent of buyers who bought X purchased Y as well."

Web personalization techniques also serve to improve customer service, increase sales and connect with prospective or potential clients. You can implement several types of intelligent Web personalization techniques to help organization reach its goals.

The Web information age has brought a dramatic increase in the amount of information (Web content), in the access to this information (Web usage), and in the intricate complexities governing the relationships within this information (Web structure). Hence, not surprisingly, information overload when searching and browsing the World Wide Web (WWW).One of the most promising and potent remedies against this plague comes in the form of personalization. Personalization aims to customize the interactions on a Web site, depending on the user's explicit and/or implicit interests and desires.

Amazon use very simple collaborative filtering based on what you have looked at or purchased previously and serve them up to you. Also the product recommendations are based around what people have done on this particular product not specifically geared up for you. Suppose you bought camera on Amazon a while back, and now get homepage recommendations for other cameras, but it would be better to target maybe lenses or accessories for this camera that I have not bought before. A true personalization would look at what users who bought this camera have gone on to do and based on what you have purchased target relevant cross sell and up sell items.

WEB PERSONALIZATION PROCESS: In brief, web personalization can be defined as any action that customizes the information or services provided by a web site to an individual user, or a set of users, based on knowledge acquired by their navigational behavior, recorded in the web site's logs, in other words, its usage. This information is often combined with the content and the structure of the web site, as well as the interests/preferences of the user, if they are available. The web personalization process is illustrated in Figure 2. Using the four aforementioned sources of information as input to pattern discovery techniques, the system tailors the provided content to the needs of each visitor of the web site. The personalization process can result in the dynamic generation of recommendations, the creation of index pages, the highlighting of existing hyperlinks, the publishing of targeted advertisements or emails, etc. In this thesis we focus on personalization systems that aim at providing personalized recommendations to the web site's visitors. Furthermore, since the personalization algorithms we propose in this work are generic and applicable to any web site, we assume that no explicit knowledge involving the users' profiles, such as ratings or demographic information, is available. The problem of providing recommendations to the visitors of a web site has received a significant amount of attention in the related literature. Most of the research efforts in web personalization correspond to the evolution of extensive research in web usage mining, taking into consideration only the navigational behaviour of the (anonymous or registered) visitors of the web site[2,3,4]
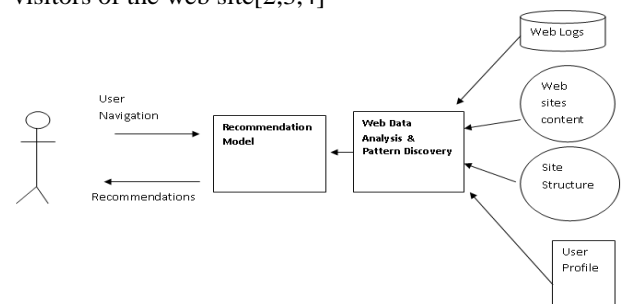

Figure 2. The web personalization process

Personalization, however, presents certain shortcomings. This may happen when, for instance, there is not enough usage data available in order to extract patterns related to certain navigational actions, or when the web site's content changes and new pages are added but are not yet included in the web logs. Moreover, taking into consideration the temporal characteristics of the web in terms of its usage, such systems are very vulnerable to the training data used to construct the predictive model. As a result, a number of research approaches integrate other sources of information, such as the web content [5] or the web structure in order to enhance the web personalization process.

2.1 USE OF WEB PERSONALIZATION IN ECOMMERCE

Applying personalization also become especially tricky on retail websites and web applications. Personalization in retail websites have to satisfy both the retailer and

customers.
For e.g. retailers want to promote the latest electronic gadgets to increase their profit, but at the same time provide a way to display the right products that customers are looking for.
So taking retail website as an example, when you apply a personalization technology to provide better user experience for the customers, think about personalization can be easily managed by the retailers and provide the right content for the customers.

I. TECHNIQUES USED IN COLLECTING THE DATA

Figure 3 is an overview of personalization techniques. The major steps -- collecting visitor information, filtering, and developing recommendations -- may or may not be performed dynamically; part or all of some steps may be performed offline, in batch mode, or even manually.

The objective of collecting visitor information is to develop a profile that describes a site visitor's interests, role in an organization, entitlements, purchases, or some other set of descriptors important to the site owner. The most common techniques are explicit profiling, implicit profiling, and using legacy data:

Explicit profiling asks each visitor to fill out information or questionnaires. This method has the advantage of letting customers tell the site directly what they want to see. An example is MyYahoo, where the visitor is asked to specify profile information, including, for example, what stocks to track and what news categories to report. MyYahoo dynamically constructs a personalized Web page accordingly.

Implicit profiling tracks the visitor's behaviour. This technique is generally transparent to the visitor. Browsing and buying patterns are the behaviours most often assessed. The browsing pattern is usually tracked by saving specific visitor identification and behaviour information in what is called a cookie that is kept at the browser and updated at each visit. The buying pattern is generally available in the customer purchase database. For example, Amazon.com logs each customer's buying history and, based on that history, recommends specific purchases.

Using legacy data accesses legacy data for valuable profile information, such as credit applications and previous purchases. For existing customers and known visitors, legacy data often provides the richest source of profile information.
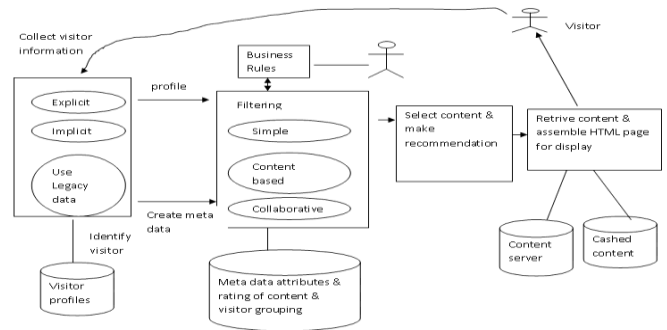

Figure 3. Overview of personalization techniques

The techniques can be combined to produce comprehensive profiles. Access to legacy data can be an important component of explicit or implicit profiling. Profile and legacy data become the metadata processed by the filtering techniques.

II. WEB PERSONALIZATION TECHNIQUES FOR ANALYSING DATA.

When the profile is available, the next step is to analyze the profile information in order to present or recommend documents, purchases, or actions specific to the visitor. Making such recommendations is the most challenging step. Many techniques for presenting content and making recommendations are in use or under development. Rule-based and filtering techniques are the best known.

4.1 RULE-BASED TECHNIQUES: Based on "if this, then that" rules processing. Rule-based techniques provide a visual editing environment for the business administrator to specify business rules to drive personalization. This requires the administrator, most likely with the help of a consultant, to figure out the appropriate rules. The rule-based approach provides a flexible mechanism to specify rules for business applications or marketing campaigns.

Cross-selling is an e-business example of the rule-based technique. For example, a rule could be specified to offer product X to a customer who has just bought product Y; for example, a customer of a book might be interested in current or previous books by the same author or in books on the same subject.

Rule-based techniques can be used with filtering techniques, either before or after the filtering process, to develop the best recommendation.

4.2 FILTERING TECHNIQUES: Filtering techniques employ algorithms to analyze meta data and drive presentation and recommendations.

THE THREE MOST COMMON FILTERING TECHNIQUES ARE simple filtering, content-based filtering, and collaborative filtering -- are introduced below.

A) SIMPLE FILTERING: It relies on predefined groups, or classes, of visitors to determine what content is displayed or what service is provided. An example of simple filtering is managing access to corporate information. For example,

----

employees identified with the Human Resources department would have personalized Web sites that give them access to information and applications specific to their job. Online brokerages often classify their accounts by asset value or age groups. Their sites could use simple filtering to provide preferential treatment to customers based on whether they are in the silver, gold, or platinum account class. Or, referring to the age group, the site could recommend savings accounts for college tuition or retirement.

B) CONTENT-BASED FILTERING

Content-based filtering works by analyzing the content of the objects to form a representation of the visitor's interests. Generally, the analysis needs to identify a set of key attributes for each object and then fill in the attribute values.

C) COLLABORATIVE FILTERING

Collaborative filtering collects visitors' opinions on a set of items, using either explicit or implicit ratings, to form like-minded peer groups and then learns from the peer groups to predict a particular visitor's interest in an item. Instead of finding objects similar to those a visitor liked in the past, as in content-based filtering, collaborative filtering develops recommendations by finding visitors with similar tastes.

III. COMPARATIVE ANALYSIS OF WEB PERSONALIZATION TECHNIQUES

Rule-based techniques and simple filtering offer significant personalization capabilities for an investment of effort relatively smaller than content-based and collaborative filtering.

Content-based filtering is most suitable when the objects are easily analyzed by computer and the visitor's decision about object suitability is not subjective. For some objects, such as the videos, analyzing content cannot be automated today, and the effort to identify attributes and evaluate each object can be considerable and require specific knowledge or skills. Recommendations are limited to objects related to those the visitor has tried, with no provision for visitor qualification. If video B is closely related to video A on the content, it will always be recommended to visitors interested in video A. Whether anyone interested in video A actually finds video B worth viewing is not factored into the consideration for making the recommendation.

Even in the case of recommending documents or Web pages, which is most amenable for automation, content-based filtering remains an active area of research because of inherent redundancies and ambiguities in textual descriptions. The basic approach is to treat each document as a weighted vector of keywords and partition documents into clusters. From the documents of interest to each visitor, one can derive the relevant keywords or document clusters of interest to a visitor.

Basic collaborative filtering addresses some of the shortcomings of pure content-based filtering. Recommendations produced by collaborative filtering are qualified based on the peer group's response and are not restricted to a simple profile matching.

Collaborative filtering requires visitors to rate objects, introducing the biases of different visitors. Certain people tend to give ratings on the extreme ends of the scale, and others tend to give rating around the middle. This can make the formation of a peer group difficult.

TABLE NO.1 COMPARATIVE ANALYSIS OF WEB PERSONALIZATION TECHNIQUES

	Site type				
Technique	**Publish/ subscribe**	**Online shopping**	**Self-service**	**Trading**	**B to B**
Rule based		X	X	X	X
Simple filtering	X	X	X	X	X
Content-based filtering	X		X	X	X
Collaborative filtering		X	X		X

For product recommendations, collaborative filtering is most suitable for homogeneous, simple products, such as books, CDs, or videos. This is because a peer group is determined using some type of nearest neighbor algorithm, where each person is represented by a vector of ratings. The more objects two visitors have rated similarly, the closer the two visitors are. This implicitly assumes a homogeneous environment. In a computer store, there are objects of vastly different characteristics and prices, from cable to memory chips to software CDs to PCs. Collaborative filtering to form peer groups and make recommendations for such a store would need to account not only for how many objects, but also for which type of objects are of common interest.

Simple filtering relies on predefined groups, or classes, of visitors to determine what content is displayed or what service is provided. An example of simple filtering is managing access to corporate information. For example, employees identified with the Human Resources department would have personalized Web sites that give them access to information and applications specific to their job. Online brokerages often classify their accounts by asset value or age groups. Their sites could use simple

----

filtering to provide preferential treatment to customers based on whether they are in the silver, gold, or platinum account class. Or, referring to the age group, the site could recommend savings accounts for college tuition or retirement.

Content-based filtering works by analysing the content of the objects to form a representation of the visitor's interests. Generally, the analysis needs to identify a set of key attributes for each object and then fill in the attribute values. One example is a document filtering system that analyzes documents based on keywords. Recommending video movie purchases is another example of content-based filtering. Content-based filtering is most suitable when the objects are easily analyzed by computer and the visitor's decision about object suitability is not subjective.

Collaborative filtering collects visitors' opinions on a set of objects, using either explicit or implicit ratings, to form like-minded peer groups and then learns from the peer groups to predict a particular visitor's interest in an item. Instead of finding objects similar to those a visitor liked in the past, as in content-based filtering, collaborative filtering develops recommendations by finding visitors with similar tastes. Recommendations produced by collaborative filtering are based on the peer group's response and are not restricted to a simple profile matching. For product recommendations, collaborative filtering is most suitable for homogeneous, simple products, such as books, CDs, or videos.

IV. CONCLUSION

Personalization has become feature of an e-commerce Web site. The quality of site personalization determines whether visitors find your site attractive and return to it with an intention to buy. The real question is how to implement personalization while maximizing performance, which can be as important as the business effectiveness of the techniques we choose. In this paper, you've learned about current personalization techniques to maximize site performance.

REFERENCES

[1] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=6021686

[2] C. Anderson, P. Domingos, D. S. Weld, Relational Markov Models and their Application to Adaptive Web Navigation, in Proc. of the 8th ACM SIGKDD Conference, Canada (2002)

[3] R. Baraglia, F. Silvestri, An Online Recommender System for Large Web Sites, in Proc. of ACM/IEEE Web Intelligence Conference (WI'04), China (2004)

[4] J. Kleinberg, M. Sandler, Using Mixture Models for Collaborative Filtering, in Proc. of ACM Symposium on Theory of Computing (STOC'04), (2004)

[5] J. Guo, V. Keselj, Q. Gao, Integrating Web Content Clustering into Web Log Association Rule Mining, In Proc. of Canadian AI 2005 (2005)

[6] Christian Ricci, Personalization is not Technology: Using Web Personalization to Promote your Business Goal, January 12th, 2004

[7] Willy Chiu (wchiu@us.ibm.com), Vice-President, High Volume Web Sites, Software Group (AIM Division)

[8] SES Magazine Guest Author, June 7, 2009, Personalized e-Commerce Sites Can Increase Conversions

[9] "The Intelligent Recommendation Analyzer," by C. Aggarwal, J.L.Wolf, K-L. Wu, and P.S. Yu, to appear in proceedings of ICDCS Workshop on Knowledge Discovery and Data Mining, April 2000.

[10] Web Personalization in Intelligent Environments, Studies in Computational Intelligence, Vol. 229 Castellano, Giovanna; Fanelli, Anna Maria (Eds.) 2009

[11] The Complete E-Commerce Book: Design, Build & Maintain a Successful Web-based Business by Janice Reynolds

[12] E-Commerce 2010 (6th Edition) by Kenneth C. Laudon

[13] eCommerce Best Practices - How to market, sell, and service customers with internet technologies by Thomas M McFadyen

[14] Deep Inside osCommerce: The Cookbook: Ready-to-use recipes to customize and extend your e-commerce website by Monika Mathe

AUTHORS

Rajesh R. Gawali (BSc (Chem.), MCM, MBA, MCA) was born in 1970 is well-known professor in Information Technology, Management, and Computer Management etc. Having 10 years of IT industry experience at various posts. He has conducted many Corporate Training programs for IT industries. He was also worked as visiting faculty for many PG colleges in Pune. He joined as a Asst. Professor in Sharadchandra Pawar Institute of Management in 2008. Presently he is working as a Assistant Professor in Sinhgad Institute of Computer Applications. Applications. He is working as a member of various bodies at University and State level. He has attended and presented various research articles in national and international conferences. He has also developed software's for private and government organizations. His current research interest lies in Web Personalization in E-Commerce.

Dr. Shivaji D. Mundhe M.Com (Stat).,DCM, MCA, MBA, M.Phil, Ph.D is presently working as Director at Sinhgad Institute of Management and Computer Applications Pune. He has started his teaching carrier as a lecturer from SIBER, An Autonomous College, Shivaji University. The author has taught numerous courses like, C, C++, Unix Programming, Oracle, Web Technology, Quantitative Techniques and Research Methodology etc. He has rich experience in the field of academics and research in management and computer application disciplines. He has published many research article in national and international journal and Presented substantial number of papers in national and international conferences. The research is the senor member for the International Association of Computer Science and Information Technology and International Economic Development and Economic Center. Also he is working as a member of various bodies at University and State level.