Improving E-Commerce User Experience with Data-Driven Personalized Persuasion & Social Network Analysis

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ABSTRACT

Simply selling products online can no longer guarantee profits for e-businesses especially for new comers to the e-commerce industry, as the competition among companies is more intense. In order to keep existing customers and make new ones, e-businesses have to provide products and services that feel personal to their clients. This research proposes a framework for improving a user's e-commerce experience by using personalized persuasion techniques and social network analysis. The proposed framework proposes the use of persuasion profiles in implementing a customer segmentation strategy. The framework also proposes the analysis of social networks to improve customers' shopping experience.

Keywords

User modelling, personalization, persuasive technology, social network analysis

1. INTRODUCTION

E-businesses can stay ahead of their competitors by offering personalized products and services tailored to individual users using existing data about their clients, recommender systems and persuasive technology [1]. Recommender systems suggest products to users according to their interests. However, research shows that the most accurate recommender algorithms do not always generate choices that the users are satisfied with [2]. Many factors, including the way recommended products are presented to a client play a role in whether a customer will eventually buy the product [3], [4]. In essence, the presentation of an online product to a customer is key in the final purchase decision of the client. As the client is not able to touch the product as he/she would do in a brick and mortar store, it is essential that items are presented to online clients in a way that they are encouraged to buy it. Persuasive technology attempts to favorably change the clients' perception of products or services to convince them to buy the items or use the services. Since the target audience for persuasive systems are usually heterogeneous, a one-size-fits-all approach is usually ineffective [5]. As people differ in their motivations and perceptions; in order to be successful, persuasive technologies need to be tailored to the individual user [4].

Fogg and Eckles [6] suggest that for a persuasion technique to be effective, it has to deliver 1) the right message 2) at the right time and 3) in the right way. Online recommendation systems focus on 1) delivering the right message; generating suggestions about products that are tailored to a user's interests, based on their history of interactions. My proposed research studies parts 2) and 3) of Fogg and Eckles' definition of an effective persuasive system; delivering a message at the right time and in the right way, bearing in mind that both the right time and the right way differ from one individual to another.

This research aims at developing a framework that will make product selection and presentation more personalized and persuasive to customers with the aim of increasing the success of e-businesses.

2. RESEARCH OBJECTIVES

Companies collect data of their clients including demographics data, browsing patterns, product reviews and ratings, and purchase history. This data is a huge repository of information and can tell a company a lot about their clients. In addition, a large proportion of online shoppers are active social media users. These users also generate a lot of online data that companies can take advantage of in designing products and services to meet their customers' needs. I propose to develop a data driven framework to support a dynamic personalized persuasion approach. Using user generated data, this research will answer questions such as:

1. How likely is a customer to complete a purchase in a session?
2. How focused or distracted does the customer appear to be?
3. How likely is it that the customer leaves the site?

To investigate how to deliver a persuasive message in e-commerce in the right way, my research will focus on human behavior through design and user studies addressing these questions:

1. What influence strategies can be adopted in displaying a product in e-commerce?
2. How do people respond to these strategies?
3. How can we measure people's response to the various ways in which product information is presented?

The potential contributions of this proposed research will be important and novel for several reasons:

1. Personalized Persuasion in the context of e-commerce has not been researched sufficiently so far.
2. A novel method for data-driven user behavior modeling in the area of e-commerce will be developed that will be able to achieve e-commerce success in terms of the four core success metrics of e-businesses; customer loyalty, conversion, retention and average order size [7].
3. A novel method for building user persuasive profiles based on their susceptibility to visual and strategic persuasion will be developed, that will be used for tailoring the display and persuasive interventions to optimize the user experience in the e-commerce system.

This research will lead to results that will be beneficial to new and existing e-commerce businesses.

3. PROPOSED SOLUTION

The aim of this research is to improve the success of e-businesses. In order to achieve this, I propose a framework which implements persuasive interventions and mines social media data as shown in figure 1.

To implement the persuasive technology module of the proposed framework, I intend to use the Persuasive Systems Design model [8]. Although there are currently several frameworks and strategies

for designing persuasive systems in different domains, I choose to use this model for two reasons. First, the framework this model was derived from, Fogg's functional triad [9], has been studied extensively over the years, but there is little or no research on newer models derived from it. Second, as noted by Oinas-Kukkonen and Harjumaa [8], Fogg's framework and principles are too general to be useful in designing and evaluating persuasive systems.
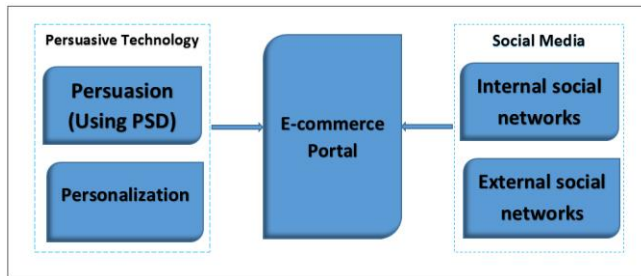

Figure 1: Proposed framework

Table 1. Persuasive principles[1] of the PSD framework

Primary Task Support	Dialogue Support	Social Support	System Credibility Support
Reduction	Praise	Social learning	Trustworthiness
Tunneling	Rewards	Social comparison	Expertise
Tailoring	Reminders	Normative influence	Surface credibility
Personalization	Suggestion	Social facilitation	Real-world feel
Self-monitoring	Similarity	Cooperation	Authority
Simulation	Liking	Competition	Third-party endorsement
Rehearsal	Social role	Recognition	Verifiability

The PSD framework consists of 28 persuasive principles grouped into four categories based on the task the principle aims to accomplish. Table 1 lists the principles and their categories. Though this model comprises of several persuasive techniques, I propose to include (or exclude) other principles, like visual contrast, that might enhance the persuasiveness of the proposed system.

To implement the social media module of the framework, I propose to use two methods. First is to implement an internal social network in the proposed e-commerce platform as is evident in successful e-commerce companies like Amazon and E-bay. The internal social network will provide a medium for customers to interact with each other, ask questions about products, read and write reviews and earn virtual rewards. This is to enhance user participation which could lead to more sales for the e-business. The second implementation method I propose is to take advantage of existing social networks in order to understand current business trends from the view point of the customers. This will be done using data mining techniques with data from the popular social networks.

This proposed system, including the effectiveness of the persuasive techniques, will be evaluated using the four core success metrics of e-businesses; customer loyalty, conversion, retention and average order size [7].

4. RELATED WORK

My research aims at improving the persuasiveness of an e-business by adopting several principles of the Persuasive Systems Design (PSD) framework for designing and evaluating persuasive systems. The PSD framework categorizes and maps the elements of persuasion in a system and also describes the software functionality expected in the end product [8]. The framework consists of 28 persuasive principles categorized according to the task they are to accomplish. The PSD framework, though partly derived from B.J. Fogg's functional triad [9], is different from it. The PSD framework, unlike B.J. Fogg's functional triad, suggests how the principles of persuasion can and should be translated to software requirements which are thereafter implemented as features of the system [8]. To the best of my knowledge, there is currently no e-commerce platform developed based on this model. On the other hand, Cialdini's six principles of persuasion [10] have been used extensively in various domains. I however did not adopt this model because the principles are not extensive and do not suggest possible implementation as systems features, while the PSD framework does.

In order to give customers relevant shopping experiences that feels personal to them, I propose to use personalization. There have been several attempts at personalization in the past. Kaptein and Parvinen [11] developed a process framework for personalization in e-commerce. Their implementation of personalization is similar to that of the PSD framework, hence I adopted it in my research. They suggest that for personalization in e-commerce to be successful, it should have a positive effect on the outcome of the business, this effect should be different between customers and the effect on clients should be stable.

To ensure that the effect of personalization is different among users, several researchers have adopted the use of persuasion profiles, also referred to as personas [7], [4], [1], [12], [13], [14]. Persuasion profiles use persuasive strategies and data such as demographic information, purchase patterns, buying history, click behavior and shopping cart items of clients to personalize their shopping experience [7]. Kaptein et al [4] implemented persuasion profiles by evaluating the effect of several persuasive principles on a user. They implemented both explicit and implicit profiling. In explicit profiling, the user has to fill out a questionnaire stating their preferences before using the system. With implicit profiling, the system infers the user's preferences based on actions and responses of the user. My proposed implementation of persuasion profiles is implicit using data such as demographic information, purchase patterns, buying history, click behavior and shopping cart items of clients when they launch the e-commerce platform. It however differs from Kaptein et al's implementation because while they used only six influence principles to build the user's profile, I propose to use a combination of the 28 influence principles of the PSD model as described in figure 1. While the customer browses products on the e-commerce platform, products will be displayed with a combination of several of these principles until a profile is generated

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[1] The authors defined these as *principles*. For a detailed explanation of these principles, please see [8]

successfully for the user. The selection will be based on the user's response to the principles at runtime.

5. PROGRESS AND FUTURE RESEARCH

This research aims at improving the success of e-business companies by enhancing users' experience with data-driven personalized persuasion and social network analysis. I propose to achieve this using the framework described in Figure 1 and the success metrics; customer loyalty, conversion, retention and average order size.

5.1 Progress Made So Far

To gain insight into designing the persuasive module, I evaluated two well-known systems using the PSD framework. Using Stack Overflow as a case study, I identified how the persuasive principles of the PSD framework were implemented in a question and answer social network [15]. All but four of the 21 principles I investigated were identified in Stack Overflow[2]. This study is important because the proposed solution will incorporate a social network module where users can ask and answer questions in addition to review products and earn points. Knowing how a successful question and answer social network implements persuasion will be beneficial in the design of the internal social network module of my proposed solution. I am currently extending this work by carrying out a user study where the implementations of the identified persuasive principles will be validated by Stack Overflow users. This user study will determine the persuasiveness or otherwise of these persuasive principles.

In order to discern the implementation of persuasion in a typical e-commerce platform, I evaluated Amazon's persuasion strategies using the PSD framework [16]. In this study, I was able to identify all 21 principles of persuasion that were investigated. Furthermore, I was also able to identify the personalization strategies implemented by Amazon in tailoring content and recommendations to users' preferences. This study is very important to my research as it sheds light on what strategies I can adopt in my proposed solution to enhance personalization and successfully implement the persuasive principles of the PSD framework. The study on Amazon is still in progress; I am working on a user-study that will enable users describe the effect of the identified personalization strategies on them and identify the persuasive principles that work best. This is important in creating a personalized user experience.

The System Credibility Support persuasive principles of the PSD framework deserve special attention in the context of e-commerce. My PhD research will incorporate visual complexity contrast as one of the persuasive strategies to be implemented in the proposed model. Visual complexity contrast refers to how complex an image is compared to surrounding images [17]. A study I conducted with colleagues in our group [3] reveals that visual persuasion can be achieved through visual complexity contrast. This conclusion is important in designing the proposed system to ensure that products are presented to users in a way that will positively influence them to buy the products.

In another study carried out in our group, I investigated customer trust in reviewers' credibility [18]. This study revealed, among other conclusions, that reviewers with mixed positive and negative reviews tends to be perceived as being more trustworthy. The result of this study is important as it can be used to implement persuasion profiles that are tailored to the users' preferences. Persuasion profiles will also ensure that the right content is presented to the user at the right time and in the right way. For example, when displaying product recommendations to clients, one can opt for products with mixed reviews as these reviews are perceived to be more trustworthy and hence could be more persuasive to the customer.

In evaluating the success of the personalized persuasive interventions generated by my proposed framework, I propose to adopt the core metrics for e-commerce success of [7]: loyalty, conversion, retention and average order size. In order to ensure customer retention, it is imperative to predict customer churn; when a client is no longer satisfied with doing business with a company and decides to stop using their service. Being able to predict customer churn is important as it will enable the e-businesses put strategies in place to prevent the loss of customers. In a study I carried out on e-commerce data, I was able to identify what data mining algorithm to use for churn prediction in e-commerce. The result of the study is under review for publication in an e-commerce journal.

Since high quality answers keep a question and answer forum active, it is also important to identify and predict the churn of expert respondents; the users who give the best answers to most of the questions. In view of this, I conducted a study on a successful question and answer social network, Stack overflow. This study [19] identifies expert respondents and successfully predicts their churn using data mining techniques. This study is essential to my research because the social network module is an integral part of the proposed solution and research has shown that overall success of a business is partly owed to a successful social media strategy [20].

5.2 Future Research

Over the next several months, my focus will be on identifying the personalization and persuasive strategies that work best together in both e-commerce and social networks. I will do this by conducting several user-studies where users will be asked to answer questions based on their experience of using different e-commerce and social network platforms. In one of the studies, users will be presented with image and text product descriptions and will be asked to identify which ones they find more persuasive and why.

Since persuasion profiles are an integral part of providing personalized content to customers, I will work on designing and implementing dynamically generated persuasion profiles for users with the aim of answering the following research questions.

1. How can one apply the data-driven user model and the persuasion profile to generate a personalized persuasive product display? In other words, can a system dynamically apply a user's persuasion profile when presenting information about a selected product?
2. How can one evaluate the effectiveness of the user's personalization experience?

Answering these questions will involve reading vast literature on the subject of persuasion profiles. In addition, it will involve carrying out user-studies to validate the effectiveness of existing implementations of persuasion profiles.

6. CONCLUSION

Simply selling products online can no longer guarantee profits for e-businesses especially for new comers to the e-commerce industry. Since e-commerce is now a mainstream activity, the competition among companies is more intense. Consequently, e-businesses have to adopt strategies that can enhance the shopping experience of their customers that will subsequently translate to profits for the e-business. My research aims at improving e-commerce users'

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[2] For this study, I only investigated 21 of the 28 principles

experience using data-driven personalized persuasion and social network analysis.

I propose to use a framework that combines persuasive technology and social network analysis to provide an e-commerce platform that will deliver the right content to a user at the right time and in the right way. The persuasive technology module will implement personalization and persuasive strategies based on the PSD framework. The social media module will incorporate a social network on the proposed e-business platform that will allow for communication between customers.

The contributions of this research are novel and relevant because they will introduce an innovative approach for generating content for users in e-commerce that is data-driven and personalized. When implemented, my proposed solution will lead to an improved user experience in an e-commerce platform.

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