A Survey on Norwegian User's Perspective on Privacy in Recommender Systems

Itishree Mohallick and Özlem Özgöbek

Norwegian University of Science and Technology, Trondheim 7491, Norway
m.itishree@gmail.com
ozlem.ozgobek@ntnu.no

Abstract. In this digital era, there is ample research on the issue of privacy concerns in recommender systems. Still, there remain many important research questions which are yet to be answered concerning the topic. In one such attempt, this survey is designed to study and understand the opinion of Norwegian users as compared to the users from different nationalities regarding their privacy concerns in recommender systems. This article analyses the survey results of Norwegian users' privacy attitude over several aspects such as behavioral preferences, privacy preferences, trust, ownership, and control. A comparative study between the demographic differences demonstrates the influence of demographics on individual user's privacy opinion. Norwegian users are found to be less concerned regarding their privacy in recommender systems. This article concludes with a discussion where the aforesaid privacy aspects and their interconnectivity are studied from the Norwegians' and others' point of view. This opinion based research can help designers and researchers to understand and mitigate user's privacy concern while designing cutting age recommender systems.

Keywords: Recommender Systems, Privacy Perception, Trust and Ownership.

1   Introduction

With the advent of World Wide Web, recommender systems have gained significant importance. Most of the internet users must have come across recommender systems during their internet usage. For example, Facebook suggests new friends for adding into the existing friend list whereas LinkedIn suggests job offers, new connections, news and interesting companies for its's registered users. Advances in such modern technologies which includes data collection, matching, and profiling for creating "user profiles" to offer tailored products to the users have raised privacy concerns in recommender systems.

The conventional research approach in recommender systems focuses on the prediction accuracy of various recommendation algorithms [1-3]. The prediction accuracy of any recommender system partially constitutes the user experience. But, the performance and accuracy of the prediction algorithms are primarily used for evaluating the recommender systems. However, researching the user experience for such personalized systems are found to be effective for evaluation of these user-adaptive systems in recent years. The effectiveness and evaluation criteria of recommender systems are investigated from user's perspective [4] as recommendation accuracy does not suffice for being useful to the users [5]. The various user-centric concerns related to recommender systems (i.e.; privacy concerns) can only be addressed effectively by studying the actual opinion of real users.

Privacy in recommender systems is concerned with user information. Generally, users keep on worrying regarding their online privacy. Although many surveys conclude the fact that users, in general, are concerned about their online privacy none of them present a demographic study of this privacy concerns in recommender systems. In this paper, we present the results of the survey which is basically designed to find out the interesting and unique features related to users' perception of privacy in recommender systems with a focus on cultural differences of different nationals (Norwegian users and users from other nationalities).

The objective of this paper is to investigate the opinion of users regarding recommender systems; especially focusing on Norwegian user's privacy behavior and opinion while using various recommender systems. This user study was run with 100 people from different nations where 26 of them were Norwegians. In this paper, the privacy preferences of Norwegian users are presented in comparison with other nationals. As a result, it is observed that users' trust in the service provider and ownership of the users' own data are correlated. This, in return, reduces the privacy concerns of the users. The paper is structured as follows: A brief background study related to user-centric surveys and privacy risks in recommender systems is given in Section 2. The interpretation and evaluation of the user study based on the key findings are presented in Section 3. Section 4 includes a brief discussion providing the executive summary of the survey results. Section 5 concludes the paper.

2 Related Work

Evaluating recommender systems is not an easy task as it involves both the system and the users. Many different evaluation techniques are adopted in dissimilar ways to evaluate the recommender systems [6]. These evaluation techniques are broadly classified into two types; system-centric and user-centric. The latter technique has been discussed in detail in [6, 7] where the users interact with a recommender or multiple recommenders in an online environment. The output data is collected based on the user and system interaction. This interaction is carried out through either a preset questionnaire or online surveys where users are required to provide their input. Experiments involving real users are helpful in evaluating recommender systems effectively than the offline experiment.

It is however important to look at user's privacy concern as part of the user-centric evaluation in recommender systems. In general, privacy in recommender systems is multi-faceted which includes the recommender system itself, users and third parties (any external entity involved in the process such as data brokers, other companies where user data is outsourced from the parent company) [8, 9]. Hence, user-centric research is similarly important as the system-centric research in such user-adaptive systems because recommender systems are designed and developed to be used by the end users. Evaluating recommender systems from user's privacy perspective as in [10] further helps in distinguishing the actual behaviors of users from their privacy preferences.

User's privacy concern has been addressed from a different perspective such as user's personal traits, trust, the value of disclosure in many prior researches [11]. Trust in the service providers has been long identified as one of the main influential characteristics to reduce privacy worries of users in the online environment [12-14]. User control is given much importance to influence (reduce) the user's privacy concern by inducing trust in the service providers.

User's personal characteristics influence the information disclosure behavior of the user and often contributes to individual user's privacy perception [15]. Value of the perceived benefit also determines user's information disclosure behavior as the gained benefits can overweight the risk factors involved with user's personal information disclosure [16, 17].

Prior researches have addressed the various privacy Laws and Regulations as an impact to the user's privacy behavior. Considerably a stronger privacy law such as the European Union (EU) privacy Directive might reduce privacy concerns of EU users than rest of the world [18]. International differences in the privacy laws and regulations further influence user's privacy perception.

User's opinion regarding privacy hold a prominent place in decision making and influences the information disclosure behavior of the user [19]. Hence, the user-centric comparative survey based on demographic may bring forth any interesting result regarding the user's privacy perspective.

3   User Study

The main goal of this user-centric evaluation process is to understand the user's opinion concerning privacy and accessing the numerous factors which contribute to user's privacy concern in recommender systems. For the user study, an online survey is designed to understand the behavioral approaches and privacy concerns among online users. The outputs of the survey are beneficial for providing user-centered guidelines or solutions in the said problem domain.

The online survey is conducted for a duration of 30 days and 100 responses from 16 nationalities are recorded. The aim of the user experience research is to gain adequate knowledge from a group of people who have the preliminary understanding of the personalized services. Hence, most of the respondents belong to the student and professional networks. But a common diversity designed during the survey is to find

the opinion from different age groups and different nationalities. The users are asked to complete a set of questionnaires referring to various aspects of user experience related to recommender systems. It includes users' impression of the usability of the system, user awareness, privacy concerns of users, trust, ownership, behavioral preferences and preferences for cross-domain recommendation.

The initial analysis of the survey results demonstrated that user's privacy concerns are a major issue and it directly impacts the recommender systems. Based on the results, the findings are divided into the following categories (i.e., behavioral preferences, trust, and ownership) which we hope that they help researchers and developers to provide better privacy solutions in the recommender systems domain. The outcomes of the survey are further analyzed for the Norwegian users against the non-Norwegian users to find out similarities and differences.

3.1 Behavioral Preferences and Privacy Concerns

On the topic concerning user's behavioral preferences and privacy, Norwegian users are found to be more active in using the recommendation service daily. A whopping 62% of Norwegian users replied to have used the recommender system several times a day proves the aforesaid fact. However, the preferences for using the recommendation service do not influence directly the privacy behavior of every user. Although all the participants have used the recommendation service at some point in time, respondents who have asked for the service providers to view their own user profiles or other information are found to be 35%. User's perception of recommender systems following laws and regulations are found to be undermined. To understand user's behavior from the demographic point of view, a further analysis has been done for Norwegian users versus non-Norwegian users.

An interesting result has been found was that the non-Norwegian users are more privacy concerned than the Norwegian users whereas the Norwegian users most frequently use the recommendation services compared to the non-Norwegian users. In Fig. 1, the differences between the privacy concerns among Norwegian users and non-Norwegian users is shown. Here we interpret that the users requesting to see the user profiles are more privacy aware or concerned about their personal information. As it can be seen in the figure, while replying to a 'Yes' or 'No' type question, only 28% Norwegian users have replied that they have requested their user profile data whereas 38% non-Norwegian users have requested to view their user profile data.

Have you ever requested to see your user profile or any other information the provider has about you?
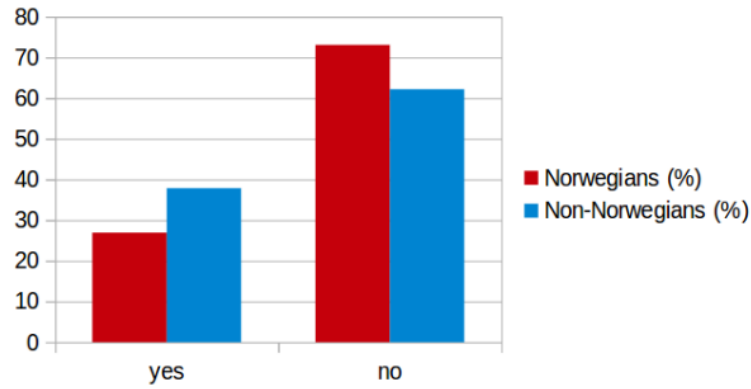
Fig. 1. Privacy Privacy concerned (a) Non-Norwegian (b) Norwegian users

In the survey, a group of questions whose objective is to determine the most preferred recommendation domain from a group of recommendation services (e.g., news, music, movies, books, shopping, and tourism) were asked. In Table 1, domain dependent interests of users to get recommendations are shown. According to the table, the most interesting domain that users would like to get recommendations was music. However, news was the least preferred recommendation domain for all the users. Norwegian users are found to be less interested in news recommendation as compared to the non-Norwegian users by giving an average rating of 3.92 out of 10.

Table 1. User's average rating (1-10) for different recommendation domain

| Recommendation domain	Norwegian	Non-Norwegian
Music	5.88	6.66
Movies	5.42	6.31
News	3.92	5.17
Books	5.57	6.09
Other products	3.96	5.60

Both the Norwegian and non-Norwegian users are equally found to be uncertain if the recommender systems are following the existing privacy laws and regulations. Another question based on user's perception on "systems violate privacy" draws similar response from the users. In a scale from 1 to 10 ratings, both the Norwegian and non-Norwegian users expressed a similar concern by giving an average approximate rating of 6 for this question.

3.2   Trust and Privacy Concerns

Trust and privacy have been interlinked in recommender systems. User's trust can be violated in many ways such as exposure, sabotage, and bias [14]. A part of our user survey demonstrates the link between user trust and privacy in recommender systems.

For instance, when users were asked if they would prefer a single user profile instead of having multiple user profiles across different recommender system domains like movies, music or news, more than half of the users (53% approx.) opted out by saying "Not at all". Exposure of personal data through sharing user profiles is found to be a concern for both Norwegian and non-Norwegian users whereas 46% Norwegian users chose not to share their user profiles among multiple domains which is given in Fig. 2. In a follow-up question, it is found that added trust reduces the privacy concern among users and more users are willing to share their user profile across applications with trusted service providers. When the service provider is trusted, only 36% users refused to share their user profiles. It has been observed from the above trend that added trust with the service provider increased the willingness of 17% users to avail the service by allowing their profiles to be shared across applications. The same trend has been observed for the Norwegian users where the denial rate has dropped from 46% to 38% where the service provider is a trusted one. The link between user trust and exposure risk is clearly visible in Fig. 3.
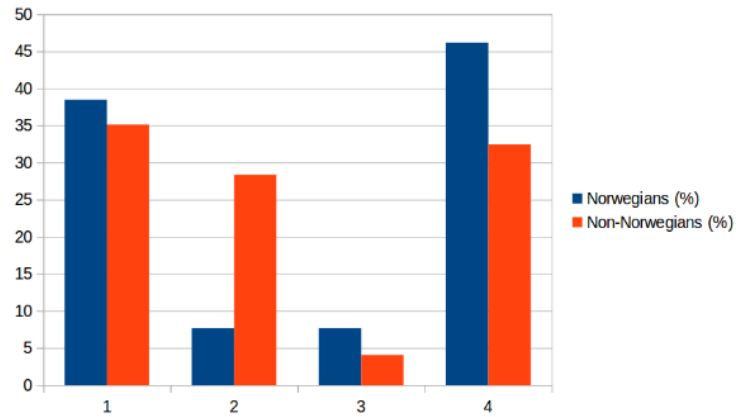
Would you be willing to let your user profile be shared across applications?
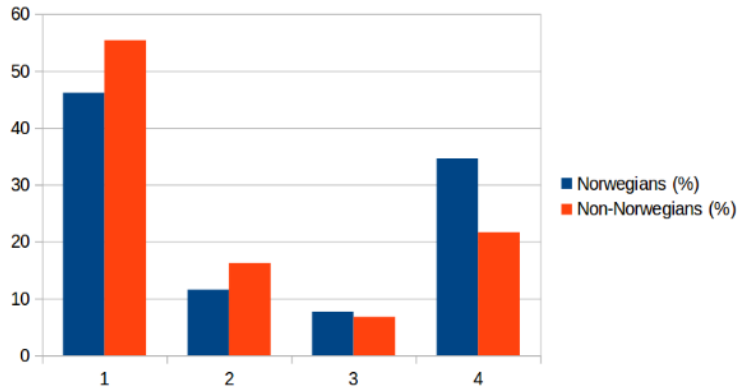
1. Not at all
2. Yes, but only within the same domain (e.g. between newspapers)
3. Yes, also across domains (e.g. news user profile used for movie recommendations)
4. Yes, also across domains (e.g. news user profile used for movie recommendations) but I would like to choose the applications

Fig. 2. Sharing user profiles across applications with any service providers (Norwegian versus non-Norwegians)

Would you be willing to let your user profile be shared across applications if it is a service provider that you trust?

1. Not at all
2. Yes, but only within the same domain (e.g. between newspapers)
3. Yes, also across domains (e.g. news user profile used for movie recommendations)
4. Yes, also across domains (e.g. news user profile used for movie recommendations) but I would like to choose the applications

Fig. 3. Sharing user profiles across applications with a trusted service provider (Norwegian versus non-Norwegians)

One of the important results we got is that the user trust for a service provider can be established by allowing the users to control their personal data, through privacy policies, and by followings privacy guidelines. In the survey, most of the users expressed their concerns regarding to the service providers seeking the permission before using personal data can build user trust for the concerned service providers.

Hence, user trust is found to be a primary factor from the survey results for reducing the privacy concerns of any user. In addition, user trust can motivate the user for using the services of a trusted provider and increase the user's willingness to share their personal information (user profiles) with the service providers.

3.3 Ownership and Privacy Concerns

Ownership or control of user data plays a very crucial role in information privacy. One of the basic privacy requirement for any user is to have a minimal level of user control over their own data which is critical to the level of privacy concern experienced by these users [20].

The survey results convey the concept of users' ownership over their data from the privacy perspective. By ownership of the data, the users are supposed to gain control over their data by being able to modify, access or delete their personal data (stored in the user profile) as and when they wish. Ownership over personal data makes the respondent less concerned about privacy in recommender systems, increases the trust for the service provider, and encourages the disclosure of profile data across applica-

tions and frequent system usage. Almost 88.6 % of Norwegian users (23 out of 26 respondents) as compared to 59.45 % of non-Norwegian users (44 out of 74 respondents) replied that ownership over their data makes them feel more secure regarding their online privacy in recommender systems. The users could select multiple options under this category of questions. Hence, many users (both Norwegian and non-Norwegian) have also stated that ownership can enhance their trust for the service providers. In addition, 30.76 % of Norwegian users (8 out of 26 respondents) as 27.02 % of non-Norwegian users (20 out of 74 users) have shown their interest in sharing their user profiles across multiple domains if they are given the ownership over their own data.

While studying users' opinion regarding ownership, 88.6% Norwegian users (23 out of 26 respondents) stated that the access to modify and delete their own data provides them true control regarding their personal data. However, 78.37% non-Norwegian users (58 out of 74 respondents) selected the above-said options in the context of true ownership over user's own data. Moreover, users would prefer to be asked for their consent before the data is being shared. This trend is evident as 76.92 % Norwegian users and 78.37 % non-Norwegian users (58 out of 74 respondents) opted "I decide how my data is shared". Equal responses are received from the non-Norwegian users regarding ownership of their data as they would prefer to be allowed to modify and delete their data as well as asked for their consent before the data is shared.

How important for you to own your data in recommender system domain?
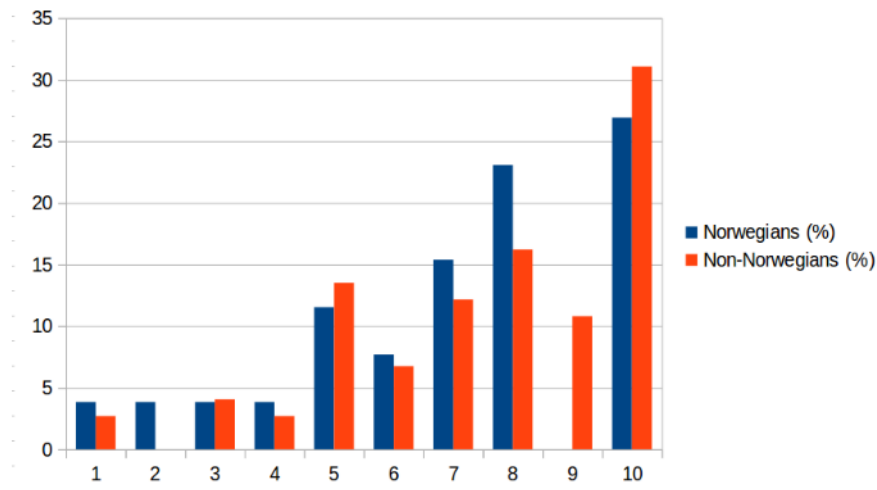
Fig. 4. Importance of owning user's own data

The results regarding importance of owning user data in recommender systems is shown in the below Fig. 4 for the Norwegian users and non-Norwegian users. Ownership of the user data is found to be more important for Norwegian users (see Fig. 4).

4   Discussion

The outcomes of this survey demonstrate that all the users (100%) are using recommendation services in various frequencies as all the participants stated availing the recommendation service. However, 61.53% of Norwegian users access the recommendation services by using it several times a day, while only 41.81 % of Non-Norwegian users have the same habits. This can also be interpreted as Norwegians are the most aware user group about existing online recommender systems. Irrespective of the popularity of the recommendation service, there is an increasing concern among the users related to privacy of their personal data in the recommender systems.

While most of the users are concerned regarding privacy in recommender systems, a limited number of users really tried to ask and learn more about their personal data shared with these personalized service providers. An interesting fact came into sight as the survey results shown that the Norwegian users are less concerned regarding privacy in recommender systems than the rest of the users from different nationalities.

Most of the users from all nationalities lack in knowledge regarding the privacy laws and regulations whereas 30.76% Norwegian users think that recommender systems do not adhere to the existing regulations. Most users believe that recommender systems violate their privacy through collecting more data than approved and by sharing the data with any external entities. Most of the users believe that their personal information is being exploited. Users have shown less interest in news recommendation as compared to other domains such as movie, music, books, shopping, and tourism. However, movie, music, and books are found to be most preferred by the users. Interestingly, news and tourism are two domains where the users are less interested in receiving any recommendation. Majority of participants not at all prefer to share their user profiles across domains, although a common profile for multiple domains has its advantages, for example, it is less time consuming while getting personalized services. Whereas certain users prefer a common profile with adequate user control. Trust is an important characteristic which can influence user's privacy attitude. Users prefer to share their information with a trusted service provider. With trust, more users are ready to share their personal information across the domain. User control and user consent regarding the data usage are the two key factors which can build trust for the service providers although the other options are equally relevant. User control increases trust and reduces privacy concerns for the users. User preferences are difficult to predict under different environment. However, a common trend for positive preferences is observed for book recommendation from the user behavior whereas news recommendation is found to be not that much desired. Ownership of the data can provide more user control over their online data. Ownership of the user data can reduce the privacy concerns of users. Most of the users believe to gain complete control (modification, deletion and usage control) over their data can provide them with actual ownership.

In the end, users detailed comments revealed some explanations for the outcome of the study. Most of the user opinion, in the very last open question, indicated to the user's information privacy concern from three basic angles; data collection, user control, and awareness. The received opinion from users clearly states that how data col-

lection and the control over individual data is undervalued in the user privacy scenario. Users are found to be concerned about the received benefit versus risk while receiving the recommendation services. Another concern reveals that online service provider's profits outweigh user privacy in practice. These user opinions if considered can certainly contribute to getting a robust recommendation while preserving the privacy of users.

5   Conclusions

The survey results based on the influence of demographic information such as nationalities (Norwegian users) on user's privacy opinion is presented in this paper. A comparative study between the Norwegian users and rest other respondents establishes the two-different perspective of their privacy opinion mainly focusing on behavioral preferences, trust, and ownership.

The survey results demonstrated here is unique and has its merits in many aspects. The Norwegian users are found to be less privacy sensitive than rest of the users. In contrast, Norwegian users are found to be more concerned regarding ownership and control of their online data in recommender systems than the non-Norwegian users.

In this exploratory study, the received responses relied solely on user's assumptions and imaginations as given by the survey description. The respondents might have evaluated or responded differently if they could interact with a real recommender interface. Their privacy concerns over several topics such as cross-recommendation, ownership or trust might be hypothetical or depended on a previous privacy encounter. Therefore, a future research would be helpful to implement a real user interface based on our survey findings and later measuring the privacy concerns of Norwegian users than the rest of the users. Another future research perspective can consider the impacts of the existing privacy laws and regulations on users' privacy perceptions from different nations (since privacy laws and regulations differ from country to country).

6   Acknowledgement

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