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Sharing Economy: How to support users in selecting the right transaction partner?

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Abstract. Sharing economy is a new way of coordinating economic activities that is more and more growing in importance. This economy is closely linked to collaborative platforms. This environment creates a large risk of opportunistic or even inappropriate behaviours. Therefore, it becomes important to find and select trustworthy transaction partners. The aim of this proposal is to define a model able to take into account the possibility of opportunistic behaviours of end-users in order to support decision makers in their choice of the right partner.

Keywords: Sharing Economy · Recommender system · Opportunistic Behaviour.

1 Introduction

The emerging digital economy creates an environment that differs significantly from the usual assumptions of economic analysis. On the one hand, electronic media make markets much more transparent. It is far easier than in former times to find suitable transaction partners, to compare prices between different suppliers, and in general to obtain information on any aspect of a transaction and to process this information almost instantly. This creates an environment that more and more resembles the ideal of a perfect market. On the other hand, the physical distance and anonymity of cyberspace create many opportunities for opportunistic behavior that would not exist in conventional markets and the multitude of offerings increases the complexity of choice problems for consumers.

One example in which these two aspects are particularly visible is provided by collaboration platforms. Collaboration and sharing platforms allow a wide range of participants to share resources and conduct transactions of different types. From an economic point of view, these platforms, therefore, enable the creation of a contractual relationship between users, which exhibits the above-mentioned tension between the availability of information and the possibility of

opportunistic behavior to a large extent. As a consequence of these opportunistic behaviors, the decision makers (end-users) are not very confident with the partners. Even if these collaborative platforms provide information about the trustworthiness of users, making a good choice of partners is not an easy task. In this paper, our aim is to define a general framework in order to develop a recommender system that would be able to recommend good and trustworthy partners.

The paper is organised as follows. In the first section a literature review about collaborative platforms and their use is presented. A definition of sharing economy is also given. In this literature review a section is devoted to recommender systems. The second section presents our proposal for a specific recommender system for partner selection and the last section concludes the paper.

2 Literature Review

Many collaboration and sharing platforms involve transactions that cover a comparatively long time period. In case of physical exchange of goods, the potentially large geographical distance of transaction partners meeting in Cyberspace implies long transport times, contracts involving services like accommodations (as offered e.g., by one of the largest sharing platforms, Airbnb) often involve a long period between concluding and actually fulfilling the contract. These long intervals create ample opportunity for opportunistic behavior, such as cancellations of contracts, incomplete shipments, providing inadequate services (Williams et al., 2020), unresolved and unregulated disputes (Al-Ramahi and Ahmed, 2019), increased environmental pressure and resource exploitation (Tussyadiah and Pesonen, 2016), etc. These problems are further aggravated by anonymity and the lack of efficient mechanisms to enforce compliant behavior against transaction partners who are far away and potentially anonymous.

2.1 Sharing Economy

Economic theory would argue that the resulting risk can be mitigated by formulating more complete contracts, which specify the expected behavior of all contract partners in detail and which can be enforced by recourse to legal action. This in turn would increase transaction costs, possibly leading to the transaction being coordinated in a hierarchy rather than via the market. Collaboration platforms deal with this problem in a different way. Instead of more elaborate contractual mechanisms, they aim at increasing the trust between transaction partners. Trust between transaction partners can result from different sources, in particular from social interaction between them and from information that is provided about (potential) transaction partners as well as the object of the transaction.

Consequently, the choice of an adequate, trustworthy transaction partner becomes a crucial issue in collaboration platforms. Collaborative platforms already provide some mechanisms to support users in selecting trustworthy partners such

as reputation mechanisms that allow users to rate their transaction partners after completing a transaction. However, in comparison to the recommender systems that many platforms offer to support users in selecting products, these features are rather limited. In general, the two problems of recommending products and recommending transaction partners share the property that evaluations must combine multiple criteria, with only incomplete knowledge of the user's preferences.

2.2 Recommender Systems

Existing research mainly deals with recommender systems that support the selection of products and services rather than transaction partners. Still, existing classifications of such systems can be useful to identify important design parameters for such systems. Literature distinguishes four types of recommender systems: personalized recommendation based on the past behavior of the user, the content based recommendation considering characteristics of the objects, collaborative recommendation that is based on all users and finally the hybrid recommendation which, as its name indicates, combines the other three methods

Personalized recommendation is based on the user's past behavior. For example, products previously purchased or selected from an e-commerce site, or previous actions or decisions made by the user are analyzed to predict new products which may be of interest to the same or similar users. These systems are sometimes also called referral systems. Advertisements (e.g., Google AdSense) are considered to be personalized referral systems based on past behavior of the user (navigation, clicks, search history, etc.)

Content based recommendation involves recommending objects (or contents) based on qualities and properties intrinsic to the object itself and correlates them with the preferences and interests of the user. This type of system will therefore extract a number of features and content-specific attributes, in order to be able to recommend content to the user with similar properties. This method creates a set of attributes/properties that characterize each object. For example, the decision to select and recommend a document to a user can be based on its content, comparing the themes covered in the document with the themes of interest to the user. Examples of systems using this principle can be found in (Billsus et al., 1998; Pazzani and Billsus, 1997; Zhang et al., 2002).

This type of content recommendation has the advantage that it does not need a large community of users. A list of recommendations can be generated even if there is only one user. However, only some attributes can be extracted automatically from content. For example, it is relatively easy to deduce certain semantic properties of a text document automatically. We also see that in practice, characteristics and properties like the genre of a book or the list of actors in a movie, are usually provided by their creators. What remains more problematic is the acquisition of subjective and qualitative properties such as style, design, etc. These are difficult to acquire automatically, and will instead have to be introduced manually, leading to problems such as cost and possible errors.

Collaborative or social recommendation (Billsus et al., 1998; Breese et al., 1998) consists of recommending objects based on the past behavior of users with similar preferences and interests. Methods are used to collect and analyze data on the behavior, activities and preferences of users and algorithms try to predict what the user will like by searching for users who have the same behaviors. The main assumption of this approach is that if users have shared the same interests in the past, there is a good chance that they also share the same tastes in the future.

The purely social recommendation approach does not exploit or require knowledge of the contents. The social recommendation is able to recommend content without the need to understand the meaning or the semantics of the content itself. Information specific to the object need not be introduced into the system. A problem of this approach is scalability: often the platforms on which collaborative filters are used have millions of users, products, and content. Thus considerable computational power is needed to offer suggestions to users. This is a particular problem in memory-based approaches, which maintain a comprehensive database of all ratings. In an item-centric or model-based approach, the data is previously processed offline and the system then uses pre-processed templates to make predictions. The model-based approach is less precise, but avoids the problem of scalability. Another problem is the Cold Start: Social recommendation systems need a lot of data and many users to perform. The launch of a recommendation system may suffer from a lack of users and information.

Finally, there is the problem of sparsity: since the number of products or content is huge, even the most active users will have noticed or evaluated a very small subset of the entire database. So even the most popular article will have very few ratings. In such a situation, two users will have few commonly valued items, making the correlation task more difficult. This is a situation encountered when the system has a high ratio of content in relation to users, which is also often found at the initial stage of the launch of the referral service.

Hybrid methods (Basu et al., 1998; Schein et al., 2002), which are a combination of the above three approaches, are more and more used, because they solve problems such as cold start and sparsity found in a purely social advocacy approach. For example, Amazon uses all 3 approaches (personalized, social, and object). Amazon (Linden et al., 2003) has a highly sophisticated system, the recommendations are on the one hand customized based on the past individual behavior of the user (browsing history and history purchase), and on the other hand, Amazon also uses the features of the item itself (subject recommendation) and behaviors of others (social recommendation). Anyone who has ever made a purchase on Amazon probably read the message from Amazon telling us “People who bought x also bought y”. This approach is simply the item-based nearest neighbor approach (Schafer et al., 2007) previously described. It would appear that Amazon’s recommendations result in more than 30 percent of the company’s total turnover (in 2009).

3 Proposal

We propose to apply similar concepts that are up to now used to recommend products or services also for recommending potential transaction partners to users. Following the state of the art, we consider a hybrid method most appropriate, which combines collaborative recommendation similar to existing approaches for evaluating transaction partners after concluding a transaction with an innovative “content based” approach. We consider personalized recommendation less suitable for our purpose. If a user already has experience with a transaction partner, the user has concluded several transactions with that partner and thus has already developed a sufficient level of trust in that partner. For recommending transaction partners, “content” here means properties of users. Trust refers to both the competence and the benevolence of the potential transaction partner (McKnight et al., 2002). Trust in competence is the belief that the transaction partner is indeed able to provide the goods or services ordered, and trust in benevolence is the belief that the transaction partner is also willing to do so. Both of these main dimensions can be further separated into various sub-dimensions, so evaluation of the trustworthiness of a transaction partner is a multi-criteria evaluation problem. Furthermore, information both on the competence and the benevolence of the potential transaction partner can be collected by the recommender system itself (e.g. by collecting statistics on previous contract violations), and from the experiences (ratings) of users who previously interacted with that transaction partner.

Ratings provided by other users therefore serve a double role: on the one hand, they provide a basis for collaboration in the sense that users directly rate and recommend a potential transaction partner. On the other hand, they serve as the source of information for a detailed, multi-criteria evaluation of transaction partners. For this purpose, comments made by users on their transaction partners need to be mined for specific information such as the number of times in which a transaction partner has violated a contract in a certain way, e.g. by delayed shipment. Identifying such behavioral patterns in user comments will require the use of adequate Natural Language Processing tools.

These multiple dimensions of evaluating the trustworthiness of potential transaction partners need to be aggregated to an overall evaluation and recommendation according to the personal preferences of users. Some users might be more interested in their transaction partner’s competence, others in benevolence. Some users might want to rely more on objective data collected by the system, others on personal experiences of other users. A recommender systems for transaction partners therefore needs an elaborate model of user preferences towards the multiple evaluation criteria. We expect that criteria will be highly interdependent and therefore consider Choquet or Sugeno integrals as adequate models of such complex preference structures.

4 Conclusion

The sharing economy based on collaboration platforms is gaining more and more importance. While sharing platforms provide a new way of using resources efficiently, they also bring a significant risk of opportunistic behavior. Therefore, the choice of the right transaction partner in a sharing platform becomes even more important than in the traditional economy, where contracts were concluded in personal interaction.

Recommender systems are already widely and successfully used to assist users in selecting the right product in a complex environment with many, sometimes confusing choices. We therefore propose to apply this concept also to the selection of transaction partners in sharing platforms. Developing a recommender system for this purpose requires first of all the definition of criteria to be used for making such recommendations. We have outlined a broad classification of possible criteria using the distinction between trust in competence and trust in benevolence, and between different information sources in this paper, but it is clearly necessary to develop a more precise list of criteria. The second step is the formulation of a preference model. This on the one hand needs to contain descriptive elements to consider how users in a sharing platform actually develop trust in a transaction partner and which criteria are important for them. On the other hand, to make valid recommendations, this preference model also needs a prescriptive perspective to identify which criteria are objectively important and how they should be aggregated to provide useful recommendations. Such a model based on economic theory is currently under development. Once these important questions are resolved, a prototype recommender system can be created and tested in empirical studies.

Bibliography

- Al-Ramahi, M., Ahmed, A.: Identifying users' concerns in lodging sharing economy using unsupervised machine learning approach. In: 2019 2nd International Conference on Data Intelligence and Security (ICDIS), pp. 160–166, IEEE (2019)
- Basu, C., Hirsh, H., Cohen, W., et al.: Recommendation as classification: Using social and content-based information in recommendation. In: Aaai/iaai, pp. 714–720 (1998)
- Billsus, D., Pazzani, M.J., et al.: Learning collaborative information filters. In: *Icml*, vol. 98, pp. 46–54 (1998)
- Breese, J.S., Heckerman, D., Kadie, C.: Empirical analysis of predictive algorithms for collaborative filtering. in proceedings of fourteenth conference on uncertainty. Artificial Intelligence, Madison, Wisconsin. Morgan Kaufmann (1998)
- Linden, G., Smith, B., York, J.: Amazon. com recommendations: Item-to-item collaborative filtering. *IEEE Internet computing* **7**(1), 76–80 (2003)
- McKnight, D.H., Choudhury, V., Kacmar, C.: Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research* **13**(3) (2002)
- Pazzani, M., Billsus, D.: Learning and revising user profiles: The identification of interesting web sites. *Machine learning* **27**, 313–331 (1997)
- Schafer, B.J., Frankowski, D., Herlocker, J.L., Sen, S.: Collaborative filtering recommender systems. *e adaptive web* 4321 (2007), 291–324. h ps. doi. org/10.1007/978-3-540-72079-9 **9** (2007)
- Schein, A.I., Popescul, A., Ungar, L.H., Pennock, D.M.: Methods and metrics for cold-start recommendations. In: Proceedings of the 25th annual international ACM SIGIR conference on Research and development in information retrieval, pp. 253–260 (2002)
- Tussyadiah, I.P., Pesonen, J.: Impacts of peer-to-peer accommodation use on travel patterns. *Journal of travel Research* **55**(8), 1022–1040 (2016)
- Williams, G., Tushev, M., Ebrahimi, F., Mahmoud, A.: Modeling user concerns in sharing economy: the case of food delivery apps. *Automated Software Engineering* **27**, 229–263 (2020)
- Zhang, Y., Callan, J., Minka, T.: Novelty and redundancy detection in adaptive filtering. In: Proceedings of the 25th annual international ACM SIGIR conference on Research and development in information retrieval, pp. 81–88 (2002)