Personality aware Product Recommendation System based on User Interests Mining and Meta path Discovery

Malayala Bhanu Priya[1], Dr.Y.V.S.Sai Pragathi[2]
[1]M.Tech, Scholar, [2]Professor,
Stanley College of Engineering and Technology for Women

Abstract

A recommendation system is an integral part of any modern online shopping or social network platform. Product recommendation system as a typical example of the legacy recommendation systems suffer from two major drawbacks, recommendation redundancy and unpredictability concerning new items (cold start). These limitations take place because the legacy recommendation systems rely only on the user's previous buying behavior to recommend new items. Incorporating the user's social features such as personality traits and topical interest might help alleviate the cold start and remove recommendation redundancy. Therefore, in this paper, we propose Meta-Interest, a personality-aware product recommendation system based on user interest mining and meta-path discovery. Meta-Interest predicts the user's interest and the items associated with these interests, even if the user's history does not contain these items or similar ones. This is done by analyzing the user's topical interests, and eventually recommend the items associated with the user's interest. The proposed system is personalityaware from two aspects; it incorporates the user's personality traits to predict his topics of interest, and to match the user's personality facets with the associated items. The proposed system was compared against recent recommendation methods, such as deep-learning based recommendation system and session-based recommendation systems. Experimental results show that the proposed method can increase the precision and recall of the recommendation system especially in cold start settings.

1. Introduction

With the widespread of personal mobile devices and the ubiquitous access to the internet, the global number of digital buyers is expected to reach 2.14 billion people within the next few years, which accounts for one fourth of the world population. With such a huge number of buyers and the wide variety of available products, the efficiency of an online store is measured by their ability to match the right user with the right product, here comes the usefulness of a product recommendation systems. Generally speaking, product recommendation systems are divided into two main classes: (1) Collaborative filtering (CF), CF systems recommend new products to a given user based on his/her previous (rating/viewing/buying) history. Far from that, with the popularity of online social networks such as Face book, Twitter and Instagram , many users use social media to express their feeling or opinions about different topics, or even explicitly expressing their desire to buy a specific product in some cases. Which

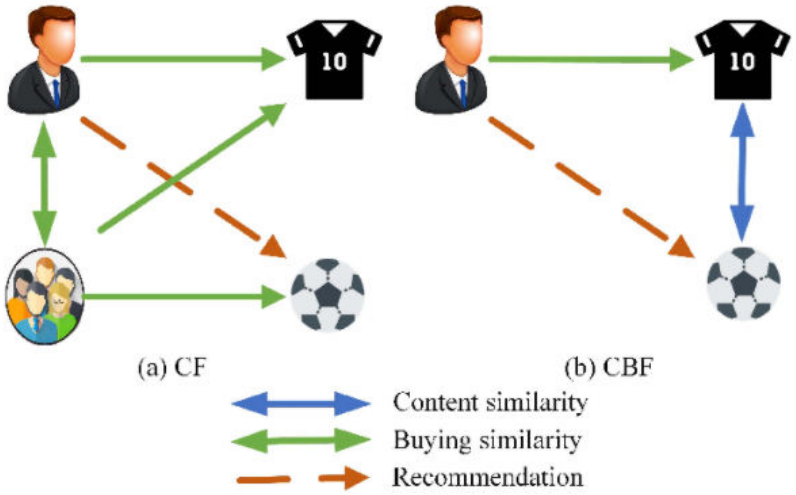
made social media content a rich resource to understand the users' needs and interests [1]. On the other hand, the emerging of personality computing [2] has offered new opportunities to improve the efficiency of user modeling in general and particularly recommendation systems by incorporating the user's personality traits in the recommendation process. In this work, we propose a product recommendation system that predicts the user's needs and the associated items, even if his history does not contain these items or similar ones. This is done by analyzing the user's topical interest, and eventually recommend the items associated with the theses interest. The proposed system is personality-aware from two aspects; it incorporates the user's personality traits to predict his topics of interest, and to match the user's personality facets with the associated items. As shown in Figure 2 the proposed system is based on hybrid. Since we have multiple types of nodes (users, items and topics), the system is modeled as a heterogeneous information network (HIN), which includes multiple types of nodes and links. In our case, product recommendation could be formulated as link prediction in HIN [3]. For example, in Figure 2, given the user's previous rating and topical interest represented in a HIN, the problem is to predict whether or not a link exists between the user and the product (the ball). One of the main challenges of link prediction in HIN is how to maintain a reasonable balance between the size of information considered to make the prediction and the algorithm complexity of the techniques required to collect that information. Since in practice, the networks are usually composed out of hundreds of thousands or even millions of nodes, the method used to perform link prediction in HIN must be highly efficient. However, computing only local information could lead to poor predictions, especially in very sparse networks. Therefore, in our approach, we make use of meta-paths that start from user nodes and end up in the predicted node (product nodes in our case), and try to fuse the information from these meta-paths to make the prediction.

The contributions of this work are summarized as follows:

1) Propose a product recommendation system that infers the user's needs based on her/his topical interests.

2) The proposed system incorporates the user's Big-Five personality traits to enhance the interest mining process, as well as to perform personality aware product filtering.

3) The relationship between the users and products is predicted using a graph-based meta path discovery, therefore the system can predict implicit as well as explicit interests.



2. Literature Survey:

A Survey on Personality-Aware Recommendation Systems

Sahraoui Dhelim, Nyothiri Aung, Mohammed Amine Bouras, Huansheng Ning and Erik Cambria.

With the emergence of personality computing as a new research field related to artificial intelligence and personality psychology, we have witnessed an unprecedented proliferation of personality-aware recommendation systems. Unlike conventional recommendation systems, these new systems solve traditional problems such as the cold start and data sparsity problems. This survey aims to study and systematically classify personalityaware recommendation systems. To the best of our knowledge, this survey is the first that focuses on personality-aware recommendation systems. We explore the different design choices of personality-aware recommendation systems, by comparing their personality modeling methods, as well as their recommendation techniques. Furthermore, we present the commonly used datasets and point out some of the challenges of personality-aware recommendation systems.

Personality-Aware Product Recommendation System Based on User Interests Mining and Metapath Discovery

Sahraoui Dhelim, Huansheng Ning, Jianhua Ma

A recommendation system is an integral part of any modern online shopping or social network platform. The product recommendation system as a typical example of the legacy recommendation systems suffers from two major drawbacks: recommendation redundancy and unpredictability concerning new items (cold start). These limitations take place because the legacy recommendation systems rely only on the user's previous buying behavior to recommend new items. Incorporating the user's social features, such as personality traits and topical interest, might help alleviate the cold start and remove recommendation redundancy. Therefore, in this article, we propose Meta-Interest, a personality-aware product recommendation system based on user interest mining and metapath discovery. Meta-Interest predicts the user's interest and the

items associated with these interests, even if the user's history does not contain these items or similar ones. This is done by analyzing the user's topical interests and, eventually, recommending the items associated with the user's interest. The proposed system is personality-aware from two aspects; it incorporates the user's personality traits to predict his/her topics of interest and to match the user's personality facets with the associated items. The proposed system was compared against recent recommendation methods, such as deep-learning-based recommendation system and session-based recommendation systems. Experimental results show that the proposed method can increase the precision and recall of the recommendation system, especially in cold-start settings.

Personality-Aware Product Recommendation System Based on User Interests Mining and Metapath Discovery

A recommendation system is an integral part of any modern online shopping or social network platform. The product recommendation system as a typical example of the legacy recommendation systems suffers from two major drawbacks: recommendation redundancy and unpredictability concerning new items (cold start). These limitations take place because the legacy recommendation systems rely only on the user's previous buying behavior to recommend new items. Incorporating the user's social features, such as personality traits and topical interest, might help alleviate the cold start and remove recommendation redundancy. Therefore, in this article, we propose Meta-Interest, a personality-aware product recommendation system based on user interest mining and metapath discovery. Meta-Interest predicts the user's interest and the items associated with these interests, even if the user's history does not contain these items or similar ones. This is done by analyzing the user's topical interests and, eventually, recommending the items associated with the user's interest. The proposed system is personality-aware from two aspects; it incorporates the user's personality traits to predict his/her topics of interest and to match the user's personality facets with the associated items. The proposed system was compared against recent recommendation methods, such as deep-learning-based recommendation system and session-based recommendation systems. Experimental results show that the proposed method can increase the precision and recall of the recommendation system, especially in cold-start settings.

3. System Analysis

Yang et al. [4] proposed a recommendation system of computer games to players based on their personality traits. They have applied text mining techniques to measure the players' Big-five personality traits, and classified a list of games according to their matching with each dominant trait. They have tested their proposed system on 2050 games and 63 players form Steam gaming network. While Wu et al. [5] presented a personality based greedy re-ranking algorithm that generates the recommended list, where the personality is used to estimate the users' diversity

preferences. Ning et al. [6] proposed a friend recommendation system that incorporates the Big-five personality traits model and hybrid filtering, where the friend recommended process is based on personality traits and the users' harmony rating.

Ferwerda et al. [7] studied the relationship between the user's personality traits and music genre preferences, they have analyzed a dataset that contains personality test scores and music listening histories of 1415 Last.fm users. Similarly in [8] they conducted an online user survey where the participants were asked to interact with an application named Tune-A-Find, and measured taxonomy choice (i.e. activity, mood, or genre), individual differences (e.g. music expertise factors and personality traits), and different user experience factors. Similarly, Hafshejani et al. [9] proposed a collaborative filtering system that cluster the users based on their Big-Five personality traits using K-means algorithm. Following that, the unknown ratings of the sparse user-item matrix are estimated based on the clustered users.

Dhelim et al. [10] discussed the benefits of capturing the user's social feature such as personality traits that are represented as a cyber entities in the cyberspace. Similarly, Khelloufi et al. [11] showed the advantages of leveraging the user's social features in the context of service recommendation in the Social Internet of Things (SIoT).

Zarrinkalam et al. [12] presented a graph-based link prediction scheme that operates over a representation model built from three categories of information: user explicit and implicit contributions to topics, relationships between users, and the similarity among topics. Trikha et al. [13] investigated the possibility of predicting the users' implicit interests based on only topic matching using frequent pattern mining without considering the semantic similarities of the topics. While Wang et al. [14] proposed a regularization framework based on the relation bipartite graph, that can be constructed from any kind of relationships, they evaluated the proposed system from social networks that were built from retweeting relationships.

Disadvantages

1) The system less effective since it is not implemented by user interest mining, personality computing.

2) The system doesn't implement Collaborative filtering (CF) method.

Proposed System

In the proposed system, product recommendation could be formulated as link prediction in HIN [3]. For example, in this system, given the user's previous rating and topical interest represented in a HIN, the problem is to predict whether or not a link exists between the user and the product (the ball). One of the main challenges of link prediction in HIN is how to maintain a reasonable balance between the size of information considered to make the prediction and the algorithm complexity of the techniques required to collect that information. Since in practice, the networks

are usually composed out of hundreds of thousands or even millions of nodes, the method used to perform link prediction in HIN must be highly efficient. However, computing only local information could lead to poor predictions, especially in very sparse networks. Therefore, in our approach, we make use of meta-paths that start from user nodes and end up in the predicted node (product nodes in our case), and try to fuse the information from these meta-paths to make the prediction.

Advantages

1) Propose a product recommendation system that infers the user's needs based on her/his topical interests.

2) The proposed system incorporates the user's Big-Five personality traits to enhance the interest mining process, as well as to perform personality-aware product filtering.

3) The relationship between the users and products is predicted using a graph-based meta path discovery, therefore the system can predict implicit as well as explicit interests.

4. Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

Number of Modules

After careful analysis the system has been identified to have the following modules:

Registration based Social Authentication Module
Security Module
Attribute-based encryption module.
Multi-authority module.

Registration -Based Social Authentication Module:

The system prepares trustees for a user Alice in this phase. Specifically, Alice is first authenticated with her main authenticator (i.e., password),and then a few(e.g., 5) friends, who also have accounts in the system, are selected by either Alice herself or the service provider from Alice's friend list and are appointed as Alice's Registration.

Security Module:

Authentication is essential for securing your account and preventing spoofed messages from damaging your online reputation. Imagine a phishing email being sent from your mail because someone had forged your information. Angry recipients and spam complaints resulting from it become your mess to clean up, in order to repair your reputation. trustee-based social authentication systems ask users to select their own trustees without any constraint. In our experiments (i.e., Section VII), we show that the service provider can constrain trustee selections via imposing that no users are selected as trustees by too many other users, which can achieve better security guarantees

Attribute-based encryption module.

Attribute-based encryption module is using for each and every node encrypt data store. After encrypted data and again the re-encrypted the same data is using for fine-grain concept using user data uploaded. the attribute-based encryption have been proposed to secure the cloud storage. Attribute-Based Encryption (ABE). In such encryption scheme, an identity is viewed as a set of descriptive attributes, and decryption is possible if a decrypter's identity has some overlaps with the one specified in the ciphertext.

Multi-authority module.

A multi-authority system is presented in which each user has an id and they can interact with each key generator (authority) using different pseudonyms. Our goal is to achieve a multi-authority CP-ABE which achieves the security defined above; guarantees the confidentiality of Data Consumers' identity information; and tolerates compromise attacks on the authorities or the collusion attacks by the authorities. This is the first implementation of a multi-authority attribute based encryption scheme.

5. Conclusion

In this paper, we have proposed a personality-aware product recommendation system based on interest mining and meta path discovery, the system predicts the user's needs and the associated items. Products recommendation is computed by analyzing the user's topical interest, and eventually recommend the items associated with the those interests. The proposed system is personality-aware from two aspects, firstly because it incorporates the user's personality traits to predict his topics of interest. Secondly, it matches the user's personality facets with the associated items. Experimental results show that the proposed system outperforms the state-of-art schemes in terms of precision and recall especially in the cold start phase for new items and users.

References

[1] G. Piao and J. G. Breslin, “Inferring user interests in microblogging social networks: a survey,” User Modeling and User-Adapted Interaction, vol. 28, no. 3, pp. 277–329, aug 2018. [Online]. Available: http://link.springer.com/10.1007/s11257-018-9207-8
[2] A. Vinciarelli and G. Mohammadi, “A Survey of Personality Computing,” IEEE Transactions on Affective Computing, vol. 5, no. 3, pp. 273–291, jul 2014. [Online]. Available: http://ieeexplore.ieee.org/document/6834774/
[3] V. Mart´ınez, F. Berzal, and J.-C. Cubero, “A Survey of Link Prediction in Complex Networks,” ACM Computing Surveys, vol. 49, no. 4, pp. 1–33, feb 2017.
[4] H.-C. Yang and Z.-R. Huang, “Mining personality traits from social messages for game recommender systems,” Knowledge-Based Systems, vol. 165, pp. 157–168, feb 2019. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S095070511830577X
[5] W. Wu, L. Chen, and Y. Zhao, “Personalizing recommendation diversity based on user personality,” User Modeling and User-Adapted Interaction, vol. 28, no. 3, pp. 237–276, 2018.
[6] H. Ning, S. Dhelim, and N. Aung, “PersoNet: Friend Recommendation System Based on Big-Five Personality Traits and Hybrid Filtering,” IEEE Transactions on Computational Social Systems, pp. 1–9, 2019. [Online]. Available: https://ieeexplore.ieee.org/document/8675299/
[7] B. Ferwerda, M. Tkalcic, and M. Schedl, “Personality Traits and Music Genres: What Do People Prefer to Listen To?” in Proceedings of the 25th Conference on User Modeling, Adaptation and Personalization. ACM, 2017, pp. 285–288.
[8] B. Ferwerda, E. Yang, M. Schedl, and M. Tkalcic, “Personality and taxonomy preferences, and the influence of category choice on the user experience for music streaming services,” Multimedia Tools and Applications, pp. 1–34, 2019. [9] Z. Yusefi Hafshejani, M. Kaedi, and A. Fatemi, “Improving sparsity and new user problems in collaborative filtering by clustering the personality factors,” Electronic Commerce Research, vol. 18, no. 4, pp. 813–836, dec 2018. [Online]. Available: http://link.springer.com/10.1007/s10660- 018-9287-x
[10] S. Dhelim, N. Huansheng, S. Cui, M. Jianhua, R. Huang, and K. I.-K. Wang, “Cyberentity and its consistency in the cyber-physical-social-thinking hyperspace,” Computers & Electrical Engineering, vol. 81, p. 106506, jan 2020. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S0045790618334839
[11] A. Khelloufi, H. Ning, S. Dhelim, T. Qiu, J. Ma, R. Huang, and L. Atzori, “A Social Relationships Based Service Recommendation System For SIoT Devices,” IEEE Internet of Things Journal, pp. 1–1, 2020. [Online]. Available: https://ieeexplore.ieee.org/document/9167284/
[12] F. Zarrinkalam, M. Kahani, and E. Bagheri, “Mining user interests over active topics on social networks,” Information Processing & Management, vol. 54, no. 2, pp. 339–357, 2018.
[13] A. K. Trikha, F. Zarrinkalam, and E. Bagheri, “Topic-Association Mining for User Interest Detection,” in European Conference on Information Retrieval. Springer, 2018, pp. 665–671.
[14] J. Wang, W. X. Zhao, Y. He, and X. Li, “Infer user interests via link structure regularization,” ACM Transactions on Intelligent Systems and Technology (TIST), vol. 5, no. 2, p. 23, 2014.

[15] S. Dhelim, H. Ning, M. A. Bouras, and J. Ma, "Cyber-Enabled Human-Centric Smart Home Architecture," in 2018 IEEE SmartWorld). IEEE, oct 2018, pp. 1880–1886. [Online]. Available: https://ieeexplore.ieee.org/document/8560294/

[16] S. Faralli, G. Stilo, and P. Velardi, "Automatic acquisition of a taxonomy of microblogs users' interests," Web Semantics: Science, Services and Agents on the World Wide Web, vol. 45, pp. 23–40, 2017.

[17] S. Dhelim, N. Aung, and H. Ning, "Mining user interest based on personality-aware hybrid filtering in social networks," Knowledge-Based Systems, p. 106227, jul 2020. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S0950705120304354

[18] J. Kang and H. Lee, "Modeling user interest in social media using news media and wikipedia," Information Systems, vol. 65, pp. 52–64, 2017.

[19] Qi Liu, Enhong Chen, Hui Xiong, C. H. Q. Ding, and Jian Chen, "Enhancing Collaborative Filtering by User Interest Expansion via Personalized Ranking," IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics), vol. 42, no. 1, pp. 218–233, feb 2012. [Online]. Available: http://ieeexplore.ieee.org/document/6006538/