

DOCTORAL THESIS

Augmenting personalized recommender systems based on user personality

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Abstract

Recommender systems (RS) have become increasingly popular in many web applications for eliminating online information overload and making personalized suggestions to users. In recent years, user personality has been recognized as valuable info to build more personalized recommender systems. However, the existing personality-based recommender systems has mainly focused on revealing the impact of personality on the user's preference over a single item or an attribute, which may ignore the impact of personality on users' perceptions of recommender systems when multiple recommendations are returned at the same time. In addition, they have mostly relied on personality quiz to explicitly acquire users' personality, which unavoidably demands user efforts. From users' perspective, they may be unwilling to answer the quiz for the sake of saving efforts or protecting their privacy. The application of existing personality-based recommender systems will thus be limited in real life.

In this thesis, we aim at 1) incorporating personality into top-N ($N > 1$) recommendations, with emphases on personalizing recommendation diversity and improving the recommendation interface design, 2) deriving users' personality from their implicit behavior for augmenting the existing recommender systems.

Specifically, we first develop a generalized, dynamic diversity adjusting approach based on user personality with the goal of achieving personalized diversity tailored to individual users' intrinsic needs. In particular, personality is integrated into a greedy re-ranking process, by which we select the item that can best balance accuracy and personalized diversity at each step, and then produce the final recommendation list.

In this approach, personality is both used to estimate each user’s diversity preference and to alleviate the cold-start problem of collaborative filtering recommendations. The experimental results demonstrate that our personalized diversity-oriented approach significantly outperforms related methods (including both non-diversity-oriented and diversity-oriented methods) in terms of both accuracy and diversity metrics, especially in the cold-start setting.

In addition to the algorithm development, designing diversity-oriented interface has been proven helpful to augment users’ perception of recommendation diversity. However, little work has been done to identify the impact of users’ personality on their preference for different types of recommendation interfaces (e.g., the diversity-oriented interface and the non-diversity-oriented interface). In order to fill the gap, we conduct a within-subject user study. We concretely compare a diversity-oriented organization-based recommendation interface with the standard ranked list interface covering three product domains with different investment levels and users’ purchase experiences (i.e., mobile phone, hotel and movie). We find that users’ perceptions of different recommendation interface are influenced by the product types. More notably, we identify the important role of users’ personality in influencing their preference for recommendation interfaces. For instance, introverted users tend to reuse the organization-based interface in the future than the standard ranked list. The results can hence be constructive for improving existing recommendation interface design by considering users’ personality.

Although personality has been proven effective at enhancing the multiple recommendations, the effort of explicitly acquiring users’ personality traits via psychological questionnaire is unavoidably high, which may impede the application of personality-based recommenders in real life. We hence propose a generalized method to derive users’ personality from their implicit behavior and further improve the existing recommender systems. A preliminary experiment has been conducted in movie domain. More specifically, we first identify a set of behavioral features through experimental validation, and develop inference model based on Gaussian

Process to unify these features for determining users' big-five personality traits. We then test the model in a collaborative filtering based recommending framework on two real-life movie datasets, which demonstrates that our implicit personality based recommending algorithm significantly outperforms related methods in terms of both rating prediction and ranking accuracy. The experimental results point out an effective solution to boost the applicability of personality-based recommender systems in online environment.

Keywords: recommender systems, personality traits, diversity, interface design, user study, implicit acquisition, collaborative filtering

Table of Contents

Declaration	i
Abstract	ii
Acknowledgements	v
Table of Contents	vii
List of Tables	xi
List of Figures	xiii
Chapter 1 Introduction	1
1.1 Research Background	1
1.2 Problem Definitions	3
1.2.1 How to Improve the Top-N Recommendation Based on Users’ Personality?	3
1.2.2 How to Accurately Derive Users’ Personality from Their Be- havior for Augmenting Recommender Systems?	9
1.3 Main Contributions	10
1.4 Overview of the Dissertation	11
Chapter 2 State of Art	13
2.1 Personality Theoretical Foundations	13
2.1.1 Personality Definition and Theories	13

2.1.2	Trait Approach	14
2.2	Personality and Recommender Systems	19
2.2.1	Alleviating the New User Issue	19
2.2.2	Personalizing Recommendation Diversity	24
2.2.3	Improving Recommendation Interface Design	32
2.3	Personality Acquisition	34
2.3.1	Explicit Personality Acquisition	34
2.3.2	Implicit Personality Acquisition	37
2.4	Summary	40

Chapter 3 Personalizing Recommendation Diversity Based on User

	Personality	42
3.1	Introduction	42
3.2	User Survey	44
3.2.1	Materials and Participants	44
3.2.2	Procedure and Measurement	46
3.2.3	The Impact of Personality on Users' Preference for Diversity and Group Types	50
3.3	Methodology: Personality-based Greedy Re-ranking for Personalized Recommendation Diversity	52
3.3.1	Step 1: Predicting User Preference for Items	55
3.3.2	Step 2: Adjusting Diversity Degree within the Recommenda- tion List	57
3.4	Experiment Design	59
3.4.1	Data Set	59
3.4.2	Evaluation Procedure and Metrics	60
3.4.3	Compared Methods	63
3.5	Results and Analysis	66
3.5.1	Cold-Start Scenarios	67
3.5.2	Overall Comparisons Involving Non Cold-Start Scenarios . . .	71

3.6	Discussion	76
3.7	Summary	83

**Chapter 4 Improving Recommendation Interface Design Based on
User Personality 85**

4.1	Introduction	85
4.2	Interface Design	90
4.3	User Study	93
4.3.1	Materials and Participants	93
4.3.2	Procedure and Measurement	96
4.4	Results and Analysis	99
4.4.1	User Perceptions of Recommendation Interface	99
4.4.2	The Impact of Personality on Users' Preference for Recommendation Interface	103
4.5	Discussion	106
4.6	Summary	107

**Chapter 5 Implicit Acquisition of User Personality for Augmenting
Recommender Systems 108**

5.1	Introduction	108
5.2	Implicit Acquisition of User Personality	109
5.2.1	Feature Identification	110
5.2.2	Validation Experiment	112
5.2.3	Personality Inference Model and Evaluation	115
5.3	Recommendation Based on Implicit Personality	121
5.3.1	Algorithm Development	121
5.3.2	Experiment Setup	123
5.3.3	Results	124
5.4	Discussion	128
5.5	Summary	135

Chapter 6 Conclusion	138
6.1 Contributions	138
6.2 Future Work	140
Bibliography	144
Appendix Consent Forms	163
Curriculum Vitae	166