

On the Role of Personality Traits in Followee Recommendation Algorithms

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Followee Recommendation

- Online social networks have an important place in the life of their millions of users.
 - In face-to-face relationships, exposure to similar people can promote the development of relationships with liked-minded users.
 - Finding new friends in an online context, where the majority of users do not know each other personally, might be a challenging task.
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Followee Recommendation

Motivation

- Several approaches have been proposed in the literature to suggest users worth following in social networks based on homophily.
- The rationale behind the decision to start following other users in the context of social networks might attend, possibly simultaneously, to several reasons.
- Those reasons might differ according to the characteristics, experience, behaviour or life circumstances of each individual user.

Understanding how users select their friends or followees emerges as a key design factor of strategies for personalised followee recommendations.

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Followee Recommendation

Motivation

- Personality is acknowledged as one of the most important factors that can affect human behaviour and social relationships.
- Most followee selection approaches have been only based on topological, content or other independent factors.
- They disregard how user's preferences and interests can affect the selection of followees.
- This study measures the impact of personality in the accurate prediction of followees beyond common recommendation factors.
- A quantitative assessment of the behaviour and characteristics of users is combined with common factors influencing followee selection in *Twitter*.

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Factors for Followee Recommendation

Topology

- Most link prediction algorithms are based on network topology.
- They compute the similarity between nodes based on their neighbourhoods or ensembles of paths.

Common Neighbours

$$\frac{|\Gamma(x) \cap \Gamma(y)|}{|\Gamma(x) \cup \Gamma(y)|}$$

Sørensen

$$\frac{2 |\Gamma(x) \cap \Gamma(y)|}{k_x + k_y}$$

Factors for Followee Recommendation

Content

- The interest of a user can be characterised in terms of the information they create and publish (***publishing profile***).
- The interests of users can be characterised in terms of the information they read and consider interesting (***reading profile***).
- A content-based followee recommendation should match the ***reading profile*** of a user with the ***publishing profile*** of their potential followees.
- Two text processing approaches were defined: the full-text of tweets (***FULL***), and a pre-processed version of tweets (***PROC***).
- Similarity between two user profiles can be computed using the cosine similarity metric.

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Personality

Definition

- Psychology defines personality as a set of emotional, attitudinal, interpersonal processes and behavioural response patterns specific to each person.
- Personality can be considered one of the most important factors influencing behaviour, as it moderates how people behave, interact and react to other individuals.
- Personality remains stable during adulthood, exhibiting considerable continuity and stability over time.

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Personality

Definition

- Personality can be expressed via the Big Five model.
 - **Agreeableness** refers to being sympathetic, cooperative and helpful towards others.
 - **Extraversion** refers to being outgoing, friendly, assertive and energetic.
 - **Openness to Experience** refers to being curious, intelligent and imaginative.
 - **Conscientiousness** refers to being organised, persevering, disciplined, achievement-oriented and responsible.
 - **Neuroticism-Emotional Stability** refers to being anxious, insecure, moody, and sensitive.

Personality

Personality and Social Relationships

- Social environments can encourage personality manifestation as they satisfy all the basic psychological needs.
- Individuals with similar personalities might have similar interests.
- Each dimension has an important and differentiated role in the selection of friends and the similarity between friends.
- Similarities across the different dimensions are more important than the overall similarity computed considering all dimensions.

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Quantitatively Evaluating Personality

- The scores of each personality dimension must be summarised into a unique personality matching score.
 - An overall similarity measure might not be adequate for computing the similarity.
- A strategy that quantitatively assesses personality scores' statistical distribution for the five separate dimensions is defined.
- The strategy consists of a similarity matching rule set for each personality dimension.
 - Conscientiousness and Emotional Stability dimensions are ignored as they do not have significant effects on the friendship selection processes.

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Quantitatively Evaluating Personality

Rules

- Each rule analyses the personality score of the potential followees in relation to the statistical distribution of scores of the actual user followees.
- If users tend to relate with others in a certain range of personality, other users scoring in the same range should be preferred over others.

$$\text{MatchingScore}(u, pf, dimension) = \begin{cases} 1 & \text{score}(pf, dimension) \in \text{interquartile.range}(u, dimension) \\ 0 & \text{every other case} \end{cases}$$

- The overall personality matching score is computed as the average of the individual dimensions scores.

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Combining Factors for Followee Recommendation

- The recommendation algorithm needs to combine the topological and/or content-based factors with the matching personality scores.
- The similarity between a user and a potential followee must be unified to obtain a similarity ranked list.
- The different factors for followee recommendation are linearly combined.
- Several weight combinations for each factor are analysed to determine their optimal weights.
- The summation of each combination of weights is constrained to 1.

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Evaluation Settings

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Evaluation Settings

Dataset (?)

Total number of Twitter users	1,852
Total number of tweets	2,307,920
Average number of tweets per user	1,247
Total number of followee relations	780,220
Average number of followee relations per user	422
Total number of follower relations	19,548,850
Average number of follower relations per user	10,556

Evaluation (?)

- For each user, their actual followees and a set of randomly selected non-followees equivalent to the double of the number of actual followees were added to the pool of potential followees to be recommended.
- The quality evaluation assumes that items that were not originally part of the followee set are uninteresting for the user.
- The top- N recommended users were selected for computing the overall precision and assessing the quality of recommendations.
- N was set to 5, 10, 15, and 10%, 15% and 25% of the ranked list of recommendations.

Experimental Results

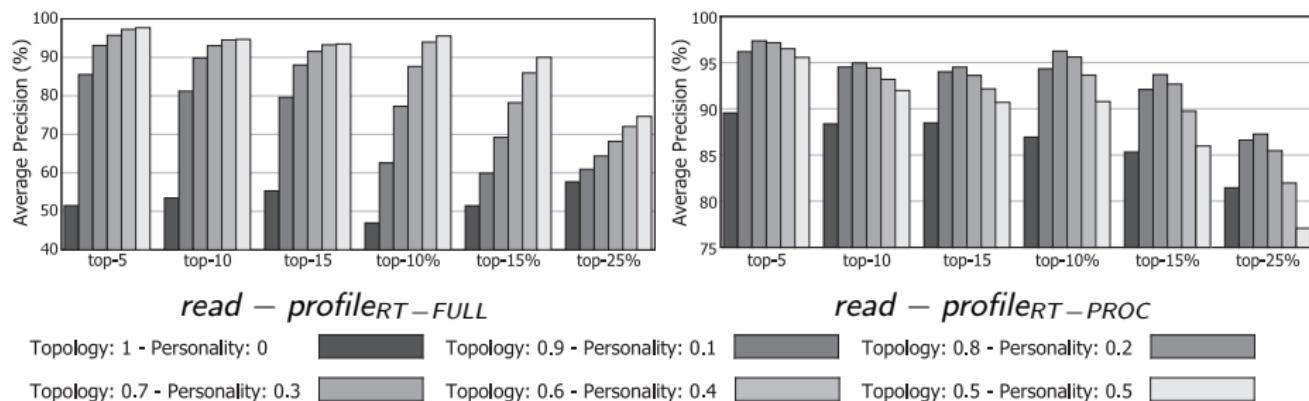
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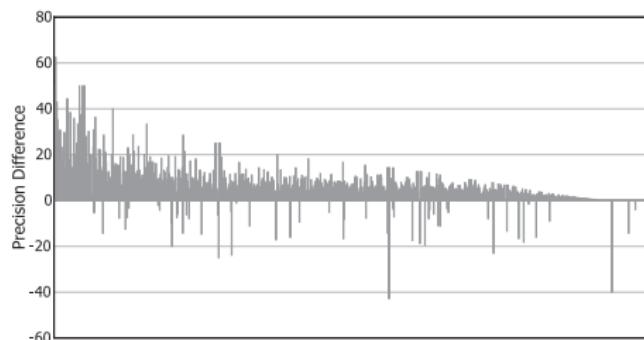
Personality and Content-based

Average Precision

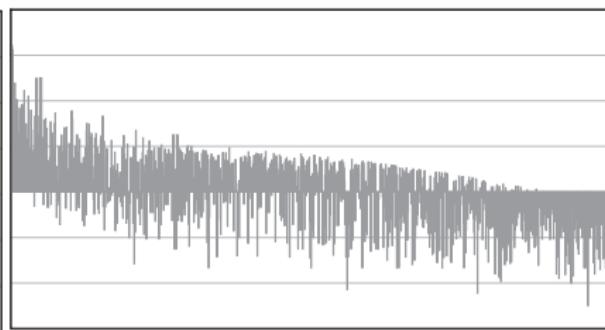


Experimental Results

Personality and Content-based Precision Differences



Content-based: 0.9 Personality: 0.1

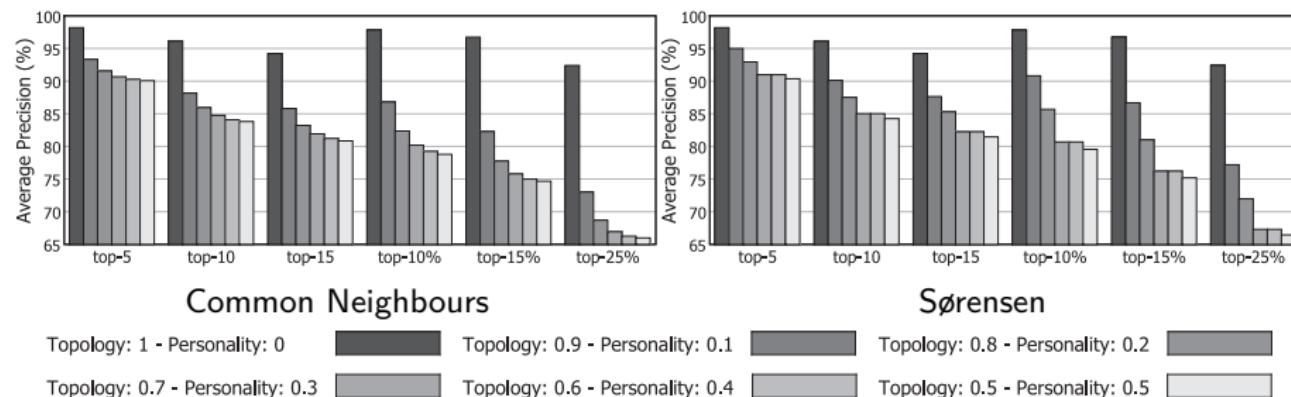


Content-based: 0.5 Personality: 0.5

Experimental Results

Personality and Topology

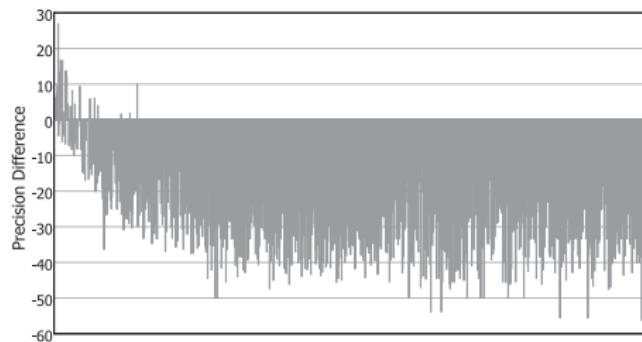
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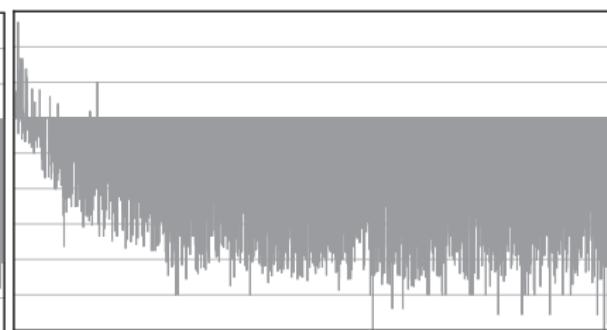
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Personality and Topology

Precision Differences



Topology: 0.9 Personality: 0.1



Topology: 0.5 Personality: 0.5

Experimental Results

Statistical Significance of Results (?)

- In all cases, the null hypothesis was rejected.
- Personality had a significant and non-incidental effect on results regarding the precision achieved when recommending followees solely based on topology or content.

	Statistic Value	Significance Level
$read - profile_{RT-FULL}$	5,721.128	< 2.2e-16
$read - profile_{RT-PROC}$	1,726.086	< 2.2e-16

Common Neighbours	6,357.037	< 2.2e-16
Sørensen	6,613.550	< 2.2e-16

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Summary

- This study analysed the impact of user behaviour and characteristics in the selection of followees.
- A strategy for quantitatively assessing the matching degree of personality between two users was defined.
- Personality was combined with two traditional followee recommendation factors.
- Evaluation was based on a real set of *Twitter* Users.

Conclusions

- Personality should be considered as a distinctive factor for followee selection in content-based social networks, such as *Twitter*.
- An accurate appreciation of commonly used factors tied to a quantitative analysis of personality is crucial to guide the search of potential followees.
- Personality helped to correctly place the most important or interesting users in the first positions of the similarity ranking.
- There is a limit to the importance that should be assigned to personality in order to either improve precision results or at least avoid their reduction.

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Questions



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