ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Togther4Ever: A Social Network with a Social Life Based Friend Recommendation System

Aiman Muneam Suhail
Master of Science (Information System),
Nizam College (Autonomous),O.U,
Basheer Bagh, Hyderabad.

ABSTRACT:

Existing social networking services recommend friends to users based on their social graphs, which may not be the most appropriate to reflect a user's preferences on friend selection in real life. In this paper, we present Together4ever, a novel social network with a social-life based friend recommendation system, which recommends friends to users based on their life styles instead of social graphs.

By taking advantage of sensor-rich smart phones, Together4ever discovers life styles of users from user-centric sensor data, measures the similarity of life styles between users, and recommends friends to users if their life styles have high similarity.

Inspired by text mining, we model a user's daily life as life documents, from which his/her life styles are extracted by using the Latent Dirichlet Allocation algorithm. We further propose a similarity metric to measure the similarity of life styles between users, and calculate users' impact in terms of life styles with a friend-matching graph.

Upon receiving a request, Together4ever returns a list of people with highest recommendation scores to the query user. Finally, Together4ever integrates a feedback mechanism to further improve the recommendation accuracy.

Index Terms:

Friend recommendation, mobile sensing, social networks, life style.

INTRODUCTION:

Twenty years ago, people typically made friends with others who live or work close to themselves, such as neighbours or colleagues. We call friends made through this traditional fashion as G-friends, which stands for geographical location-based friends because they are influenced by the geographical distances between each other. With the rapid advances in social networks, services such as Face book, Twitter and Google+ have provided us revolutionary ways of making friends. According to Face book statistics, a user has an average of 110 friends, perhaps larger than any other time in history. One challenge with existing social networking services is how to recommend a good friend to a user.

Most of them rely on pre-existing user relationships to pick friend candidates. For example, Face book relies on a social link analysis among those who already share common friends and recommends symmetrical users as potential friends. Unfortunately, this approach may not be the most appropriate based on recent sociology findings. According to these studies, the rules to group people together include: 1) habits or life style; 2) attitudes; 1) tastes; 4) moral standards; 5) economic level; and 6) people they already know.

Apparently, rule #1 and rule #6 are the mainstream factors considered by existing recommendation systems. Rule #1, although probably the most intuitive, is not widely used because users' life styles are difficult, if not impossible, to capture through web actions. Rather, life styles are usually closely correlated with daily routines and activities.Therefore, if we could gather information on users' daily routines and activities, we can exploit rule #1

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

and recommend friends to people based on their similar life styles. This recommendation mechanism can be deployed as a standalone app on smart phones or as an add-on to existing social network frameworks. In both cases, Toghter4Ever can help mobile phone users find friends either among strangers or within a certain group as long as they share similar life styles.In our everyday lives, we may have hundreds of activities, which form meaningful sequences that shape our lives. In this paper, we use the word activity to specifically refer to the actions taken in the order of seconds, such as "sitting", "walking", or "typing", while we use the phrase life style to refer to higher-level abstractions of daily lives, such as "office work" or "shopping". For instance, the "shopping" life style mostly consists of the "walking" activity, but may also contain the "standing" or the "sitting" activities.

To model daily lives properly, we draw an analogy between people's daily lives and documents, as shown in Figure 1. Previous research on probabilistic topic models in text mining has treated documents as mixtures of topics, and topics as mixtures of words. Inspired by this, similarly, we can treat our daily lives (or life documents) as a mixture of life styles (or topics), and each life style as a mixture of activities (or words). Observe here, essentially, we represent daily lives with "life documents", whose semantic meanings are reflected through their topics, which are life styles in our study.Just like words serve as the basis of documents, people's activities naturally serve as the primitive vocabulary of these life documents. Our proposed solution is also motivated by the recent advances in smart phones, which have become more and more popular in people's lives. These smart phones (e.g., iPhone or Android-based smart phones) are equipped with a rich set of embedded sensors, such as GPS, accelerometer, microphone, gyroscope, and camera.

Thus, a smart phone is no longer simply a communication device, but also a powerful and environmental reality sensing platform from which we can extract rich context and content-aware information. From this perspective, smart phones serve as the ideal platform for sensing daily routines from which people's life styles could be discovered. In spite of the powerful sensing capabilities of smart phones, there are still multiple challenges for extracting users' life styles and recommending potential friends based on their similarities.

First, how to automatically and accurately discover life styles from noisy and heterogeneous sensor data? Second, how to ensure the similarity of users in terms of life styles? Third, who should be recommended to the user among all the friend candidates? To address these challenges, in this paper, we present Toghter4Ever, a social-life based friend recommendation system based on sensor-rich smart phones.

The contributions of this work are summarized as follows:

- To the best of our knowledge, Toghter4Ever is the first friend recommendation system exploiting a user's life style information discovered from smart phone sensors.

- Inspired by achievements in the field of text mining, we model the daily lives of users as life documents and use the probabilistic topic model to extract life style information of users.

- We propose a unique similarity metric to characterize the similarity of users in terms of life styles and then construct a friend-matching graph to recommend friends to users based on their life styles.

- We integrate a linear feedback mechanism that exploits the user's feedback to improve recommendation accuracy.

- We conduct both small-scale experiments and large scale simulations to evaluate the performance of our system. Experimental results demonstrate the effectiveness of our system.

Advantages of social networks:

1.Social networking helps people stay in touch that might not do it otherwise.

2. Social networking can be used to help advertise goods and services.

3. Social networking can provide an extremely accessible medium for self expression to those with access to computer

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

4. Social networking can help families torn apart by war, divorce, etc. stay in touch easier and quicker than by some other means.

5. Social networking can be a powerful engine for job searches.

6. Social networking can be used to find dating partners in a fractured society where healthy meeting places are limited.

7. Social networking can be used to memorialize and honour dead persons to keep memories and history that would otherwise fade alive.

8. Social networking can be used to get difficult personal issues out of the closet in front of others so they can be examined and evaluated, and people in trouble can garner support from their friends.

isadvantages of social network:

1. Social networking takes time away from other activities and can take over from real time interaction.

2. Social networking formats set up expectations of importance for certain types of communication at the expense of other types. Pictures and phrases on a wall can take the place of phone calls and face to face time with family and friends.

3. Social networking magnifies the gap between people who have access to computer technology and those that don't, exacerbating other social inequities.

4. Social networking can compromise privacy in a big way.

5. Social networking can force changes in public policy which can either be a good thing or a bad thing depending on whose ox is gored. Employers can now make access to private social networking history a condition of hiring. Lawmakers may want to change that to prevent discrimination.

6. Social networking can be used to promote organized crime.

7. Social networking can become a venue for bullying.

8. Social networking can be a vector for simplifying language, thereby limiting concept development and expression.

9. Social networking can leave an indelible personal history that keeps a person who has grown past a bad time from moving on freely.

Problem Statement:

Most of the friend suggestions mechanism relies on pre-existing user relationships to pick friend candidates. For example, Face book relies on a social link analysis among those who already share common friends and recommends symmetrical users as potential friends.

Disadvantages:

» Existing social networking services recommend friends to users based on their social graphs, which may not be the most appropriate to reflect a user's preferences on friend selection in real life
Problem Solution

» The system is to define a unique similarity metric to characterize the similarity of users in terms of life styles and then construct a friend-matching graph to recommend friends to users based on their life styles.

» A novel Social-Life based Friend Recommendation system for social networks, which recommends friends to users based on their life styles instead of social graphs.

» By taking advantage of sensor-rich smart phones, Toghter4Ever discovers life styles of users from user-centric sensor data, measures the similarity of life styles between users, and recommends friends to users if their life styles have high similarity.

» We model a user's daily life as life documents, from which his/her life styles are extracted by using the Latent Dirichlet Allocation algorithm.

» Similarity metric to measure the similarity of life styles between users, and calculate users'

» Impact in terms of life styles with a friend-matching graph.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

» We integrate a linear feedback mechanism that exploits the user's feedback to improve recommendation accuracy.

Advantages:

» Recommended potential friends to users if they share similar life styles.

» The feedback mechanism allows us to measure the satisfaction of users, by providing a user interface that allows the user to rate the friend list

Objectives:

The main objective of this paper is to form the rules to group people together include habits or life style, attitudes, tastes, moral standards, economic level, and people they already know.

IMPLEMENTATION

Life style modelling:

Life styles and activities are reflections of daily lives at two different levels where daily lives can be treated as a mixture of life styles and life styles as a mixture of activities. This is analogous to the treatment of documents as ensemble of topics and topics as ensemble of words. By taking advantage of recent developments in the field of text mining, we model the daily lives of users as life documents, the life styles as topics, and the activities as words.

Friend-matching graph:

To characterize relations among users, in this section, we propose the friend-matching graph to represent the similarity between their life styles and how they influence other people in the graph. In particular, we use the link weight between two users to represent the similarity of their life styles. Based on the friend-matching graph, we can obtain a user's affinity reflecting how likely this user will be chosen as another user's friend in the network.

User Impact Ranking:

The friend-matching graph has been constructed to reflect life style relations among users. However, we still lack a measurement to identify the impact ranking of a user quantitatively.

Intuitively, the impact ranking means a user's capability to establish friendships in the network. In other words, the higher the ranking, the easier the user can be made friends with, because he/she shares broader life styles with others. Inspired by Page Rank which is used in web page ranking, we form the idea that a user's ranking is reflected by his neighbours in the friend-matching graph and how much his neighbours endorse the user as a friend.

Query and friend recommendation :

Before a user initiates a request, he/she should have accumulated enough activities in his/her life documents for efficient life styles analysis. The period for collecting data usually takes at least one day. Longer time would be expected if the user wants to get more satisfied friend recommendation results. After receiving a user's request (e.g., life documents), the server would extract the user's life style vector, and based on which recommend friends to the user.

Feedback control :

To support performance optimization at runtime, we also integrate a feedback control mechanism into Togther4Ever. After the server generates a reply in response to a query, the feedback mechanism allows us to measure the satisfaction of users, by providing a user interface that allows the user to rate the friend list.

Algorithm in Use:

Introduction to latent Dirichlet allocation (LDA):

In natural language processing, latent Dirichlet allocation (LDA) is a generative model that allows sets of observations to be explained by unobserved groups that explain why some parts of the data are similar.

Suppose you have the following set of sentences:

- I like to eat broccoli and bananas.
- I ate a banana and spinach smoother for breakfast.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

• Chinchillas and kittens are cute.

• My sister adopted a kitten yesterday.

• Look at this cute hamster munching on a piece of broccoli.

What is latent Dirichlet allocation? It's a way of automatically discovering topics that these sentences contain. For example, given these sentences and asked for 2 topics, LDA might produce something like

• Sentences 1 and 2 100% Topic A

• Sentences 3 and 4 100% Topic B

• Sentence 550% Topic A, 40% Topic B

• Topic A 30% broccoli, 15% bananas, 10% breakfast, 10% munching, … (at which point, you could interpret topic A to be about food)

• Topic B 20% chinchillas, 20% kittens, 20% cute, 15% hamster, … (at which point, you could interpret topic B to be about cute animals)
The question, of course, is how does LDA perform this discovery?

LDA :

In more detail, LDA represents documents as mixtures of topics that spit out words with certain probabilities. It assumes that documents are produced in the following fashion when writing each document, you

• Decide on the number of words N the document will have (say, according to a Poisson distribution).

• Choose a topic mixture for the document (according to a Dirichlet distribution over a fixed set of K topics). For example, assuming that we have the two food and cute animal topics above, you might choose the document to consist of 1/3 food and 2/3 cute animals.

• First picking a topic (according to the multinomial distribution that you sampled above; for example, you might pick the food topic with 1/3 probability and the cute animals topic with 2/3 probability).

• Using the topic to generate the word itself (according to the topic's multinomial distribution). For example, if we selected the food topic, we might generate the word "broccoli" with 30% probability, "bananas" with 15% probability, and so on. Assuming this generative model for a collection of documents, LDA then tries to backtrack from the documents to find a set of topics that are likely to have generated the collection.

Example:

Let's make an example. According to the above process, when generating some particular document D, you might

• Pick 5 to be the number of words in D.

• Decide that D will be 1/2 about food and 1/2 about cute animals.

• Pick the first word to come from the food topic, which then gives you the word "broccoli".

• Pick the second word to come from the cute animals topic, which gives you "panda".

• Pick the third word to come from the cute animals topic, giving you "adorable".

• Pick the fourth word to come from the food topic, giving you "cherries".

• Pick the fifth word to come from the food topic, giving you "eating".

So the document generated under the LDA model will be "broccoli panda adorable cherries eating" (note that LDA is a bag-of-words model).

CONCLUSION:

In this paper, we presented the design and implementation of Togther4Ever, a Social-Life based friend recommendation system for social networks. Different from the friend recommendation mechanisms relying on social graphs in existing social networking services, Togther4Ever extracted life styles from user-centric data collected from sensors on the smart phone and recommended potential friends to users if they share similar life styles.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

We implemented Togther4Ever on the Android-based smart phones, and evaluated its performance on both small-scale experiments and large-scale simulations. The results showed that the recommendations accurately reflect the preferences of users in choosing friends.

Future Work:

Beyond the current prototype, the future work can be four-fold. First, we would like to evaluate our system on large-scale field experiments. Second, we intend to implement the life style extraction using LDA and the iterative matrix-vector multiplication method in user impact ranking incrementally, so that Togther4Ever would be scalable to large-scale systems. Third, the similarity threshold used for the friend-matching graph is fixed in our current prototype of Togther4Ever. It would be interesting to explore the adaption of the threshold for each edge and see whether it can better represent the similarity relationship on the friend-matching graph.

At last, we plan to incorporate more sensors on the mobile phones into the system and also utilize the information from wearable equipments (e.g., Fit bit, watch, Google glass, Nike+, and Galaxy Gear) to discover more interesting and meaningful life styles. For example, we can incorporate the sensor data source from Fit bit, which extracts the user's daily fitness info graph, and the user's place of interests from GPS traces to generate an info graph of the user as a "document". From the info graph, one can easily visualize a user's life style which will make more sense on the recommendation. Actually, we expect to incorporate Togther4Ever into existing social services (e.g., Face book, Twitter, LinkedIn) so that Togther4Ever can utilize more information for life discovery, which should improve the recommendation experience in the future.

REFERENCES:

[1] Amazon. http://www.amazon.com/.

[2] Face book statistics. http://www.digitalbuzzblog.com/ facebook-statistics-stats-facts-2011/.

[3] Netflix. https://signup.netflix.com/.

[4] Rotten tomatoes. http://www.rottentomatoes.com/.

[5] G. R. Acre. Nonlinear Signal Processing: A Statistical Approach. John Wiley & Sons, 2005.

[6] B. Bahmani, A. Chowdhury, and A. Goel. Fast incremental and personalized page rank. Proc. of VLDB Endowment, volume 4, pages 173-184, 2010.

[7] J. Biagioni, T. Gerlich, T. Merrifield, and J. Eriksson. Easy Tracker: Automatic Transit Tracking, Mapping, and Arrival Time Prediction Using Smartphone's. Proc. of SenSys, pages 68-81, 2011.

[8] L. Bian and H. Holtzman. Online friend recommendation through personality matching and collaborative filtering. Proc. of UBICOMM, pages 230-235, 2011.

[9] C. M. Bishop. Pattern recognition and machine learning. Springer New York, 2006.

[10] D. M. Blei, A. Y. Ng, and M. I. Jordan. Latent Dirichlet Allocation. Journal of Machine Learning Research, 3:993-1022, 2003.

[11] P. Desikan, N. Pathak, J. Srivastava, and V. Kumar. Incremental page rank computation on evolving graphs. Proc. of WWW, pages 1094-1095, 2005.

[12] N. Eagle and A. S. Pentland. Reality Mining: Sensing Complex Cocial Systems. Personal Ubiquitous Computing, 10(4):255-268, March 2006.

[13] K. Farrahi and D. Gatica-Perez. Probabilistic mining of sociogeographic routines from mobile phone data. Selected Topics in Signal Processing, IEEE Journal of, 4(4):746-755, 2010.

[14] K. Farrahi and D. Gatica-Perez. Discovering Routines from Largescale Human Locations using Probabilistic Topic Models. ACM Transactions on Intelligent Systems and Technology (TIST), 2(1), 2011.

[15] B. A. Frigyik, A. Kapila, and M. R. Gupta. Introduction to the dirichlet distribution and related processes. Department of Electrical Engineering, University of Washignton, UWEETR-2010-0006, 2010.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

[16] A. Giddens. Modernity and Self-identity: Self and Society in the late Modern Age. Stanford Univ Pr, 1991.

[17] L. Gou, F. You, J. Guo, L.Wu, and X. L. Zhang. Sfviz: Interestbased friends exploration and recommendation in social networks. Proc. of VINCI, page 15, 2011.

[18] W. H. Hsu, A. King, M. Paradesi, T. Pydimarri, and T. Weninger. Collaborative and structural recommendation of friends using weblog-based social network analysis. Proc. of AAAI Spring Symposium Series, 2006.

[19] T. Huynh, M. Fritz, and B. Schiel. Discovery of Activity Patterns using Topic Models. Proc. of UbiComp, 2008.

[20] J. Kwon and S. Kim. Friend recommendation method using physical and social context. International Journal of Computer Science and Network Security, 10(11):116-120, 2010.

[21] J. Lester, T. Choudhury, N. Kern, G. Borriello, and B. Hannaford. A Hybrid Discriminative/Generative Approach for Modeling Human Activities. Proc. of IJCAI, pages 766-772, 2005.

[22] Q. Li, J. A. Stankovic, M. A. Hanson, A. T. Barth, J. Lach, and G. Zhou. Accurate, Fast Fall Detection Using Gyroscopes and Accelerometer-Derived Posture Information. Proc. of BSN, pages 138-143, 2009.

[23] E. Miluzzo, C. T. Cornelius, A. Ramaswamy, T. Choudhury, Z. Liu, and A. T. Campbell. Darwin Phones: the Evolution of Sensing and Inference on Mobile Phones. Proc. of MobiSys, pages 5-20, 2010.

[24] E. Miluzzo, N. D. Lane, S. B. Eisenman, and A. T. Campbell. Cenceme-Injecting Sensing Presence into Social Networking Applications. Proc. of EuroSSC, pages 1-28, October 2007.

[25] L. Page, S. Brin, R. Motwani, and T. Winograd. The Pagerank Citation Ranking: Bringing Order to the Web. Technical Report, Stanford InfoLab, 1999.

[26] S. Reddy, M. Mun, J. Burke, D. Estrin, M. Hansen, and M. Srivastava. Using Mobile Phones to Determine Transportation Modes. ACM Transactions on Sensor Networks (TOSN), 6(2):13, 2010.

[27] I. Ropke. The Dynamics of Willingness to Consume. Ecological Economics, 28(3):399-420, 1999.

[28] A. D. Sarma, A. R. Molla, G. Pandurangan, and E. Upfal. Fast distributed pagerank computation. Springer Berlin Heidelberg, pages 11-26, 2013.

[29] G. Spaargaren and B. Van Vliet. Lifestyles, Consumption and the Environment: The Ecological Modernization of Domestic Consumption. Environmental Politics, 9(1):50-76, 2000.

[30] M. Tomlinson. Lifestyle and Social Class. European Sociological Review, 19(1):97-111, 2003.

[31] Z. Wang, C. E. Taylor, Q. Cao, H. Qi, and Z. Wang. Demo: Friendbook: Privacy Preserving Friend Matching based on Shared Interests. Proc. of ACM SenSys, pages 397-398, 2011.

[32] X. Yu, A. Pan, L.-A. Tang, Z. Li, and J. Han. Geo-friends recommendation in gps-based cyber-physical social network. Proc. Of ASONAM, pages 361-368, 2011.

[33] Y. Zheng, Y. Chen, Q. Li, X. Xie, and W.-Y. Ma. Understanding Transportation Modes Based on GPS Data for Web Applications. ACM Transactions on the Web (TWEB), 4(1):1-36, 2010.

AUTHORS BIOGRAPHY:

Aiman Muneam Suhail
pursuing his Master of Science in Information System, from Nizam College (Autonomous),O.U,Basheer Bagh, Hyderabad,India.