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FRIENDBOOK: A SEMANTIC-BASED FRIEND RECOMMENDATION SYSTEM FOR SOCIAL NETWORKS

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Abstract *— Present social networking services suggests friends to users based on their social graphs, which may not be the most correct to reflect a user's preferences on friend selection in their real life. In this paper, we present Friendbook, a novel semantic-based friend recommendation system for social networks, which suggests friends to users based on their life styles instead of their social graphs. With the help of sensor-rich smart phones, Friendbook discovers life styles of users from user-centric sensor data, measures the similarity of life styles between users, and suggests friends to users if their life styles have high similarity. Inspired by text mining, we model a user's daily lifestyle as life documents, from which his/her life styles are extracted by using the Latent Dirichlet Allocation algorithm. We further use 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. On receiving a request, Friendbook returns a list of people with highest recommendation scores to the requesting user. Finally, Friendbook integrates a feedback mechanism to further increase the recommendation accuracy. We have implemented Friendbook on the Android-based smart phones, and calculated its performance on both small-scale experiments and large-scale simulations. The results show that the recommendations accurately reflect the preferences of users in choosing their friends.*

Keywords:- *Friend recommendation, mobile sensing, Social network, life style.*

I. INTRODUCTION

In past, people typically made friends with others who live or work near themselves, such as friends or colleagues. We call friends made through this traditional ways as G-friends, which means geographic allocation-based friends as they are influenced by the physical distances between one another. With the excess advances in social networks, services such as Facebook, Whatsapp, Tweets and Google+ have provided us advance ways of making friends. According to Facebook records, an consumer has an average of 130 friends, perhaps bigger than some other time in history One problem with existing social networking services is how to suggest a good friend for an user. Most of them rely on pre-existing end user relationships to select friend applicants. For example, Facebook depends on asocial link evaluation among those who already share common friends and recommends symmetrical users as potential friends. Unfortunately, this method may well not be the exactly correct based on recent sociology findings. Relating to these studies, the protocol to group people together include: 1) practices or life style; 2) attitudes; 3) tastes; 4) moral standards; 5) economical level; and 6) known peoples. Although the most intuitive, is not mainly used because users' life styles are difficult, if not hard, to catch through web actions. Somewhat, life-style are usually carefully related to daily regimens and activities. Therefore, if we could gather information on users' daily regimens and activities, This suggestion phenomenon can be used as a standalone software on Smartphone's or as an add-on to existing social network frameworks. In both cases, Friendbook 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 daily lives, we may have hundreds of activities, which form meaningful sequences that condition our lives. With this paper, we use the term activity to specifically refer to the activities taken in the order of seconds, such as "sitting", "walking", or "typing", while we use the phrase life style to refer to higher-level metre of daily lives, such as "office work" or "shopping". For instance, the "shopping" life style mainly contains 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, topics, and subject areas as mixtures of words Inspired by this, likewise, we can treat our day to day 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 matters, which are life-style in our study. Just like words serve as the basis of documents, householder's activities naturally act as the primitive vocabulary of those life documents. On the customer side, each smartphone can record data of the user, perform real-time activity recognition and report the made life documents to the servers.

II. LITERATURE REVIEW

1.Friendbook: A Semantic-Based Friend Recommendation System for Social Networks

Author: Zhibo Wang, Jilong Liao, Qing Cao, and Zhi Wang

In this paper author introduced design and implementation of Friendbook which is different from other friend recommendation mechanisms relying on social graphs in existing social networking services, Friendbook extracted life styles from user-centric data collected from sensors on the smartphone and recommended potential friends to users if they share similar life styles.

2.Understanding Transportation Modes Based on GPS Data for Web applications
Author: Y. Zheng, Y. Chen, Q. Li, X. Xie, and W.-Y. Ma
In this paper author described an approach based on supervised learning to automatically infer users' transportation modes, including driving, walking, taking a bus and riding a bike, from raw GPS logs.

3.Probabilistic Approch to Mining Mobile Phone Data Sequence
Author: KatayounFarrahi
In this paper author address the complex data mining from big data of large sequence, author proposed an unsupervised probabilistic topic model called the distant n-gram topic model (DNTM). The DNTM is based on Latent Dirichlet Allocation (LDA), which is extended to integrate sequential information.

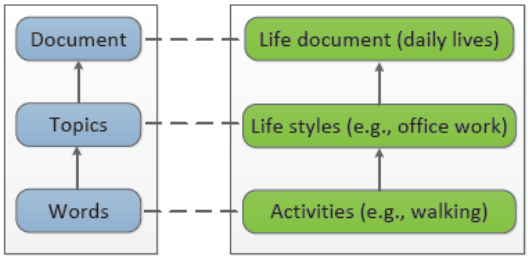
4. Discovering Routines from Large Scale Human Location using Probabilistic Data Models

Author: KatayounFarrahi

In this work we discover the daily location-driven routines which are contained in a massive real-life human dataset collected by mobile phones. Author developed an unsupervised methodology based on two differing probabilistic topic models and apply them to the daily life of user mobile phones

III. PROPOSED SYSTEM

Earlier research on probabilistic subject models in text exploration has considered documents as mixtures of topics, and subject areas as mixtures of words. Inspired by this, similarly, we can treat our day to day lives (or life documents) as a mixture of life styles (or topics), and each life style as a mixture of activities (or words). In this paper, we offered the design and execution of Friendbook, a semantic-based friend recommendation system for internet sites. Different from the friend suggestion mechanisms depending on social graphs in existing social networking services, Friendbook extracted life styles from user-centric data gathered from sensors on the smartphone and recommended potential friends to users if they share similar life styles. We implemented Friendbook on the Android-based smart- phones, and evaluated the performance on both small- scale experiments and considerable simulations. The results demonstrated that the advice effectively reflect the preferences of users in choosing friends. Beyond the current model, the near future work can be fourfold. Initially, we would like to evaluate our bodies on large-scale field experiments. Second, we intend to apply the life style removal using LDA and the iterative matrix-vector multiplication method in user impact rating incrementally, so that Friendbook would be scalable to large-scale systems. Third, the similarity threshold used for the friend-matching graph is fixed in our current prototype of Friendbook. This would be interesting to research the adaption of the threshold for each and every advantage and see whether it can better represent the similarity relationship on the friend matching graph. By end, we intend to include more sensors on the mobile phones into the system and also utilize the information from wearable equipments (e. g., Match bit, I watch, Yahoo glass, Nike+, and Galaxy Gear) to find outmore interesting and meaningful life-style.



An analogy between word documents and people's daily lives.

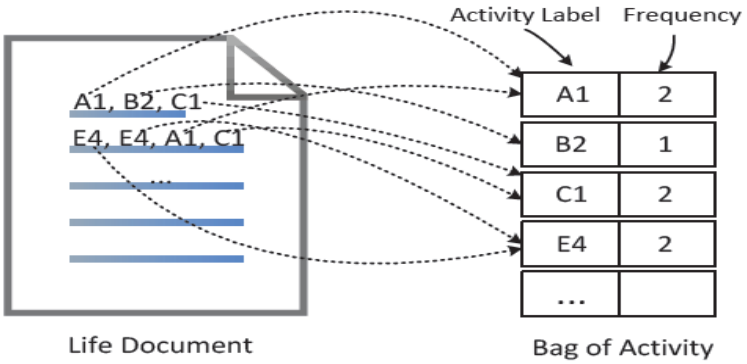


Fig. 3: Bag-of-Activity modeling for life document.

V. MATHEMATICAL MODEL

Let S is the Whole System Consists:
S= {U, w, z, d, Q, F, L,}.
Where,

1. U is the set of number of users.
   U= {u1,u2,.....,un}.
2. Q is the set of query generated from user.
   Q= {q1,q2,.....,qn}.
3. F is the set of feedback of users.
   F= {f1,f2,..... ,fn}.
4. Let w is the set of activities
   w= [w1,w2,……,wW]
   where wi is the ith activity and W is the total number of activities.
5. Let z is the set of life styles
   z = [z1, z2,……, zZ]
   where zi is the ith life style and Z is the total number of life styles.

6. Let d is the set of life documents
   d = [d1, d2,……. dn]
   where di is the ith life document and n is the total number of users.

V. SYSTEM ARCHITECTURE

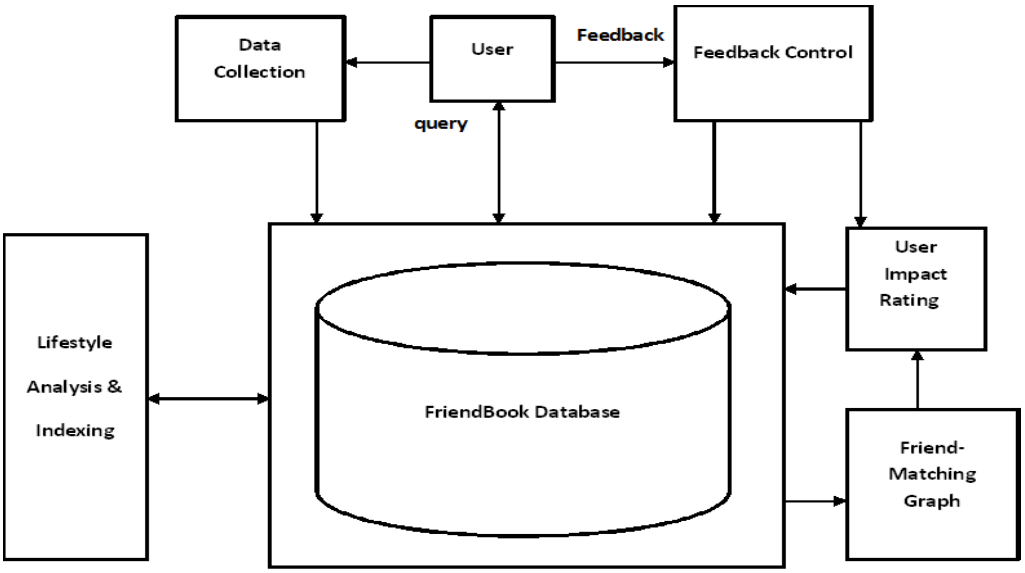


Figure 1. System Architecture

VI. MODULES

On the client side:

Each Smartphone can record data of its user, perform real-time activity recognition and report the generated life documents to the servers. It is worth noting that an offline data collection and training phase is needed to build an appropriate activity classifier for real-time activity recognition on Smartphone's.

On the Server side:

There are 7 modules on the server side to implement this system :
The data collection: This module collects life documents from users' smart phones. Like :Habits or life style ,Attitudes ,Tastes ,Moral standards, Economic level and People they already know.
Life style analysis: The life styles of users are extracted by the life style analysis module with the probabilistic topic model.
The life style indexing module: this module puts the life styles of users into the database in the format of (life-style, user) instead of (user, life-style).
A friend matching graph module: this module is implemented to construct the graph accordingly by the the similarity relationship between the users life style.
Ranking module: The impacts of users are then calculated based on the friend-matching graph.
Query module: The user query module takes a user's query and sends a ranked list of potential friends to the user as response.
Feedback control: The system also allows users to give feedback of the recommendation results which can be processed by the feedback control module

VII. CONCLUSION

All of us proposed a semantic-based good friend suggestion system for internet sites called "Friendbook". Unlike, the other friend recommendation system which are depending on social graphs in social networking services but proposed Friendbook will extract life styles from user-centric data gathered from sensors on the users Smartphone and suggested potential friends to users if they share similar life styles. We applied Friendbook on the Android Smartphone's, and evaluated the performance on both minor experiments and large-scale ruse. Our results showed that the advice are accurately reveal the preferences of users in choosing friends past the current prototype.

The future work can be four-fold. In the beginning, we would like to calculate our bodies on large-scale field experiments. Second, we plan to implement the life style extraction using LDA and the iterative matrix-vector

multiplication method in consumer impact ranking incrementally, so that Friendbook would be scalable to large-scale systems. Third, the similarity tolerance used for the friend-matching graph is fixed in our current prototype of Friendbook. It would be interesting to research the adaption of the tolerance for every single edge and see whether it can better represent the similarity romantic relationship on the friend-matching chart.

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