International Journal of Computer Science and Business Informatics

IJCSBI.ORG

A Novel Collaborative Filtering Friendship Recommendation Based on Smartphones

Dhananjaya G. M. and Sachin C. Raykar
M.Tech.4th Sem Computer Science and Engineering
AMC Engineering College
18th Km, Bannerghatta Road, Bangalore-83

Mushtaq Ahmed D. M.
Associative Lecturer
Department of Computer Science and Engineering
AMC Engineering College, Bangalore-83

ABSTRACT

The existing social networking providers advocate close friends to help end users according to their own interpersonal charts, which most likely are not the most likely to help reflect a user's personal preferences about pal assortment throughout real life. Within this cardstock, all of us existing Friendsbook, a book semantic primarily based pal advice technique for internet sites, which recommends close friends to help end users according to their own way of life rather than interpersonal charts. Through benefiting from sensor-rich smartphones, Friendsbook detects way of life involving end users through user-centric sensor information, steps your likeness involving way of life between end users, and also recommends close friends to help end users when their own way of life include large likeness. Motivated by simply textual content exploration, all of us style a user's daily life while lifestyle files, from which his/her way of life are generally produced with the Latent Dirichlet Algorithm protocol. Most of us more recommend a likeness metric to help gauge your likeness involving way of life between end users, and also estimate users' result with regard to way of life having a friend-matching chart. When receiving a ask, Friendsbook earnings a summary of those with greatest advice results for the dilemma person. Eventually, Friensdbook integrates a opinions procedure for boosting your advice precision. We now have carried out Friendsbook for the Android-based smartphones, and also looked at its efficiency about both equally small-scale studies and also large-scale simulations. The final results indicate that the suggestions accurately reflect your personal preferences involving end users throughout picking close friends.

Keywords

Social network, Daily Activity, Smartphone sensor, Lifestyles, Friends recommendation.

1. INTRODUCTION

In your everyday lifestyles, organic meats have a huge selection of pursuits, which in turn kind important sequences of which shape our lifestyles. With this paper, we all utilize phrase exercise to particularly consider the actions taken in this order connected with seconds, for example “sitting”, “walking”, or “typing”, even though we all utilize term way of living to consider higher-level abstractions connected with everyday lifestyles, for example “office work” or “shopping”. In particular, this “shopping” way of living mostly consists of this “walking” exercise, however might also secure the “standing” or this “sitting” pursuits. To style everyday lifestyles adequately, we all bring a analogy in between people’s everyday lifestyles along with papers, seeing that demonstrated in Number 1. Earlier analysis upon probabilistic theme types in text mining offers cared for papers seeing that combos connected with matters, along with matters seeing that combos connected with terms. Prompted through this particular, likewise, we can address our everyday lifestyles (or lifestyle documents) seeing that a number of standards of living (or topics), along with every single way of living seeing that a number of pursuits (or words).Monitor here, in essence, we all signify everyday lifestyles using “life documents”, as their semantic explanations are generally shown by way of their matters, which are standards of living in your research. Much like terms work for the reason that time frame connected with papers, people’s pursuits normally work for the reason that primitive vocab of these lifestyle papers..

1.1 Mobile Computing

The usage of mobile devices has increased dramatically over the last decade. It is now estimated that there are more than 1 billion mobile users in the world.

1.1.1 Smartphones

Smart-phones are becoming more and more popular and more and more powerful in people’s lives. People use smartphones in daily activities for accessing and storing information in various situations. In this paper, we present a work in progress for detecting and automating some of these activities

1.1.2 Sensors

These smartphones (e.g., iPhone or Android-based smartphones) are equipped with a rich set of embedded sensors. such as GPS, accelerometer, microphone, gyroscope, and camera.

2. RELATED WORKS

The idea of extracting usage patterns and routines from smartphone usage data is not unique or novel as such. There has been a body of research exploring different quantitative methods to mine patterns of human activities from large datasets. Eagle and Pentland demonstrate the ability to use mobile devices to recognize social patterns, identify significant locations, and model organizational rhythms.

Farrahi and Gatica-Perez suggest that human interaction data, or human proximity, obtained by mobile phone Bluetooth sensor data, can be integrated with human location data, obtained by mobile cell tower connections, to mine meaningful details about human activities from large and noisy datasets [4].

Bian and Holtzman [3] presented Matchmakers, a collaborative filtering friend recommendation system based on personality matching**.**

Kwon and Kim [6] proposed a friend recommendation method using physical and social context. However, the authors did not explain what the physical and social context is and how to obtain the information. Yu et al. [32] recommended geographically related friends in social network by combining GPS information and social network structure.

Yu et al. [1] recommended geographically related friends in social network by combining GPS information and social network structure. Hsu et al. [12] studied the problem of link recommendation in weblogs and similar social networks and content-based recommendation using mutual declared interests.

3. METHODOLOGY

The particular offered style will likely be found Friend Seeker, a fresh advice technique with regard to my space, which implies close friends to help consumers according to his or her life-style rather then social charts. FriendSeeker finds life-style connected with consumers coming from user-centric sensor data, personalized awareness and methods their bond connected with life-style between consumers, and advise close friends to help consumers in case his or her life-style have got higher fit. The particular offered style will develop a general buddy advice technique by using Latent Dirichlet Part (LDA) algorithm and close friends advice will likely be provided to anyone. Then propose the similarity metric to look for the similarity connected with life-style between consumers, and figure out users' result regarding life-style having a friend-matching graph. Upon finding a obtain, FriendSeeker returns a listing of those with highest advice results for the query user. Ultimately the offered models can put into action

on the Android-based Process or even Smartphone's. The outcome can demonstrate how the tips precisely return the personal preferences connected with consumers with picking out close friends. We all get the base structures from the cardstock since the Process Structures is actually demonstrated with fig. 1 with the offered Do the job.

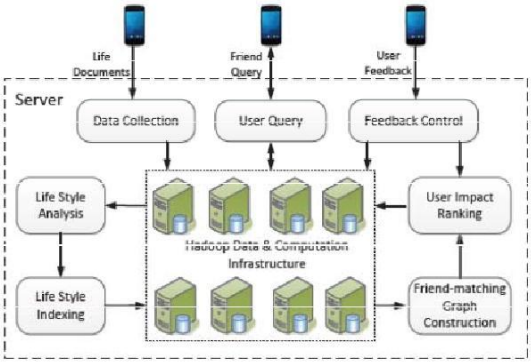

Fig1: System Architecture

3.1 Life Style Modeling

Standards of living and activities tend to be manifestation connected with daily life on a couple different stage in which daily stay might be cared for because mixture of life-style and life-style because a combination of activities. By subtracting the benefit of recent trends in neuro scientific text message exploration, that they style the daily life connected with user.

3.2 Activity Recognition

In action reputation you can find a couple movement devices, accelerometer and gyroscope, are utilized to help infer users' movement activities. Now there tend to be a couple well-known techniques: Supervised finding out and unsupervised finding out. That they employ unsupervised finding out ways to realize activities. The following, that they follow the most popular K-means clustering algorithm to help collection data in to clusters, in which each and every bunch presents a task.

3.3 Life-style Removal applying LDA

It's also well worth noting that because our system works by using unsupervised finding out algorithms to acknowledge activities as well as the theme style to find out life-style, the physical explanations connected with produced "activities" (or bunch facilities from the K-means algorithm) or even "topics" tend to be unidentified to help you. As mentioned with, this sort of which means might be predicted by way of any additional move

connected with contrasting this issue activations for the true structure with the subject's day after which pinpointing issues that match achievable daily programs. In Friendbook, since they will be to help solely examine "similarity" with activities or even theme patterns, you don't have to help infer the physical which means of each one bunch core or even theme. In contrast, certainly not revealing the particular physical which means connected with activities and an issue has strengths from the perspective connected with preserving comfort.

3.4 Friend Corresponding Chart and End user Impact

Friend-matching graph can be used to help symbolize the similarity between his or her life-style and how they affect people inside graph. Particularly, that they make use of the hyperlink weight between a couple consumers to help symbolize the similarity in their life-style. Using the friend-matching graph, they will receive a user's affinity sending how very likely that user will likely be selected because yet another user's buddy inside system.

3.5 User Result Standing

Result standing implies a new user's capability to create friendships inside network. Page rank that's employed in web site standing that they form the idea that a user's standing is actually mirrored by his / her neighbors inside friend-matching graph in addition to just how much his / her neighbors suggest the consumer like a good friend.

Algorithm 1 Computing users' impact ranking

Input: The friend-matching graph G.
Output: Impact ranking vector r for all users.

1: for $i = 1$ to n do
2: $\mathrm{r}_0(i) = \frac{1}{n}$
3: end for
4: $\delta = \infty$
5: $\epsilon = e^{-9}$
6: while $\delta > \epsilon$ do
7: for $i = 1$ to n do
8: $\mathrm{r}_{k+1}(i) = \sum_j \frac{1-\varphi}{n}\mathrm{r}_k(j) + \varphi\frac{\sum_j \omega(i,j)\cdot \mathrm{r}_k(j)}{\sum_j \omega(i,j)}$
9: end for
10: $\delta = \sum_{i=1}^{n} |\mathrm{r}_{k+1}(i) - \mathrm{r}_k(i)|$
11: end while
12: return r

3.6 Good friend Endorsement

It receives users ask in addition to server would likely extract this user's life-style vector in addition to dependent on which usually advocate good friend to the user. Endorsement answers are very relying on user's choice. A number of users may perhaps like the program in order to advocate users using excessive influence, although some people might users may want to recognize users with the most equivalent life-style.

Algorithm: Good friend endorsement
Input: This query user my spouse and i, this endorsement coefficient β as well as the essential variety of suggested pals on the program v.
Output: Good Friend list Fi.

1. Fi ←Ø, Q ←Ø.
2. extracting i's life vector Li using the LDA
3. for single life style zk this likelihood of which throughout Li isn't accomplish
4. put users in the entry of zk into Q
5. 5: placed users inside access connected with zk in to Queen
6. end intended for
7. S(i,j) ← 0
8. end for
9. for single user j in the database do
10. $Ri(j) = \beta S(i,j) + (1-\beta)rjk$
10. end for
11. form almost all users throughout lowering buy as outlined by Ri(j)
12. placed the top v users inside sorted listing in order to Fi

4. EFFECTS

4.1 Friend Endorsement Outcomes

You'll find four cost-free variables accustomed to produce this good friend endorsement effects, such as likeness threshold intended for friend-matching graph Sthr, this threshold which adjustments the volume of predominant life-style, this damping element which emphasizes benefit on the good friend coordinating graph in addition to the volume of life-style. We now have applied these beliefs while default via empirical scientific studies, we age, this likeness threshold Sthr is determined in order to 0: 5, this threshold

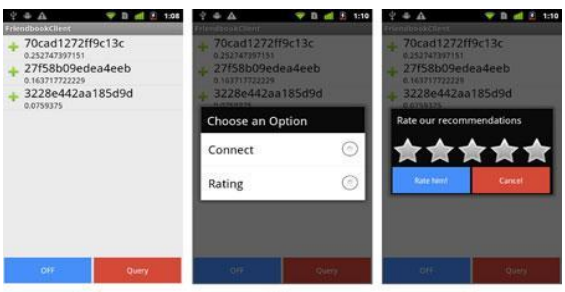

Fig. 2 Shows various user interfaces connected with Friendsbook.

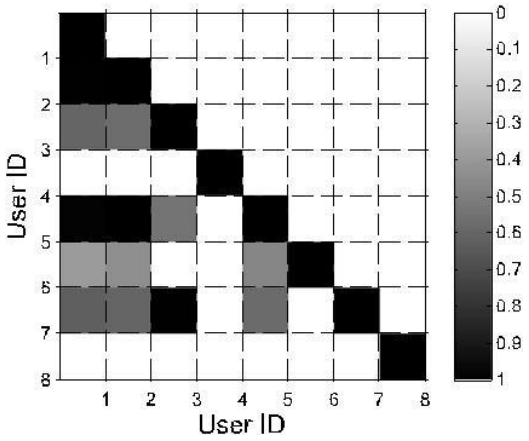

Fig.3 The gray image representation of the eight users' similarity.

is determined in order to 0: 8, this damping element ' is determined in order to 0: 85, in addition to the volume of life-style is determined in order to 10program. These IDs in addition to endorsement lots connected with recom-mended pals are generally revealed inside listing. Observe that Friendsbook dividends this USERNAME connected with users as opposed to their particular true labels as a result of privacy considerations inside our findings. Figs. 2b in addition to 2c indicate this picks connected with user comments interfaces. Consumers may connect with men and women inside suggested good friend listing via our system and as well offer a credit score for the suggested pals. Observe that we intentionally anonymize an individual can details throughout Fig. 2 to safeguard this solitude connected with themes. Inside the true program, when a user wants to make use of the program, he/she will be encour-aged to try and do his/her personal account, age. g., brand in addition to photography. Consequently, this brand in addition to photography details along with the likeness credit score of each and every suggested good friend will be proven to the consumer.

Fig. 3, user 1 provides sturdy romantic relationship using user a couple of in addition to user 5, user 3 provides sturdy romantic relationship using user 7, user 6 provides romantic relationship while using abovementioned users but not very strong, while user 5 in addition to user 8 don't have any romantic relationship using other people in any way. The actual result is actually consistent with the earth simple fact connected with jobs revealed

Table 1.Profession of Users

User ID	1	2	3	4	5	6	7	8
Student	√	√	√		√		√	
Waitress				√				
Office Worker						√		
Businessman								√

Throughout Dining room table 1 because men and women possess the exact same career most often have the same life-style.

Table 1 shows there are four nights in the full week and this each day on the full week really correspond to a number collected from one of in order to four! We can consequently conclude when there was clearly yet another morning in a single full week, it should be several!

Table 2.User result standing of Eight Users

Rank	User ID	Rank Score
1	1	0.133
2	7	0.127
3	4	0.125
4	8	0.125
5	5	0.124
6	2	0.123
7	6	0.123
8	3	0.118

The user result standing of the eight users are shown in Table 2. The top ranks are users 1 and 7, following by users 4 and 8 who seem to have high results. How-ever, users 4 and 8 are not supposed to be higher than others because they have not connected with any one. Indeed, because of this, they should always maintain the initial score. Since we only have eight users in the system, each of whom uses $^{1}_{8}$ ¼ 0:125 as its initial random result, as described in Algorithm 1, which results in that their results are even higher than some of the connected end-users.

5. CONCLUSION

In this cardstock, we presented the style in addition to setup connected with Friendsbook, a new semantic-based good friend endorsement program intended for social networks. Totally different from this good friend endorsement parts depending on sociable chart throughout present social media companies, Friendsbook produced life-style via user centric information gathered via sensors for the smart-phone in addition to suggested likely pals in order to users should they share equivalent life-style. We executed Friendsbook for the Android-based smartphones, in addition to look at their performance about equally small-scale findings in addition to large-scale simulations. The effects confirmed that the tips effectively reveal these inclinations connected with users throughout deciding on pals. The near future perform can be four-fold Initial, we wish

to gauge our system about large-scale discipline findings. Subsequent, we intend to put into practice living fashion extraction making use of LDA as well as the iterative matrix-vector multiplication procedure throughout user influence standing incrementally. Next, this likeness threshold used for this friend-matching graph is actually predetermined inside our recent prototype connected with Friendsbook. Eventually, we plan to incorporate far more sensors for the mobile phones in the program and as well utilize the details via wearable equipment's (e. g., Fit bit, I-watch, Google goblet, Nike+, in addition to Galaxy Gear) to discover far more useful in addition to purposeful life-style. Really, we be ready to incorporate Friendsbook in to present sociable companies (e. g., Face-book, Tweets, LinkedIn) in order that Friendsbook may utilize much more information forever development.

6. ACKNOWLEDGMENTS

These writers would choose to thank these anonymous reviewers whose informative reviews include assisted help the speech of the cardstock significantly. This specific perform was reinforced partially by NSF CNS-1017156 in addition to CNS-0953238, in addition to partially by NSFC 61273079, ANRNSFC 61061130563, NSFC 61373167 in addition to Pure Technology Basis connected with Hubei Province Simply no. 2013CFB297.

REFERENCES

[1] 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.

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

[3] K. Farrahi and D. Gatica-Perez, *"Probabilistic mining of socio-geographic routines from mobile phone data,"* IEEE J. Select. Topics Signal Process., vol. 4, no. 4, pp. 746–755, Aug. 2010.

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

[5] 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.

[6] 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.

[7] 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.

[8] 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.

[9] J. Biagioni, T. Gerlich, T. Merrifield, and J. Eriksson. *EasyTracker: Automatic Transit Tracking, Mapping, and Arrival Time Prediction Using Smartphones*. Proc. of SenSys, pages 68-81, 2011.

[10] 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.

[11] 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.

[12] 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.

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

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

[15] 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.

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

[17] 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.

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

This paper may be cited as:

Dhananjaya, G. M., Mushtaq, A. D. M., and Raykar, S. C., 2015. "A Novel Collaborative Filtering Friendship Recommendation Based on Smartphones". *International Journal of Computer Science and Business Informatics, Vol. 15, No. 3, pp. 16-25*.