PITAGORA: Recommending Users and Local Experts in an Airport Social Network

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ABSTRACT

In this demo we present PITAGORA[1]: a mobile web contextual social network designed for the check-in area of an airport. The app provides recommendation of potential friends, local experts and targeted services. Recommendation is hybrid and combines social media analysis and collaborative filtering techniques. Users' recommendation has been evaluated through a user study with good results.

Categories and Subject Descriptors

H.3.1 [**Information Storage and Retrieval**]: Content Analysis And Indexing; H.5.m [**Information Storage and Retrieval**]: Information Interfaces And Presentation—*Miscellaneous*

General Terms

Experimentation, Contextual Social Networking, Mobile Web Application

Keywords

Social Media Analysis, User Profiling, Local Experts Recommendation, Users Recommendation

1. MOTIVATIONS AND PREVIOUS WORK

Knowledge extracted from online social networks (e.g. Facebook and LinkedIn), combined with information about users' location, can be exploited to build more targeted contextual services, such as recommendation of people and facilities.
In this demo we present PITAGORA, a mobile social network which exploits analysis of social media to provide friend and local experts recommendation in the check-in area of an airport. The proposed analysis techniques and recommendation approaches can be applied also in other domains where social applications may be used to offer contextual services.

[1]Demo video available at http://bit.ly/1GgtUrN

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In the check-in area of an airport people basically have little time but also the opportunity to get in touch with other people. Usually, passengers are in airports for business or leisure and, in both cases, it has been demonstrated that they are more open to social interactions than usual [1]. In this context, recommendation systems and interfaces can be really valuable provided you take into account the motivations and needs of users temporary co-located in the same place. In the case of an airport check-in area, for example, the passenger's destination and the reason of the travel (professional or not) can be essential infos to improve general-purpose recommenders.

Section 2 describes the social network and gives insights on the user interface (Section. 2.1) and the two main recommendation modules: friends prediction in Section 2.2 and local experts suggestion in Section 2.3. Recommender evaluation is conducted in Section 3.

2. THE SOCIAL NETWORK

PITAGORA has been developed as a mobile web application available in the check-in area of an airport. The goal of the application is to improve passengers experience providing an enhanced people recommender by exploiting situational information. The application allows the user to search and display flight infos, to check the presence of passengers on his same flight and to communicate with them through a realtime chat. Recommendations are mainly constituted by suggestions of other users who share the same interests. Users are also provided with a recommendation of local experts, present at the airport, on the basis of their flight destination. The system uses an hybrid approach to the recommendation problem combining content-based and collaborative filtering. As well-known in literature hybrid approaches give better results solving issues related to the large amount and the sparsity of the data.

2.1 User Interface

The user interface is composed by two main views: 1) a search view and a 2) browsing view. At the first access the user is provided with an autosuggest search input which allows to identify his/her own flight. Once the user has selected the flight, the interface proposes a sliding menu based panel (i.e. browsing view) organised in several sections: 1) profile: it displays flight infos, allows to login with both Facebook and LinkedIn and provides recommendation of destination-based local experts; 2) leisure: it provides recommendation of users weighting more Facebook data; 3) professional: it provides recommendation of users weighting

more LinkedIn data; 4) chat: it allows to chat in realtime; 5) search flight: it can be used to go back to the search view. Recommendations are shown as lists of records which behave as an accordion: each item can be expanded to show things in common between users: demographic info, Facebook 'likes' (leisure), connections, groups and companies followed (professional). Users can be ordered by similarity or organised visually with a taxonomy of categories. Leisure recommendations contemplate also retails in the airport semantically matching user interests (e.g. liquor store if the user likes dry gin and tequila). Contextual retail suggestions can be exploited by the user in the chat to invite other users for dating.

2.2 Data Analysis and Users' Recommendation

Users are profiled analysing data extracted from Facebook and LinkedIn accounts. The different nature of this data is exploited in order to obtain recommendations concerning leisure (Facebook) and professional aspects (LinkedIn). When the user logs into the system the following data are extracted: *a*) demographic infos, connections, level of education, job history (Facebook and LinkedIn); *b*) page 'likes', photo albums (Facebook) *c*) groups and companies followed (LinkedIn). Profiles are described as vectors of pages on which users have expressed a 'like' and groups or companies followed. In order to solve the sparsity problem, a co-occurrence matrix is used to infer additional possible resources of interests. Users' recommendation is then achieved with a standard user-based algorithm considering the distribution of user's interests and computing a nearest-N users' neighbourhood with the Euclidean distance. Sparsity reduction is performed offline, using an item-based algorithm. Demographic data and professional history infos are used to adjust features' intra-weights for recommendation. Performance of the users' recommender is evaluated in Section 3.

2.3 Local Experts Recommendation

The goal of the local experts recommender is to suggest users that have an high level of travel experience about the flight city or region destination. The identification of local experts is obtained through the analysis of social media extracted from Facebook. In particular, user travels and location history are computed analysing geo-tagged pictures: travels are identified considering photos and photo albums metadata, birthplaces and places of residence and exploited to produce destination-based recommendations.
The proposed method for local experts estimation builds upon some approaches [2] where human location history is exploited to recommend points of interests in geographical areas: count of city visits, social media analysis, user activity in the social network and cities' correlation are used in PITAGORA to estimate the user travel experience per city. Given a set of users U and a set of visited cities C, a matrix V is defined where the item v_{ij} of V represents how many times the user u_i has visited the city c_j. Visited cities are computed by analysing data from Facebook, as stated above, but to reduce the sparsity problem also data from user's activity in the social network is exploited: selections of flight destinations are considered as visits. The travel experience E of users is calculated iteratively on the basis of the number of travels in cities as follows: $E_n = E_{n-1} \cdot V \cdot V^T$. E_n indicates the vector E at the n iteration that is initialised with $E_0 = (1, 1, \cdots, 1)$. The vector E is then normalised, dividing by its highest value. The correlation $CORR(c_i, c_j)$ between two cities c_i and c_j is expressed as $CORR(c_i, c_j) = \sum_{u_k \in U'} \alpha * e_k$. U' represents the group of users who has visited both c_i and c_j, e_k is the component of E relative to the user u_k. The weight factor α, with $0 < \alpha \leq 1$ is defined taking into account the Euclidean distance between latitude and longitude of the two cities. Finally, we compute the level of experience of a user u for a given city c. To this end, we define n_k as the number of visits of the user u in the city c_k, based on previous activity on the network (i.e. previous flight destinations). In addition the number of geo-tagged photos p_k that the user has published in c_k is extracted from Facebook. On this basis a rating $exp_{u,c}$ can be assigned to a user for a city as $exp_{u,c} = \sum_{k=0}^{|C|} (1 + p_k) * n_k * CORR(c, c_k)$. Furthermore, if a user lives (or has lived) in c or if she had educational/professional experiences in the city a *bonus* to the rating $exp_{u,c}$ is given. Local experts whose score is greater than a threshold are shown as a list of recommendation, in descending order, in a dedicated view.

3. EVALUATION

The proposed users' recommendation system is based on the ranking of user similarities and can be seen as an information retrieval system, considering a user as a query term. To evaluate the relevance of the recommendations the normalised Cumulative Discounted Gain (nDCG) measure has been used. Relevance scores are computed comparing the list of recommended users with the ideal list given by the user. The ground truth has been collected asking 150 users to express a relevance score (on a 0 to 3 scale) for the first J people suggested by the system. In this experiment, a logarithm with base 2 is used to ensure all positions are discounted. The nDCG for the top-J item results in values of 0.767 with j=5 and 0.872 for j=10.

4. CONCLUSIONS

In this demo we present PITAGORA, a mobile airport social network featuring users' recommendation and suggestion of local experts. Novel approaches are proposed which take into account profiling techniques from social media analysis (e.g. Facebook and LinkedIn) and inferred ratings for users' neighbourhood detection and identification. An evaluation of the effectiveness of the solutions is provided through a user study based on the nDCG measure which shows good results.

5. ACKNOWLEDGMENTS

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6. REFERENCES

[1] Z. Rubin. Disclosing oneself to a stranger: Reciprocity and its limits. *Journal of Experimental Social Psychology*, 11(3):233 – 260, 1975.

[2] Y. Zheng, L. Zhang, X. Xie, and W.-Y. Ma. Mining correlation between locations using human location history. In *Proceedings of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*, GIS '09, pages 472–475, New York, NY, USA, 2009. ACM.