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Point-Of-Interest Recommender System for Social Groups

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Abstract

This paper presents a signature based point of interest (POI) group recommendation system which provides personalized recommendations of places, such as restaurants, for mobile social groups. The growth of location-based social networking (LBSN) like Foursquare in recent years allowed users to explore POI's easily. While the POI recommendation for individual users has been studied greatly, there has not been much work done when it comes to recommendation for group events. The recommendation for groups is different to that of single user as the requirements vary in both cases. In this work, we identify the places which are used for group events and then build signatures based on group size, location, time and other parameters. Then, for each new group we build a similar signature and recommend places based on similarity with the calculated signatures. The experimental results demonstrate how the algorithm exploits the structure of the group and gives prediction based on the group rather than the approach of giving predictions to single user.

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Keywords: Point-of-Interest; signatures; k-core; k-NN; recommender systems

1. Introduction

The rapid urbanization of cities has led to an increase in number of point of interests (POI). These POI's can be anything from restaurants, hotels, parks or even a view point on the road. The extensive use of location-based social networking (LBSN) such as Facebook and Foursquare has provided us opportunities to explore the real-world behaviors of users, to identify potential POI's [1-3] for recommendations. For example, Ye et al. [4] built a collaborative recommendation system using features like user preference, social influence and geographical influence. However, unlike the recommendation systems developed for movies and other products in e-commerce websites, the choice of POI recommendation depends on the number of people and their relationships. Liu et al. [5] showed that groups impact the choice of recommendations like POI's. For example, places like six flags are usually visited by large group of people and places like Starbucks are favored by small group of people. In addition, places like Rio

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Grande Mexican Restaurant are preferred by groups with tight social relations and places like Mohawk, a lounge and a music venue are preferred by groups with loose relations. Using this knowledge, different recommendation systems for groups were developed in [7-8] such as collaborative filtering method (CF), least miserable collaborative methods (LM-CF), extended author topic model (E-AT) and personal impact model (PIT). However, these approaches do not use the information present in the structure of the groups to recommend new places.

In this paper, we built an approach to recommend POI's to new groups based on POI signatures generated from the structure of the groups which are extracted from geo-social networking data. Firstly, we discover which users visit a POI as a group, and generate the features for the discovered groups visiting that POI. We then build the signatures for all the groups that visited each POI. The POI signature describes various properties of the group such as number of users, number of relations, tightness and closeness. For a new group that requests recommendation of POI's, signature is calculated for that group and a recommendation is made using the K- nearest neighbors (KNN). We conducted experiments on the real data of the check-in records from Brightkite, and show that our recommendations are favorable to the groups.

The remainder of the paper is organized as follows. Section 2 introduces the concepts used in this work. Section 3 gives the methodology and algorithm used for recommender system. Section 4 presents the experimental results and Section 5 concludes the paper.

2. Definitions

2.1. Social Graph:

Given a set of users $U = \{u_1, u_2 \dots u_k\}$ and their social relations, the social graph for the users is represented by $G = (U, E)$, where V = U and $e(u_i, u_j) \in E$ if user u_i and user u_j are in social relations. For example two types of social graphs are shown below. The graph on the right is a tightly connected graph which is common for families and friends. The graph on the left shows loosely connected graph which is common for colleagues and business partners.

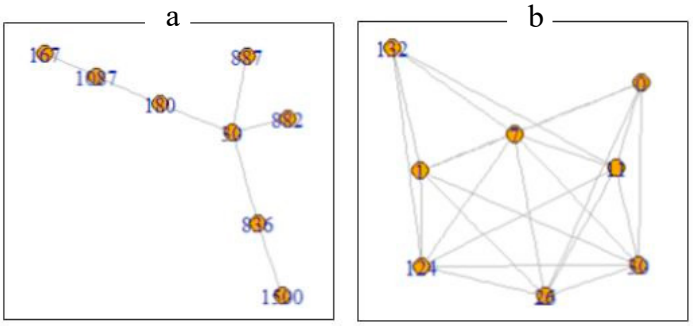

Fig 1 (a) Loosely connected graph; (b) Tightly connected graph

2.2. Event graph

Given a set of n users $U_p = \{u_1, u_2 \dots u_n\}$ where each user is related to at least one other user, the users form an event graph $G_{p,t,i} = (U_{p,}, E_p)$ if they happened to be at point of interest (POI) during an interval of time (T). In other words, given a set of related users, if they visit a POI together then that event is called an event graph.

2.3. K-core

K-core is an undirected graph in which every subgraph has a vertex of degree at most k: that is, some vertex in the subgraph touches k or fewer of the subgraph's edges [6]. In our approach, we use k-core to identify group events. As, there is a possibility that people visiting a POI at a particular time may not be related. Since they do not contribute to