Context-Aware Friend Recommendation for Location Based Social Networks using Random Walk

Hakan Bagci
Department of Computer Engineering
Middle East Technical University
Ankara, Turkey
hakan.bagci@ceng.metu.edu.tr

Pinar Karagoz
Department of Computer Engineering
Middle East Technical University
Ankara, Turkey
karagoz@ceng.metu.edu.tr

ABSTRACT

The location-based social networks (LBSN) facilitate users to check-in their current location and share it with other users. The accumulated check-in data can be employed for the benefit of users by providing personalized recommendations. In this paper, we propose a random walk based context-aware friend recommendation algorithm (RWCFR). RWCFR considers the current context (i.e. current social relations, personal preferences and current location) of the user to provide personalized recommendations. Our LBSN model is an undirected unweighted graph model that represents users, locations, and their relationships. We build a graph according to the current context of the user depending on this LBSN model. In order to rank the recommendation scores of the users for friend recommendation, a random walk with restart approach is employed. We compare RWCFR with popularity-based, friend-based and expert-based baseline approaches. According to the results, our friend recommendation algorithm outperforms these approaches in all the tests.

Keywords

Location-Based Social Networks; Friend Recommendation; Random Walk

1. INTRODUCTION

The recent advances in mobile communication and location-acquisition technologies encouraged mobile users to share their location data through LBSNs [18]. The datasets that are collected over LBSNs contain user and location items. They also include check-in history of users and friendship data. These datasets can be employed for personalized recommendations.

LBSNs provide a new way of friend recommendation based on user location histories [5]. User location histories provide valuable contextual information. Moreover, location histories and social behaviors are notably correlated [9]. Friend recommendation is extensively studied for traditional social networks. However, there are only a few number of friend recommendation algorithms that employ LBSN data in recommendation. Previous methods generally employ raw GPS data to find the similarity between users. When compared to raw GPS data, check-in data provides more contextual information. Moreover, most of the LBSNs collect check-in data rather than GPS trajectories. The majority of the proposed friend recommendation algorithms are not context-aware algorithms, hence they do not consider the current location of the user. A contextual friend recommendation algorithm can be more useful for finding new friends at visited locations.

In this paper, we propose a novel friend recommendation algorithm, RWCFR (**R**andom **W**alk based **C**ontext-aware **F**riend **R**ecommendation). Our friend recommendation algorithm considers social, personal and spatial context. It employs second degree friends (friends of friends). User's visited locations in recommendation region are also considered to identify place friends. Place friends are potential friends that have check-ins at the locations where the current user visited before. In addition to this, local experts and popular locations are employed in populating the context of the user.

In this paper, we use our LBSN model that is introduced in [2, 3]. This model represents an LBSN as an undirected unweighted graph. In [2] this model is employed for location recommendation and in [3] it is used for activity recommendation. The recommendation method that is employed in this study is similar to those in [2, 3], however, the main difference lies in the subgraph construction phase. RWCFR is a context-aware algorithm, hence it constructs a subgraph according to the current context of the user. Local experts and popular locations in region are added onto this subgraph. After constructing the subgraph, it is given as an input to our random walk algorithm, and it calculates the recommendation probabilities of users for friend recommendation. A list of potential friends is provided to user according to output of the random walk algorithm.

The main contribution of this work is that social connections, user's location history and current location are employed seamlessly in friend recommendation. Location experts and popular locations are extracted locally and employed in friend recommendation. Moreover, when new users and locations are inserted into database, unlike most of the collaborative filtering (CF) methods, our recommendation method does not need to update any existing model or structure, such as tensors. Our subgraph is constructed dynamically using efficient queries through a graph database.

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