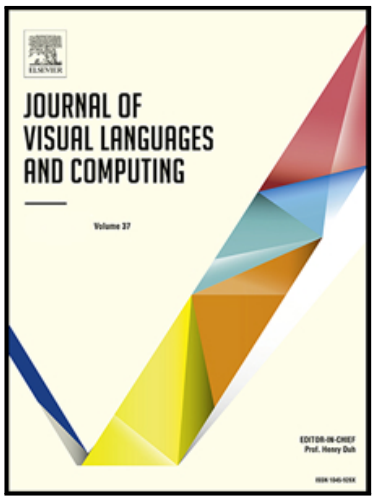

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Hongyu Jiang, Yadong Wu, Ye Zhang, Song Wang, Yangsong Zhang

PII: S1045-926X(16)30149-5
DOI: 10.1016/j.jvlc.2017.05.002
Reference: YJVLC 788

To appear in: *Journal of Visual Languages and Computing*

Received date: 17 September 2016
Revised date: 24 April 2017
Accepted date: 20 May 2017

Please cite this article as: Hongyu Jiang, Yadong Wu, Ye Zhang, Song Wang, Yangsong Zhang, From Social Community to Spatio-temporal Information: A New Method for Mobile Data Exploration, *Journal of Visual Languages and Computing* (2017), doi: 10.1016/j.jvlc.2017.05.002

From Social Community to Spatio-temporal Information: A New Method for Mobile Data Exploration

Hongyu Jiang[a], Yadong Wu[a,*], Ye Zhang[a], Song Wang[a,b], Yangsong Zhang[a]

[a]*Southwest University of Science and Technology, China, Mianyang*
[b]*Institute of Electronic Engineering, China Academy of Engineering Physics, China, Mianyang*

Abstract

Mobile data has various properties which contained social and spatio-temporal information of human activities. To support security department for crime fighting we encountered several challenges in the way of exploring complex mobile data, in order to solve those challenges this work has built a vivid method for mobile data analysis from social and spatio-temporal aspects, moreover, a prototype system was built to support person and community's pattern analysis for security department recognize abnormal person, for the sake of support quickly tagets searching, community detection was used to obtain the high-level information and the detail-information is presented by a series visualization models, users are able to accomplish their investigation tasks with interact with visual analysis system. Finally, we demonstrated the superiority of our method by the result that came from the analyzing of the call records which provided by an anonymous communications operator company.

Keywords: Social-Spatio-Temporal Information, Social Role Identification, Community Visualization

1. Introduction

In recent years, mobile communication has developed rapidly and the scale of social relation network (SRN) information has kept growing. As a kind of complex network, the obvious difference between SRN and other network is that SRN dependents on users, it can detect the behavior and social role of person. SRN research can obtain the behavior features, consumer features and social community effectively. For the cyber security institution, monitoring communications from network can help them obtain location information in whole network, and this kind of real-time monitoring could recognize abnormal events in large-scale communities. It is feasible to extract features from communities or special person. Relationship among users is a fundamental and important aspect of life. Many scientific, social and commercial decisions are made depending on proper knowledge and correct understanding of social relationship in real world. Moreover, exploring relationship among users has great value in various issues, such as consumption recommendations, abnormal behaviors and social role recognitions. As is known to all, human behaviors study is a complex field and required the knowledge of many other related fields, such as sociology, economics, operation researches, etc.

Communication social network not only used to detects the relationship among the users and telecoms operators, besides, it reflects the social relationship among persons. The large-scale groups in social network and enormous amount of information not only prompt the study of structures of human society and behaviors which has great influence in social structure and behavior study, moreover, spreading the research results to business, there is also greatly promotion in economic development. Now the study which aims to the traditional social network has made a big progress and has been successfully applied in many domains [18]. But, there are several studies about the recognition of semantic information, researchers often help users exploring in a low level semantics. Parent et al. [17] summarized the methods of semantic information processing and divided it into two types: one is semantic enrichment, another is the behavior knowledge extraction. Semantic enrichment means additive semantic property to the whole trajectory or the all points in trace. For example, each point can be represented by an activity like working or staying at home. The method of behavior knowledge extraction which adopts data mining method analyzes trajectory such as classification, clustering, public sequence identification and relationship analysis.

There are several scenarios which may wish to identify the relationship between persons from a set of call records. These include analyzing activities and similarity of suspected criminals (gang members, terrorists) whose mobile phones are tracked; monitoring offenders on probation; discovering relationship between different persons from the real world; recognizing social role for persons; consumption ability of user; or recommending appropriate formula for users[11]. Such scenarios may also happen if the users begin with an overview of a large, aggregated dataset, and give a small subset of mobile users to analyze more detailed. In order to analyze the problems above, researchers usually use two methods, one is discovering relationship between person to person by analyzing the patterns who communicate frequently and their temporal distribution, then create personalized traffic package to persons based on group properties for optimize the user service to make better experience for client, the most common way is community detection in communication network.

*Corresponding author
Email addresses: hongyuj@outlook.com (Hongyu Jiang), wuyadong@swust.edu.cn (Yadong Wu), zhangye@gd.swust.edu.cn (Ye Zhang), wangsong@swust.edu.cn (Song Wang), zhangyangsong@swust.edu.cn (Yangsong Zhang)