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FORECASTING AND ANTICIPATORY ESTIMATION OF HUMAN MOVEMENT PATTERNS

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ABSTRACT

The study of human movement patterns is integral to numerous fields, from urban planning and transportation management to public safety and healthcare. In an increasingly interconnected world, the ability to forecast and anticipate human movement holds immense potential for optimizing resource allocation, enhancing infrastructure planning, and enabling timely interventions. This project delves into the development of an innovative framework for forecasting and anticipatory estimation of human movement patterns. The proposed framework leverages advanced data analytics techniques and machine learning algorithms to analyze and interpret diverse sources of data, including historical movement data, demographic information, social events, and environmental factors. By synthesizing this multifaceted information, the framework aims to uncover hidden patterns and trends that influence human mobility. The potential applications of this research span a wide spectrum, including optimizing public transportation routes, mitigating traffic congestion, enhancing emergency response planning, and enabling personalized healthcare interventions. The results of this project contribute to the growing body of knowledge in predictive analytics, underscoring the power

of data-driven insights in shaping a more efficient and responsive urban landscape. In conclusion, this project advances the field of human movement pattern analysis by introducing a comprehensive framework for forecasting and anticipatory estimation. By harnessing the potential of data analytics and machine learning, this research opens avenues for informed decision-making and proactive intervention, ultimately fostering smarter, more resilient communities.

I. INTRODUCTION

With the rapid development of the wireless and networking technology, mobile networks have imposed a profound impact on people's daily life for their marvelous capability. These applications utilize the users' current and historical location information records (LIR) to analyze their mobility patterns to enable numerous applications, such as targeted advertising, city planning and smart navigation.

Generally speaking, the LIR data collected from the mobile networks can be divided into two categories, data collected by Internet service provider (referred to as ISP-collected data) and data collected by applications (referred to as app-collected data). The ISP-collected data are passively and periodically collected regardless of behaviors of the users.

This sort of data preserves the complete and consecutive trajectory of each user. Most of the existing studies are based on users' ISP-collected location data. quantified the predictability in human mobility by studying the regularities shown in the trajectory. According to their studies, the potential predictability reaches 93% on a mobile phone record dataset. Wang et al. link the human mobility with the social network, by segregating the similar users using the information from social media, more general and universal mobility patterns on a certain group of people were extracted, suggesting the huge predictability of the individual's movements. Moreover, applying the predictability into practice, many researches have also been conducted on the prediction of human mobility on various models, such as Markov Chain models, neural network, Bayesian network, finite state machine. On the other hand, however, few researches have focused on either predictability or prediction algorithm on app-collected location data. These aspects of researches remain to be explored.

In comparison to ISP-collected data, app-collected LIR data is actively triggered by users themselves in applications. This kind of location data will be collected when using the applications while the location information of the rest time remains unknown. It is exactly the characteristics of the app-collected data that arouses several difficulties to our study. First, the app-collected data contains the physical context of the location because the purpose of using the application certainly correlates with the location recorded, e.g., ordering a taxi, searching a restaurant. Such correlations

provide valuable information to analyze the human mobility patterns. However, simple grid for the city apparently loses the information. Hence, it is essential to find a proper spatial division of the city to reserve the physical context of app-collected data. Second, the app-collected data are partially missing since usually the applications do not record users' locations when they are not using the apps. Third, the app-collected data are heterogeneous in spatial and temporal domain since the time when people use the application is unevenly distributed. Under these circumstances, the methods aroused in the previous study apparently are not suitable for accurate predictions on the dataset. We need to propose new methods to adapt to these features of the app-collected data. In this paper, we address the above three challenges to facilitate the analysis. Our work can be summarized as follows:

In order to reserve the physical context of the locations, we contextually cluster the locations into multiple nonoverlapping districts of the city instead of using fixed coordinate grid that will lose the physical context. We also compare the predictability and the prediction accuracy between the two divisions to analyze the effect of context on prediction. Results reveal that the trajectories on context-based division are more predictable than those on division without context under the same spatial granularity.

We design a Markov-based method using Gibbs sampling to solve the unevenly distribution and the high missing rate of the app-collected data. By restoring the trajectory, we estimate the transition matrix to make prediction of users' movement. Results show

that, based on app collected dataset, our method achieves the same accuracy of the previous studies on the ISP- collected dataset. In order to investigate the effect of heterogeneity, we carry out a thorough analysis of the predictability and prediction accuracy based on our designed method on the app-collected dataset. The varying factors include the spatial and temporal resolution, the orders of Markov models, the radius of gyration etc.

II. LITERATURE SURVEY

TITLE: Limits of predictability in human mobility

AUTHORS: Chaoming Song, Zehui Qu, Nicholas Blumm, Albert-Laszlo Barabasi.

ABSTRACT:

A range of applications, from predicting the spread of human and electronic viruses to city planning and resource management in mobile communications, depend on our ability to foresee the whereabouts and mobility of individuals, raising a fundamental question: To what degree is human behaviour predictable? Here we explore the limits of predictability in human dynamics by studying the mobility patterns of anonymized mobile phone users. By measuring the entropy of each individual's trajectory, we find a 93% potential predictability in user mobility across the whole user base. Despite the significant differences in the travel patterns, we find a remarkable lack of variability in predictability, which is largely independent of the distance users cover on a regular basis.

TITLE: Human mobility, social ties, and link prediction

AUTHORS: Dashun Wang, Dino Pedreschi, Chaoming Song, Fosca Giannotti, Albert-Laszlo Barabasi.

ABSTRACT:

Our understanding of how individual mobility patterns shape and impact the social network is limited but is essential for a deeper understanding of network dynamics and evolution. This question is largely unexplored, partly due to the difficulty in obtaining large-scale society-wide data that simultaneously capture the dynamical information on individual movements and social interactions. Here we address this challenge for the first time by tracking the trajectories and communication records of 6 million mobile phone users. We find that the similarity between two individuals' movements strongly correlates with their proximity in the social.

TITLE: A class of mobile motion prediction algorithms for wireless mobile computing and communications

AUTHORS: George Liu, Gerald Maguire Jr.

ABSTRACT:

This paper describes a class of novel mobile motion prediction algorithms for supporting global mobile data accessing. Traditionally, mobility and routing management includes functions to passively keep track of the location of the users/terminals and to maintain connections to the terminals belonging to the system. To maintain uninterrupted high-quality service for distributed applications, it is important that a mobile system be more intelligent and can anticipate the change of the location of its user. We propose an aggressive mobility and routing management scheme, called predictive mobility management. A class of mobile motion prediction algorithms predicts the "future" location of a mobile user according to the user's movement history, i.e., previous movement patterns. By combining

this scheme with mobility agent functions, the service and user routing data are actually pre-connected and pre-assigned at the locations to which the user is moving. Thus, the user can immediately receive service or data with virtually the same efficiency as at the previous location, i.e., without encountering a large “data structure handover” delay before service or data is available.

III. SYSTEM ANALYSIS EXISTING SYSTEM

Most of the existing prediction methods are based on Markov model, which can only model one transition patterns, since it has only one transition kernel. For example, if a user visits his/her office in the morning, then he/she is likely to stay at the office in the following few hours. In contrast, if he/she visits his office in the afternoon, he/she probably will leave in the following time. If this example is modelled by a Markov chain, the prediction result will be the same, since the transition of Markov chain only relies on its previous state, regardless of the time when the transition happens.

Disadvantages:

Plenty of previous work adopted traditional Markov model, which suffers when the trajectory becomes sparse, or it shows distinct mobility patterns in different time of day.

PROPOSED SYSTEM

We need to propose new methods to overcome the problem aroused by these features of the app-collected data. In this paper, we address the above three challenges to facilitate the analysis. Our work can be summarized as follows:

- In order to preserve the physical context of the locations, we contextually

cluster the locations into multiple non-overlapping districts of the city instead of using fixed coordinate grid that will lose the physical context. We also compare the prediction accuracy between the two divisions to analyze the effect of context on prediction. Results reveal that the trajectories on context-based division are more predictable than those on division without context under the same spatial granularity.

- We design a time-variant Markov-based method using Gibbs sampling to model the distinct mobility patterns and solve data sparsity. By assuming multi-Markov chains, we sample the transition kernels of these chains and make predictions of users' movements based on the kernels. Results show that, based on app-collected dataset, our method achieves higher prediction accuracy than the benchmark prediction method.

- In order to investigate the effect of heterogeneity, we carry out a thorough analysis of the predictability and prediction accuracy based on our designed method on the app-collected dataset. The varying factors include the spatial and temporal resolution, the orders of Markov models, the radius of gyration, etc.

Advantages:

- We comprehensively analyse the mobility and predictability of each user.
- We adopt Gibbs sampling method to simultaneously recover the missing part of trajectories and train the Markov chains, in order to solve the unevenly distribution and the high missing rate.

IV. IMPLEMENTATION AND RESULTS

MODULE DESCRIPTION ADMIN:

In this module here admin can directly login with the application after admin successful login he can upload dataset and view dataset and also clean data set by preprocessing and we are clustering based on the country available in dataset.

V. SOFTWARE ENVIRONMENT CLIENT SERVER

Overview:

With the varied topic in existence in the fields of computers, Client Server is one, which has generated more heat than light, and also more hype than reality. This technology has acquired a certain critical mass attention with its dedication conferences and magazines. Major computer vendors such as IBM and DEC, have declared that Client Servers is their main future market. A survey of DBMS magazine revealed that 76% of its readers were actively looking at the client server solution. The growth in the client server development tools from \$200 million in 1992 to more than \$1.2 billion in 1996.

Client server implementations are complex but the underlying concept is simple and powerful. A client is an application running with local resources but able to request the database and relate the services from separate remote server. The software mediating this client server interaction is often referred to as **MIDDLEWARE**.

The typical client either a PC or a Work Station connected through a network to a more powerful PC, Workstation, Midrange or Main Frames server usually capable of handling request from more than one client. However, with some configuration server may also act as client. A server may need to access other server in order to process the original client request.

The key client server idea is that client as user is essentially insulated from the physical location and formats of the data needs for their application. With the proper middleware, a client input from or report can transparently access and manipulate both local database on the client machine and remote databases on one or more servers. An added bonus is the client server opens the door to multi-vendor database access indulging heterogeneous table joins.

What is a Client Server

Two prominent systems in existence are client server and file server systems. It is essential to distinguish between client servers and file server systems. Both provide shared network access to data but the comparison dens there! The file server simply provides a remote disk drive that can be accessed by LAN applications on a file-by-file basis. The client server offers full relational database services such as SQL-Access, Record modifying, Insert, delete with full relational integrity backup/ restore performance for high volume of transactions, etc. the client server middleware provides a flexible interface between client and server, who does what, when and to whom.



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