sccer mobility
Swiss Competence Center for Energy Research
Efficient Technologies and Systems for Mobility

In cooperation with the CTI
Energy funding programme
Swiss Competence Centers for Energy Research
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Commission for Technology and Innovation CTI

Location-based User Profiling for Personalized Mobility Support

Users of Location-Based Services (LBS) increasingly expect them to be personalized in the sense of being tailored to their individual needs and preferences. As a prerequisite for successful personalization, the process of user profiling extracts and stores a set of rules, settings, needs, interests, behaviors and preferences which virtually represent each user, and are often based on monitored user behavior (Cufoglu 2012). These issues are also of relevance for the *GoEco!* project, which aims at providing users with more energy-efficient travel alternatives via a mobile app (Cellina 2016). Before this background, we propose to derive users' mobility profiles on the basis of their movement trajectories. As a first step towards that goal, a general concept is outlined and specific research challenges are identified.

David Jonietz, Dominik Bucher, Martin Raubal
Institute of Cartography and Geoinformation
ETH Zürich
jonietzd@ethz.ch, dobucher@ethz.ch, mraubal@ethz.ch

Introduction

There is growing recognition of our mobility behavior to differ to a great degree, with individual needs, preferences or restrictions influencing our choice of destination, transport mode, time of travel and route (Golledge and Stimson 1997). Thus, mobility support systems such as *GoEco!* need to acknowledge our heterogeneity for providing better travel recommendations. A possible information source for user profiling are prerecorded movement trajectories of individual users. This poster presents a general concept for such location-based user profiling (LBUP) and identifies specific research challenges.

User Profiling and Personalization

User profiling and personalization involve three phases, namely information gathering, user profile construction and finally personalization of services (Gauch et al. 2007). Methods for the former include explicit user surveying, implicit monitoring of user behavior, or a hybrid method. Building profiles by mining monitored data is generally preferable since it is non-intrusive and allows for dynamic profile updates, however, performs poorly in case of data scarcity or unpredictable user behavior (Cufoglu 2014).

Movement Data Analysis

GPS-based movement tracking in the sense of automatically recording x, y, z coordinate tuples at predefined time intervals is possible with almost every modern smart phone. For mobility research, these data are particularly interesting since they capture human movement at a very high level of detail. Thus, trajectory data mining methods have been developed to discover knowledge from such movement data (Zheng 2016). There are, however, practical challenges due to data uncertainty caused by missing data, accuracy problems or precision deficiency (Andrienko et al. 2016), but also privacy concerns (Zheng 2016).

Research Challenges

There are several research challenges to be addressed when using trajectory data for user profiling, including the following:

- Data accuracy: The accuracy of the user profile depends on the accuracy of the (often uncertain and inaccurate) input data.
- Data sparsity and new user problem: A certain minimum amount of input data is needed for the initial creation of a user profile.
- Static vs. dynamic user information: User information can be more (e.g. modal choice) or less (e.g. home location) likely to change, also due to contextual influences (e.g. weather).
- Ad hoc user behavior: Human behavior is not always optimized and rational, which needs to be acknowledged in user profiling.
- Privacy: The users' privacy need to be protected.

A General Concept for LBUP

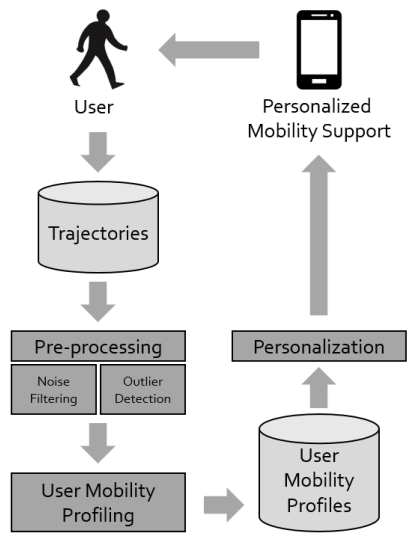

Fig. 1: A Framework for Mobility User Profiling with Trajectories

Expected Impact

Personalization is highly relevant for mobility support services such as *GoEco!*. Travel recommendations which explicitly acknowledge the specific preferences, needs and restrictions of the individual user are more likely to be accepted and lead to a behavioral change towards more sustainable mobility options. By extracting the necessary profile information from movement trajectories, no additional burden is placed on the users while at the same time, the user profile can be dynamically updated using a learning approach.

References

Cufoglu A (2014) User profiling – a short review. International Journal of Computer Applications 108(3): 1-9

Golledge RG, Stimson RJ (1997) Spatial behavior: A geographic perspective. The Guildford Press, New York, London

Gauch S, Speretta M, Chandramouli A, Micarelli A (2007) User profiles for personalized information access. In: The adaptive web, Springer: Berlin, Heidelberg, 54-89

Zheng Y (2016) Trajectory data mining: An overview. ACM Trans. Intell. Syst. Technol. 6(3): 29(1)-29(41)

Andrienko G, Andrienko N, Fuchs G (2016) Understanding movement data quality. Journal of Location Based Services 10(1): 31-46

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich