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Poster: Constructing a Unique Profile for Mobile User Identification in Location Recommendation Systems

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Categories and Subject Descriptors

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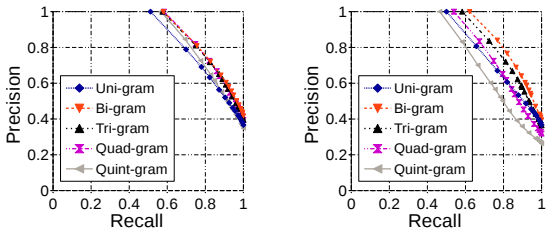
1. INTRODUCTION

It has been established in previous research that only a small number of spatio-temporal points are enough to uniquely identify an individual [1]. This means, if a user u visited the set of locations $\{a,b,\ldots,z\}$ then only a small number of these locations would be enough to prove the uniqueness of the mobility traces of u. In this research however, we argue that a profile constructed from such a small set of spatio-temporal points would not be very useful in the context of location prediction and recommendation. Indeed in such context, finding a distinct set of data that makes the individual unique is not the key point. It is much more useful to have a rich profile that, in addition to being unique also reflects the individual's interest in terms of the places that they visit and the activities that they undertake. Such a profile clearly offers a distinct advantage where it allows grouping together individuals with similar interest and taste. The ability to create such grouping is the foundation upon which collaborative prediction and recommendation systems are developed. Setting aside the sensitive privacy issues, we have been investigating the possibility of constructing a dynamic method of identification using mobility data which, for each individual user possesses measurable variations that make it suitable for *'mobility fingerprinting'*.

2. MOBILITY FINGERPRINT

We define a *Mobility Fingerprint* as a profile constructed from the user's historical mobility traces. To build such a profile, we propose a method that is a principled and scalable implementation of a variable length Markov model based on *n-grams*[1] [2]. Each trail is a sequence of spatio-temporal points that the user follows in a day. A user's *Mobility Fingerprint* contains all the *n-grams* generated from his trails.

We collect a sample of fingerprints from the publicly available Nokia Mobile Data Collection Campaign data set [3], which is relatively small but sufficient for proof of concept. We find that users have unique mobility fingerprints. Furthermore, we find that an observed mobility trail can be associated with the fingerprint of the user to whom the trail belongs, i.e. a user can be identified by his movements. Figure 1, shows the result of the experiment in which we identify the correct user from an observed trail of five spatio-temporal points. The Jaccard and Kullback-Leibler measures were used to compute the similarity between the fingerprints and the observed trail. The precision and recall were achieved within a given similarity threshold.



Jaccard *Kullback-Leibler Divergence*

Figure 1: Identifying the user from his movements.

3. REFERENCES

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[1] an *n-gram* is a contiguous sequence of n spatio-temporal points in a given mobility trail.

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