Temporal Mobility Analysis

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ABSTRACT

It's becoming a commonly accepted standard of living that we constantly have access to a mobile device which is basking in a sea of Wifi hotspots. By recording the observed Wifi signals over time, it is possible for the mobile phone to deduce the salient locations in its environment, and the mobility patterns of the user. In real-life, fluctuations of the Wifi hotspots and the unreliability of mobile phone antenna necessarily creates false readings and missed readings, making the location identification problem and its related problems particularly challenging.

In this paper, we propose a family of algorithms to perform the tasks of location identification, mobility inference, and localization. Our algorithms are able to handle the noisy reading observed in real-life application. Furthermore, our location identification algorithm constructs a hierarchy of salient locations providing a multiresolution model of the environment.

Keywords

ACM proceedings; Mobility; Temporal Analysis; Personal Data

1. INTRODUCTION

2. PROBLEM DEFINITION

A mobile device can make a scan. We refer to each scan as a *reading*. Each reading is defined as $\langle t(r), \mathbf{B}(r)\rangle$ where $t(r)$ is the timestamp of the reading, and $\mathbf{B}(r) \subseteq$ BSSID is a set of BSSID of the wifi hotspots that the scan detected. For each BSSID $b \in \mathbf{B}(r)$ detected in the reading, we also have the SSID and the signal strength, written respectively as: BSSID(b) and $s(b|r)$. We assume that each BSSID has a unique SSID, while the strength of a BSSID is specific to a given reading.

Definition 1. *A* timeline T *is a sequence of readings. We denote* T_i *as the* i*-th reading of the timeline* T*.*

A segment *of the timeline* S *is a contiguous subsequence of* T*.*

Let $\mathcal{L}$ be a (unspecified) finite set of *locations*.

Definition 2 (Location identification). *A* location identification *problem consists of several subproblems:*

1. Identification *of the distinct locations* $\mathcal{L}$ *from a given timeline* T*.*
2. Inference *of the location of a given reading.*

3. RELATED WORK

[8, 5, 4, 3, 7, 1, 6, 2]

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