A Mobility Model Based on Features of Real Human Movement

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***Abstract*—In this work, we present SMOOTH, a new mobility model that is *simple* and *realistic*, as it is based on several known features of real human movement.**

I. Introduction

In addition to being realistic, a mobility model should be easy to understand and simple to use. Unfortunately, most of the *simple* mobility models proposed thus far are not *realistic* [1] and most of the *realistic* mobility models proposed thus far are not *simple* to use. The contribution of our work is that we have developed a *simple* mobility model that is *realistic*, as it is based on several known features of real human movement. Thus, with SMOOTH, we offer researchers to leverage the statistical features present in real human movement in a simple and easy to understand manner.

II. SMOOTH: Our Simple Realistic Mobility Model

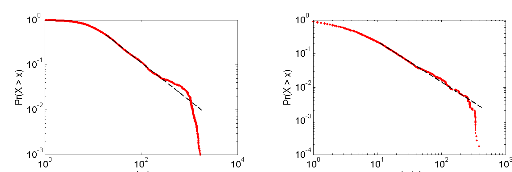
In the evaluation of real human walks, researchers have found several statistical features [2], [3]. Specifically,

- **feature1:** The flights distribution of mobile nodes follows a truncated power-law (TPL)[1].
- **feature2:** The ICTs (inter-contact time) distribution of mobile nodes follows TPL.
- **feature3:** The pause-time distribution of mobile nodes follows TPL.
- **feature4:** Mobile nodes visit popular waypoints in the network.
- **feature5:** While moving, mobile nodes tend to visit the closest waypoint first.
- **feature6:** The distribution of mobile nodes is non-uniform in the network.
- **feature7:** Mobile nodes with common interests form communities and tend to move around only their communities of interests.

We capture all seven of these features in SMOOTH. Algorithm 1 describes an easy step-by-step working of SMOOTH. The movement patterns of mobile nodes represent social behavior among humans and, thus, form communities. In SMOOTH, we represent communities by clusters. We divide the simulation area into several communities (Step 1). Mobile nodes choose a community $\propto$ its size (Step 3), and, thus, more mobile nodes visit a bigger community, making it more popular (**feature4** and **feature6**). From the selected community, a mobile node (uniformly and randomly) chooses a subset of waypoints to visit (Step 4). Therefore, a mobile node spends more time in a bigger community and, thus, meets few mobile nodes more often than others (**feature2** and **feature7**). While moving, a mobile node tends to visit the closest waypoint; however, it may occasionally visit a farther location first (Step 5; **feature1 and feature5**). Pause-times are power-law distributed (Step 6; **feature3**). Figure 1 shows the (power-law) flights and ICTs distributions extracted from the synthetic traces generated by SMOOTH for an example scenario.

Algorithm 1 SMOOTH: pseudocode

1. Divide the simulation area into several communities.
2. **for** each mobile node **do**
3. Select a community with probability $\propto$ to its *size*.
4. Select a subset (y%) of waypoints to visit from the selected community.
5. Visit the selected waypoints via the LATP algorithm (see [3] for details).
6. At each waypoint, pause for a *pause-time* distributed by power-law.
7. **end for**



(a) CCDF of flights (b) CCDF of ICTs

Fig. 1. CCDFs of flights and ICTs generated by SMOOTH for an example scenario.

[2]TPL: Truncated power-law distribution follows power-law upto certain time after which it is truncated by an exponential cut-off.

References

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