Automated WLAN Calibration with a Backtracking Particle Filter

Moritz Kessel and Martin Werner

Mobile and Distributed Systems Group
Ludwig-Maximilians-University
Munich, Germany
{moritz.kessel|martin.werner}@ifi.lmu.de

ABSTRACT

Location information is one of the most important information sources in ubiquitous computing scenarios. However, a cheap and global indoor positioning solution offering a sufficiently high accuracy and precision for most ubiquitous computing applications without much calibration effort is not yet available.

In this paper we present an indoor positioning system based on a backtracking particle filter for sensor fusion of accelerometer, magnetometer and WLAN signal strength measurements on a smartphone, offering high indoor tracking accuracy and precision. The system uses step detection and map matching for the prediction phase of the filter and is therefore also working, when no WLAN information is available rendering the system flexible enough for application in various scenarios. Even more, we show that backtracking leads to high quality track information even when no WLAN is available. This track information is sufficiently accurate to provide for the automated calibration or even the creation of a complete new WLAN fingerprint database. A ground truth position or manual calibration is not needed at all.

The positioning and tracking capabilities of the particle filter and the WLAN calibration technique are evaluated and compared to high quality ground truth position information in a test environment at our site. The experiments demonstrate the feasibility of the algorithms, offering a tracking accuracy below one meter, which is only slightly decreased when a newly and by the system automatically created WLAN fingerprint database is used instead of a manually created database. Thus, we show that the time for creation can be reduced to a minimum of just walking through each room once or twice, which was about three minutes in our test environment instead of nearly two hours for manual calibration.

KEYWORDS: WLAN fingerprinting, dead reckoning, particle filters, smartphone localization.
.