A Hybrid Approach for Indoor Mobile Phone Localization

Valentin Radu, Jiwei Li, Lito Kriara, Mahesh K. Marina
The University of Edinburgh

Richard Mortier
University of Nottingham

Motivation

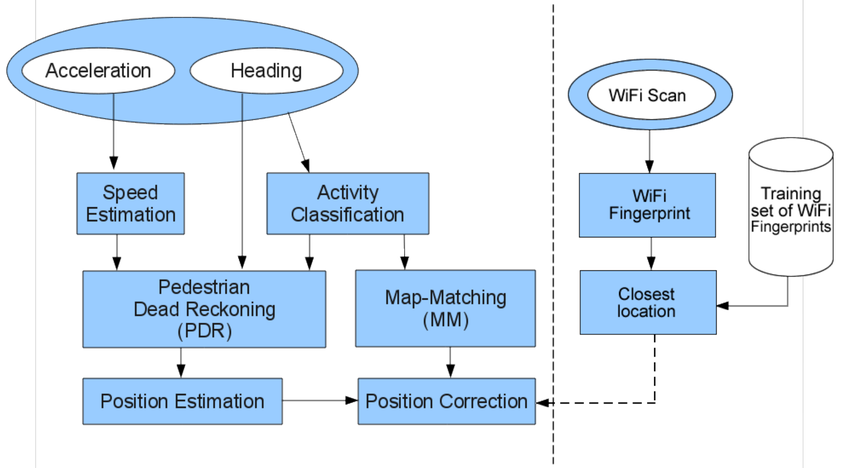
• Indoor mobile location tracking needed for many location-based apps, especially given the rapidly growing smartphone adoption

• But practical and easily deployable solutions for indoor location still being researched

Our Approach

1. Exploit built-in smartphone sensors (e.g., accelerometer, compass) to do ***dead reckoning***
   - Naturally enables continuous location tracking
   - Energy efficient
   - Explored already, but mostly for outdoor environments [1, 2]
   - Dead reckoning in indoor environments relatively more challenging
   - Needs reliable anchor points every now and then to keep location error under check
2. ***WiFi fingerprinting*** to leverage exisiting WiFi infrastructure and WiFi interfaces common on phones
   - Not suitable for continuous location tracking coz WiFi scans power hungry and time consuming

Our Approach (contd.)



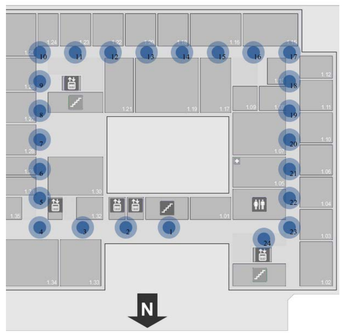
• ***Hybrid*** approach that combines dead reckoning and WiFi fingerprinting to retain their best aspects

➢ Dead reckoning using machine learning based activity recognition, speed estimation and map matching

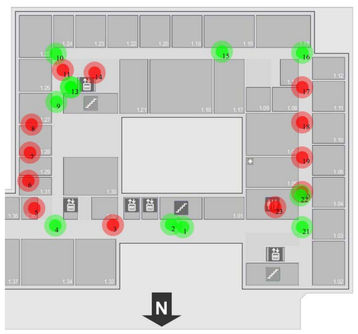
➢ Crowdsourced WiFi fingerprinting to avoid a priori training data collection

• Hybrid approach in action below

Actual locations



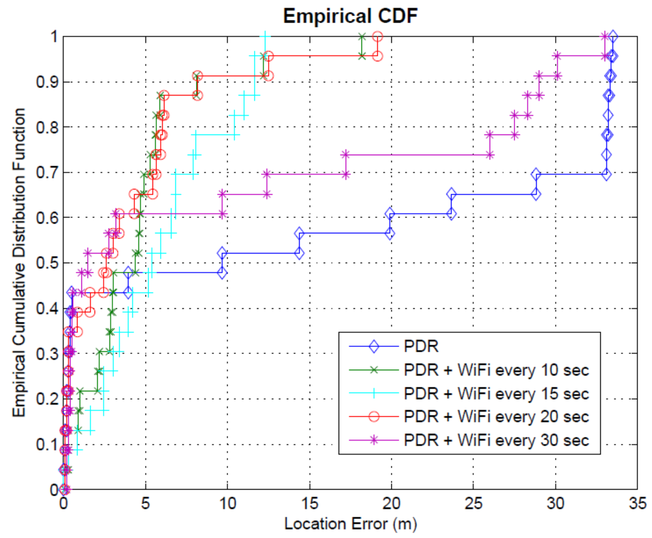
Estimated locations



Preliminary Results

• Implemented our hybrid localization system on Android Nexus One phones and using Google App Engine as back-end

• Results from early evaluation in Informatics Forum Bldg at Univ. Of Edinburgh



•Median location error ~10m with pedestrian dead-reckoning (PDR) alone

• PDR + WiFi fingerprinting brings error down to 2m

• Impact of WiFi scan frequency on location error complex

References

[1] I. Constandache et al., "Towards Mobile Phone Localization without War-Driving," In *Proc. IEEE INFOCOM*, 2010.

[2] M. Youssef et al., "GAC: Energy-Efficient Hybrid GPS-Accelerometer-Compass GSM Localization," In *Proc. IEEE GLOBECOM*, 2010.