Data Quality Evaluation for Fingerprinting based Indoor Localization with a Crowdsensing Approach

Quality Evaluation of Crowdsensed Fingerprints for Indoor Localization

Introduction

The past decade has witnessed a flourishing of indoor localization systems based on wireless techniques \cite{ rsscsi}, where the fingerprinting based methodology has been widely adopted due to its convenient deployability \cite{ mobicom04, horus }. The fingerprinting based indoor localization system has two phases: In the offline phase, the site surveyor observes the received signal strength (RSS) of Wi-Fi access points (APs) termed as RSS fingerprints at each reference point, and submit the fingerprints and the location information of the reference point to the localization database; in the online phase, a user needs localization service could submit the observed fingerprints to the database, which then returns the location of the reference point that matches the fingerprints best as the estimated location of the user.

The fingerprinting based method utilizes Wi-Fi APs widely existing in buildings and has no need for other dedicated infrastructure; however, the site survey in the offline phase requires substantial efforts, which is hardly accomplished by any single entity. The recent advances of fingerprinting localization systems utilize mobile crowdsensing approach to collect fingerprints \cite{ wen2015fundamental, Chenshu14, luo2014piloc, shen2013walkie, ez10, Chintalapudi10}. Mobile crowdsensing is a cost-effective approach to collect large scale data for mobile applications, where individuals with hand-held mobile devices collectively contribute sensing data so that information of certain events could be retrieved \cite{crowdsensing, postedpricing}. Although sensing participants could receive certain rewards for the efforts and resources spent on the sensing activity, the cost of mobile crowdsensing is still much lower than deploying the dedicated sensing networks \cite{ crowdsensing}.

As the crowdsensing data are collected by unprofessional participants with non-dedicated equipment, the sensing data obtained are usually with considerable noise. The quality of the sensing data is the crux for evaluating contribution of the participants, which is the vitally important for effective utilizing rewards to incentivize participants to accomplish sensing tasks satisfactorily. However, how to evaluate the quality of the crowdsensing data is a challenging issue, because there is no ground truth for the collected data to be compared with. Efforts have been made to evaluate the crowdsensing data quality \cite{ Lbs2, Crowdloc14}, and the task allocation scheme \cite{ Taskselection15, recruit} and incentive mechanisms considering the data quality are proposed \cite{ Pengdan15, noise, incentive, Incentive2}.

While the efforts have been made to study quality evaluation of crowdsensing data for mobile applications in general framework \cite{}, how to evaluate the quality of fingerprints with crowdsensing approach in the indoor localization case is still not fully investigated, which is the focus of this work. Our motivation is two-fold. On one hand, the existing work for data quality evaluation in the literature \cite{} can not be applied to the indoor localization system in practice; on the other hand, we want to find out how the very nature of the indoor localization system could facilitate evaluating quality of crowdsensed fingerprints. Our contributions are as following.

First, ……

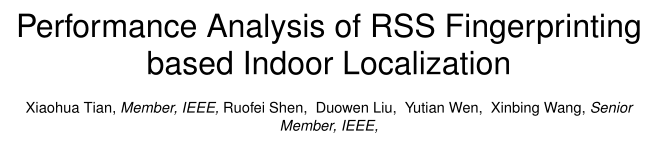
Second, …….

Third, ……

Related work

* Indoor Localization with Crowdsensing Approach

参考这篇的related work去写，语言表达要换个方式



Early indoor localization, then the AP selection and the cost,

Shen \emph{et al.} present a crowdsourcing based system \emph{Walkie-Markie} \cite{walkie} to generate indoor pathway maps from the user contributed data. The central idea of the system is to exploit Wi-Fi-Marks defined by Wi-Fi RSS features in the indoor space, so that crowdsourced data by dead reckoning \cite{deadreckon} can be fused. Luo \emph{et al.} propose a self-calibrating participatory indoor localization system \cite{piloc}, which requires no

prior knowledge about the building and user intervention including the floor planning.

* Data Quality Evaluation for Incentive Mechanism Design

The data quality is closely related to the incentive mechanism design. At the beginning, evaluated by time.

仿照“performance analysis”的例子，要详细阐述的几个文献：

noise， Pengdan15， Lbs2，Quality15，Crowdloc14

* Data Quality Evaluation for Worker Recruitment Mechanism Design

recruit, Rucruit2infocom16, ntwkeffectinfocom16

Moreover, the study could shed light on how the crowdsensing data quality should be evaluated in more specific use cases with unique characteristics.

However,

This makes how to evaluate the quality of the sensing data an important but challenging problem.

participants are usually

Mobile crowdsensing approach has been applied to various domains such as transportation \cite{transportation2,transportation}, environment surveillance \cite{ environment, environment2} and location based service \cite{lbs, lbs2}.