Abstract

This dissertation proposed a novel interaction-based HAR approach. The approach can be scalable enough to be applied to different indoor scenarios. In this dissertation, we chose smart home and smart library as the main scenarios. The dissertation makes a deep analysis on indoor human activity, and finally determines to utilize the interaction between human and objects to infer the human activity. Because only in this way, the proposed approach can be scalable, flexible, and avoid of "cold start" problem which appears commonly in data-driven approaches. The proposed approach utilized passive RFID technology to recognize the interactions between human and the objects of daily life. And with the help of machine learning and deep learning, the proposed approach can combine the recognized low level activities to infer the high level activities. So that the proposed approach can be applied to recognize all grain activities including both fine-grain and coarse-grain activities.

Smart Homes are generally considered the final solution for living problem, especially for the health care of the elderly and disabled, power saving, etc. Human activity recognition of smart homes is the key to achieving home automation, which enables the smart services to automatically run according to the human mind. Recent research has made a lot of progress of this field; however, most of them can only recognize default activities, which is probably not needed by smart homes services. In addition, low scalability makes such research infeasible to be used outside the laboratory. In this study, we unwrap this issue and propose a novel framework to not only recognize human activity but also to predict it. The framework contains three stages: recognition after the activity, recognition in progress, and activity prediction in advance. Furthermore, using passive RFID tags, the hardware cost of our framework is sufficiently low to popularize the framework. In addition, the experi-

mental result demonstrates that our framework can realize good performance in both activity recognition and prediction with high scalability.

In the library, recognizing the activity of the reader can better uncover the reading habit of the reader and make books management more convenient. In this study, we present the design and implementation of a reading activity recognition approach based on passive RFID tags. By collecting and analyzing the phase profiling distribution feature, our approach can trace the reader's trajectory, recognize which book is picked up, and detect the book misplacement. We give a detailed analysis of the factors that can affect phase profiling in theory and combine these factors of relevant activities. The proposed approach recognizes the activities based on the amplitude of the variation in phase profiling, so that the activities can be inferred in real time through the phase monitoring of tags. We then implement our approach with off-the-shelf RFID equipment, and the experiments show that our approach can achieve high accuracy and efficiency in activity recognition in a real-world situation. We conclude our work and further discuss the necessity of a personalized book recommendation system in future libraries.

Keywords: Wireless sensing, human activity recognition, activity prediction, activity of daily living, passive RFID system