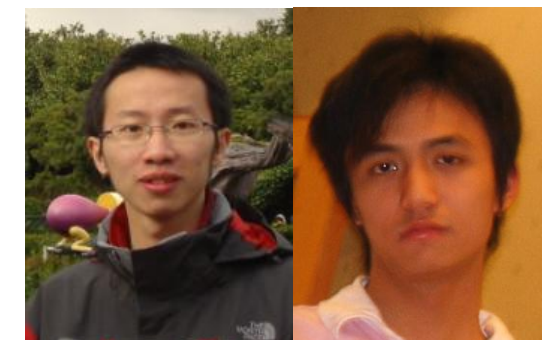


Handling Relations in a Ubiquitous Computing Environment

 Candidate:
 Min Lin
 Xifeng Wen

 Supervisor:
 Frank Reichert, UiA
 Ole Christoffer Granmo, UiA
 Anis Yazidi, UiA


Introduction

Context-awareness has been recognized as one of the most important topics in the ubiquitous computing environment. Context-awareness constitutes the basis of self-adaption which has been considered important in many mobile services. Time and location are two fundamental aspects of the context. In our thesis, we investigated a context-awareness problem in which anomalous contexts (times and locations are not conforming to the existing patterns) should be detected in order to serve for a "friend Reminder" mobile service.

Problem Description

Since this project is a part of Ericsson-UiA cooperative research on handling relations between people in the ubiquitous computing environments, our research problem is being contained in several selected scenarios.

One of such scenarios can be described by the following figures:

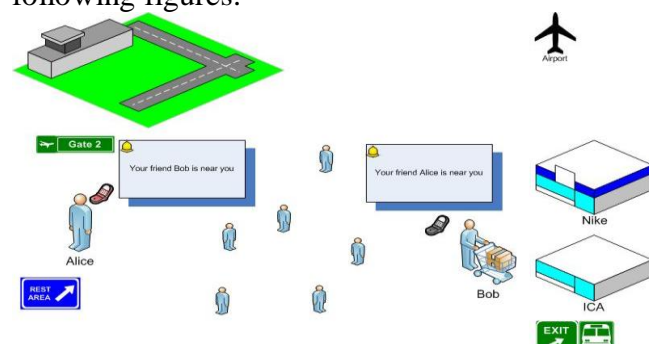


Figure 1 One of the problem scenarios

A prototype (on mobile phone) with security schemes integrated will be implemented in our research.

Proposed Solutions

- 1) Pure online, no datasets are available for machine learning in our case.
- 2) Light weight, low computational complexity, suitable for mobile applications.

For a single location, we firstly defined that in a certain level of time granularity, anomalous time refers to the time granules which do not conform to the well-defined periodic patterns.

We sketched out four common types of periodic patterns for our research problem, daily pattern, the second day pattern, weekday pattern. Then, we proposed Finite Learning Automata (FLA) based solutions.

We designed two schemes of FLA for the daily pattern (as Figure 2, Figure 3). The second day and weekday patterns can be resolved with another FLA template (Figure 4).

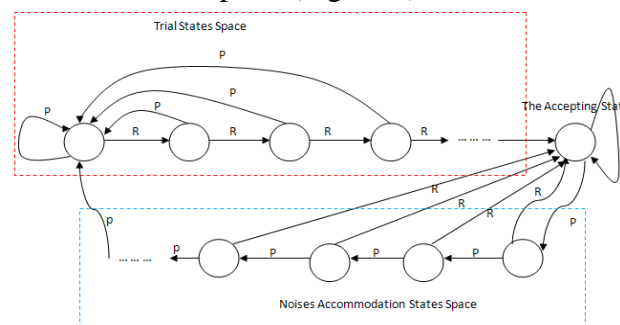


Figure 2 DPFLA for daily pattern

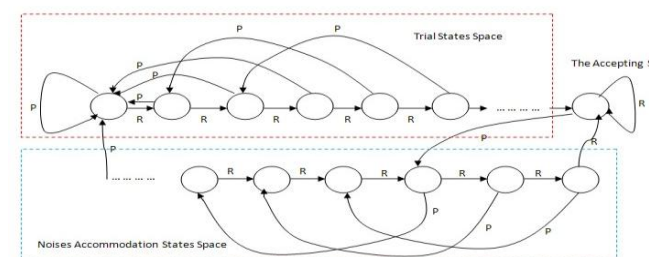


Figure 3 Alternative DPFLA for daily pattern

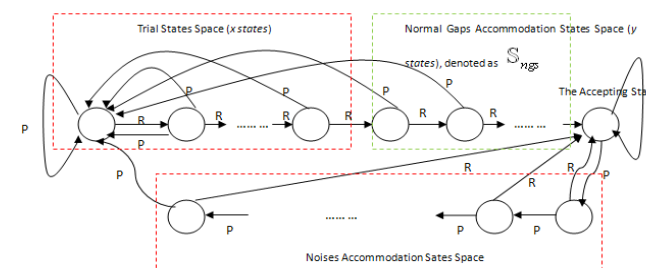


Figure 4 FLA Template for the second day and weekday patterns.

The comprehensive solution would be each FLA for a specified periodic pattern and each group of FLAs for a single location.

Extensive empirical results are presented in our thesis to demonstrate the performances of the solutions under different noisy environments.

Prototype Development

Our prototype system consists of two mobile phones: HTC P3300 and Sony Ericsson X1, both of which are equipped with Wi-Fi modules. A public ad-hoc network is established to provide a communication platform where the proposed

solution for "friend Reminder" as a service runs on these two mobile phones.

We designed and implemented a software architecture based on ad-hoc network, and solved the privacy concerns regarding "friend Reminder" in ad-hoc network, through adapting the method from "SmokeScreen". The additional service, namely "Presence-Sharing between Specific Friends" which is extension of "friend Reminder" and an application of Bloom filter, is also implemented. In this service, users can specify a friend list of presence-sharing to hide from friends, if needed.

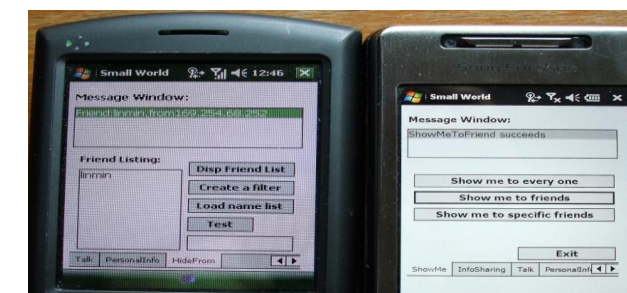


Figure 5 Screen shot of the prototype

Conclusion

The performances of the proposed solutions are scenario-dependent. Our extensive empirical results will help the industrial communities to make decisions for the design of practical mobile applications. For the prototype part, our prototype was built up by making use of the existing infrastructural technologies. Therefore, our prototype could have good usability.