AISMS: Adaptivity in Intelligent and Secure Mobile Systems

Editorial

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***Abstract*— Many modern computer systems not only tend to be used in a more and more mobile context, but also reflect the particular requirement of being *smart* – which, to some extent, can be a confusing verbalism. Smart devices are typically ones which are largely inter-connected (e.g. over the Internet), and provide particular aspects in terms of how environment is perceived and what kind of computational reactions are being issued. This enables adaptivity in terms of the context of the user, by applying generated sensory data in an *intelligent* manner. Privacy and security of personal data is often forgotten but is a crucial factor. Therefore, the special track named "AISMS: Adaptivity in Intelligent and Secure Mobile Systems" tends to provide a combined insight and discussion about those – often considered contentious – aspects.**

***Index Terms*— Artificial Intelligence; Privacy and Security in Mobile Systems; Adaptive Behavior of Mobile Systems; Wearable and Mobile Systems; Context-Awareness and Context-Aware Adaptation**

I. Introduction

With the advent of mobile systems in recent decades, people are ever increasingly connected to smart devices. These devices aim at making our lives more comfortable and assist in different situations – the most prominent examples for such devices might be the mobile phone or also wearable and ubiquitous systems in general.

By applying approaches that can be classified within the topic "artificial intelligence", these mobile systems strive to provide some kind of "intelligent behavior" adapting to the current user's contextual state [1]. Additionally, security aspects concerning personal and sensitive data are becoming more and more relevant [2]. These two important factors might be diametrically opposed, since usually "intelligence" needs a lot of data to sense the current context of users, but data might be sensitive in terms of privacy and security concerns. Nevertheless, security in mobile systems needs to be considered as a critical factor.

Therefore, this special track aims at discussing and examining the hybridity of intelligence and security with respect to the (self-) adaptation of mobile systems according to the actual contextual state. The most relevant topics of interest with respect to the aim of the special track that have been targeted include (amongst others): (i) artificial/ambient intelligence, (ii) security aspects for mobile systems, (iii) adaptive behavior of mobile systems, (iv) adaptivity in wearable and mobile systems, (v) context-awareness and context-aware adaptation, and (vi) privacy and security in mobile adaptive systems.

The rest of this editorial is structured as follows: the following section II summarizes the accepted submissions for presentation and publication in the special track. Section III provides a conclusion and gives an outlook to future perspectives and challenges of the topic.

II. Submissions

The first paper entitled "What Are You Doing? Real-Time Activity Recognition using Mobile Phone Sensors" by Hiesl et al. [3] is a follow-up article of a work-in-progress paper presented in 2019 [4] and discusses approaches towards the viability of modern commodity smartphone sensors to correctly recognize a particular set of activities. The focus of this work is on the adaptivity of an activity recognition system that operates in real-time and does not rely on a fixed mounted sensor platform. Thus, the smart-phone is utilized as sensor platform, whereas the research challenge is the fact that the phone is placed on the body of the subjects dynamically and orientation independent – thus the system has to adapt autonomously to these characteristics. In total, five different phone positions are taken into account and are therefore considered in the classification process. To achieve the best approach concerning performance and recognition, different classifiers are evaluated (i.e. (i) knearest neighbours (KNN), (ii) Naive Bayes, (iii) Decision Trees and (iv) Random Forest).

The second paper entitled "A Visible Light Vehicle-to-Vehicle Communication System Using Modulated Taillights" by Plattner and Ostermayer [5] proposes a visible light vehicle-to-vehicle communication system by modulating the taillights of a car and receiving the signal with a camera. Safety critical communication in applications like vehicle platooning requires a fast and secure wireless connection. Such a connection can be established by using optical communication as an out-of-band channel to transmit a public key to another car that is following. With this system, it takes about 5 seconds to transmit a public key, which can then be used to establish a fast and encrypted connection in the main communication channel. Five seconds might be considered slow these days, however, considering the several minutes or hours the cars might be driving in a platoon afterwards, this is an acceptable time. For a third party, it is very hard to manipulate such an optical data transmission, because the system is able to locate and identify the actual sender of the message on the camera image. This way, the car behind always knows if it is actually communicating with the car in front, or if somebody else has manipulated the connection.

Stelzhammer and Krösche [6] concern themselves in their paper entitled "A Context-enhanced Sector-based Indoor Positioning Library" with the fact, that as todays' society is more and more relying on smart-phones, -devices and -applications, thus the use of contextual information becomes more important every day. Although the devices offer plenty of sensory input, the position context is still one of the key features utilized by context-aware systems. This is especially true when it comes to building context-aware mobile applications. For people residing in the outdoors, today's GNSS provide the necessary information without much problem but indoors reliable data and systems are still a big issue. Taking into account the diversity of requirements regarding the accuracy and precision of the position information, the presented approach provides a novel approach to evaluate the position of an entity in such an indoor environment. It trades accuracy for robustness and environmental flexibility by neglecting concrete position coordinates and concentrating on sector-based positioning using the access point positions of a building's WiFi infrastructure.

For coaches and athletes alike, as Selinger and Yilmaz [7] point out in their paper "Estimating Internal Power in Walking and Running with a Smart Sock", determining the workload of a training session is an important measure in order to adapt the training plan to the actually completed training and to make predictions about the development of an athlete's performance. While in cycling the measurement of training stress with power meters has always been used for this purpose, in distance running, in addition to measuring established parameters such as heart rate and pace, the use of power meters, which are mounted on the shoe or on the body, has only emerged in recent years. Running power meters typically estimate power with inertial measurement units. In their work, they try to estimate power with pressure sensors integrated in smart socks, which would make the use of a separate power meter obsolete. While walking and running with different velocities and gradients on a treadmill, subjects wore a pair of smart socks as well as a Stryd power meter as a reference system. The measurements from the pressure sensors were used to train various regression algorithms to predict the power measured by the Stryd sensor. Preliminary results show that it is possible to estimate power in walking and running with a smart sock.

III. Conclusion & Future Perspectives

The special track "AISMS: Adaptivity in Intelligent and Secure Mobile Systems" provides a significant variety of topics discussing challenges, solutions and possibilities regarding the modern-day concepts of mobile computing from the viewpoint of both, academics and industry with focus on adaptivity in intelligent and secure mobile systems.

Future perspectives regarding the topic include questions concerning the assumption that *intelligence* and *security* in mobile systems are diametrically opposed. Additionally, further "novel" machine learning models (i.e., "deep learning, neural networks", etc.) should be considered when discussing security and adaptivity in mobile systems. Last but not least, comprehensive datasets tackling the AISMS topic would be beneficial. There, question for future challenges in this area arise like how much data would be needed, and how should this data be efficiently annotated?

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