Editorial

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“Empowering personalised healthcare on the move, building on the concept of smart health services both in hospital and in home, while transforming the wealth of the new big healthcare data into tangible clinical knowledge for enhanced healthcare provision, is the cornerstone of the next generation of mobile health systems and services.”

In recent years we have witnessed key technological advances in the multidisciplinary fields of mobile health systems and services. The vision of future healthcare delivery systems is underpinned by efforts to improve patient quality of life via anywhere, anytime, any device ubiquitous access to healthcare services, facilitating continuous monitoring and timely interventions. All while reducing associated costs and removing socioeconomic barriers in access to specialised healthcare. Empowering personalised healthcare on the move, building on the concept of smart homes (including exergaming) and cities, while transforming the wealth of the new big healthcare data into tangible clinical knowledge for enhanced healthcare provision, is the cornerstone of the next generation of mobile health systems and services. New mHealth concepts, architectures, and paradigms, linked with standardisation efforts, are expected to reshape standard clinical practice in the next decades, capitalising on the dynamics of emerging 4G and beyond (towards 5G) wireless networks, miniaturised biosensors and nano-technologies, mobile and pervasive computing including internet of things (IoT), and cloud computing technologies.

This Special Issue highlights mHealth systems and services advances in two main research areas. The first part, consisting of a group of six papers, covers different research and technological aspects in pervasive, citizen-centered patient care. It spans from prototype implementations of proof-of-concept end-to-end systems for assisted living, cognitive ageing, and rehabilitation, to evaluation and assessment of broader ICT services to be exploited within the context of smart homes, and research breakthroughs in biomedical signal processing for collecting, processing, and mining patients' physiological parameters. Moreover, it addresses fundamental security challenges in body area networks communications and engineering concerns for low power wearable sensor design.

The second group of four papers focuses on the broader area of emergency health care systems and services. More specifically, it introduces new concepts for monitoring emergency and/or disaster incidents for efficient coordination of first responders and other involved entities, and to provide enhanced triage and decision support. In addition, it covers novel telemedicine units integrating vital signals acquisition and communication, as well as the use of tele-operated robotics for remote echography diagnosis and care.

The first paper by Triantafyllidis *et al.* proposes a framework for designing sensor-based health monitoring systems aiming to provide extensible and usable monitoring services within the scope of pervasive patient care. A distributed system for monitoring patient health status anytime-anywhere and detecting potential health complications, in which healthcare professionals and patients are notified accordingly is described. A service-oriented architecture (SOA) is utilised to provide extensible

functional components and interoperable interactions among the diversified system components. The framework was applied within the REMOTE Ambient-Assisted Living (AAL) project, a prototype system utilising Bluetooth to communicate with sensors and web services for data exchange was developed and evaluated, utilising Bluetooth to communicate with the sensors and Web services for data exchange.

The work described in the second paper by Christophorou *et al.* is based on the Miraculous-Life project and emphasises identification and assessment of a set of services that an ICT system for ageing well should support, in an actual end-user setting. The outcome of this work will facilitate understanding of which ICT services can be the most valuable for end-users' quality of life, as well as prioritising the development of related ICT services, and supporting better resource allocation in order to reduce risks associated with implementation failures of these services within their respective projects. A final trial phase is planned, aiming to validate if perceived usefulness, satisfaction and motivation could be predicted by sociodemographic variables and personality.

The aim of the work of the third paper by Karasaniou *et al.* is to use machine learning to predict adherence profiles of patients with heart failure. Specifically, it investigates classification of patients as both globally adherent, in terms of medication, nutrition and physical activity as well as, in terms of medication adherence alone.

The fourth paper by Imtiaz *et al.* explores three important factors that must be considered and quantified in the design and evaluation of automatic artefact identification algorithms: signal quality, interpretation quality and computational complexity. The first two are useful for determining the effectiveness of an algorithm, while the third is particularly vital in mHealth systems where computational resources are heavily constrained. A series of artefact identification and filtering algorithms are presented focusing on electrocardiography data. These algorithms are quantified using the three metrics to demonstrate how different algorithms can be evaluated and compared to select the best ones for a given wireless sensors network.

Cryptographic algorithms for wireless body area network applications are investigated by Gangadari *et al.* They propose an Advanced Encryption Standard (AES) cryptographic algorithm for design of an S-Box using second order reversible one dimensional cellular automata (RCA2) as a replacement to the classical LUT based S-Box used in AES algorithm. The performance is evaluated in terms of security, using cryptographic properties such as the non-linearity, correlation immunity bias, strict avalanche criteria, and entropy.

Canbay *et al.* propose an FPGA application for implementation of a low cost, low power and portable architecture to compute the Dual Tree Complex Wavelet Transform with near shift-invariance. The proposed

signal processing platform could be used in a wide array of mHealth applications.

The design and development of a wearable, multimodal vitals acquisition unit for intelligent field triage is proposed by Beck and Georgiou. The unit is capable of recording ECG, blood oxygen and body temperature parameters. It also has the unique capability to simultaneously record up to eight custom designed acoustic streams for heart and lung sound auscultation. The resulting new data-set may be used for algorithm design in vital sign analysis or decision making. The monitoring unit can intelligently process the signals and transmit them to mobile response teams wirelessly.

The paper by Milis *et al.* proposes a workspace emergency response framework enabling the visualisation of the interactions between involved entities into a conceptual model. The model visualises the domain processes in a way that reveals the necessary communication and coordination points, the required data sources and data flows, as well as the decision support needs. It facilitates the parallelisation of the tasks undertaken in an emergency incident modelled as discrete time events using Petri Nets.

The paper by Kyriacou *et al.* is also related to emergency or crisis event management. More specifically, the system supports real-time management of firefighters, rescue teams, health services, and victims during a major disaster. It can be deployed in an *ad hoc* manner in the disaster area, as a stand-alone infrastructure (using its own telecommunications and power). It mainly consists of a control station, which is installed in the area

command center, the firefighter units, the rescuer units, the ambulance vehicles, and telemedicine units that can be used in order to support victim handling at the casualties clearing station.

The last paper by Avgousti *et al.* proposes an end-to-end mobile tele-echography platform using a portable robot for remote cardiac ultrasonography. They investigate the capacity of LTE wireless networks to facilitate responsive robot tele-manipulation, and real-time ultrasound video streaming that qualifies for clinical practice. The proposed robotised tele-echography platform can provide for reliable, remote diagnosis including emergency incidents (i.e. in the ambulance), with comparable quality of experience to in-hospital ultrasound examinations.

We hope that you enjoy reading this special issue in which the basic concepts, challenges, and prospects of smart health services have been represented through the selected papers. Works like these are forming the basis for the provision of a new era of mobile health services, centered on improving the quality of citizens' life.

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