Editorial

Leandro Pecchia & Rita Stagni

“The lack of specificity in fall risk assessment, a limited effectiveness in fall prediction and the inability to reliably monitor spontaneous falls in real life conditions with un-obstructive technological solutions remain key unsolved problems.”

Accidental falls are a major problem in later life, reducing the overall well-being, independence, mobility and quality of life of the elderly and those who care for them. The social and economic burden of falls is becoming unsustainable, considering the huge direct and indirect costs associated with each fall and the progressive ageing of the population in industrialised countries.

Falls are related to complex and dynamic interactions between intrinsic, subject-specific, and extrinsic, circumstance-related, risk factors. Therefore, the prevention and management of falls in later life still represents a critical challenge for active and healthy ageing.

Many healthcare technologies have been proposed to address this in recent years, ranging from fall risk screening and assessment to fall detection and, in more recent studies, fall prediction.

However, several critical issues remain, mainly regarding the effectiveness of the proposed solutions, their usability in real environments, sustainability, performance, assessment and technological limitations. The lack of specificity in fall risk assessment, a limited effectiveness in fall prediction and the inability to reliably monitor spontaneous falls in real life conditions with un-obstructive technological solutions remain key unsolved problems.

This special issue collects a selection of works across these healthcare technologies giving a snapshot of the latest research in this area.

The first paper is an invited literature review on automatic methods for the assessment of fall risk based on statistical machine learning approaches applied to features extracted from wearable accelerometers and/or gyroscopes. This study identified five major recurrent limits identified among the 30 studies included in this review, which the reader of this special issue may consider while designing future studies: publication bias, limited/inadequate sample size, poor

model validation, inappropriate model complexity with respect to the available data and poor outcome definition.

The second paper in this issue reports a collaborative research effort between Italy, UK and Croatia, investigating the associations between depressed heart rate variability (HRV) and the risk of falling in patients suffering from hypertension. This cross section study enrolled 170 patients over two years, concluding that there is a significant association between depressed HRV and risk of falling, suggesting that it is possible to automatically detect autonomous nervous system states that may lead to falls.

The third paper investigates the impact of various parameters on the accuracy vs. energy efficiency of a wearable activity recognition system, based on accelerometers. This study proved that sampling frequency, transmission rate, and method of nodal processing can impact significantly in satisfying the requirement of an activity recognition system.

The final paper proposes a framework for fall detection based on wearable accelerometric sensors and machine learning techniques. The paper offers an interesting perspective and reports promising results, although preliminarily tested on a small sample of simulated falls.

We hope that you will enjoy reading this special issue, in which some of the challenges of healthcare technologies for fall prediction, detection and risk assessment are examined through a range of different applications.

Leandro Pecchia
University of Warwick, UK
Rita Stagni
University of Bologna, Italy