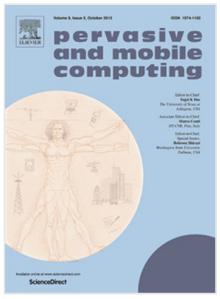
Accepted Manuscript



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Mohd Halim Mohd Noor, Zoran Salcic, Kevin I-K. Wang

PII: S1574-1192(16)30228-0
DOI: http://dx.doi.org/10.1016/j.pmcj.2016.09.009
Reference: PMCJ 762

To appear in: *Pervasive and Mobile Computing*

Received date: 11 March 2016
Revised date: 14 September 2016
Accepted date: 15 September 2016

Please cite this article as: M.H.M. Noor, Z. Salcic, K.I.-K. Wang, Adaptive sliding window segmentation for physical activity recognition using a single tri-axial accelerometer, *Pervasive and Mobile Computing* (2016), http://dx.doi.org/10.1016/j.pmcj.2016.09.009

Adaptive sliding window segmentation for physical activity recognition using a single tri-axial accelerometer

Mohd Halim Mohd Noor[a,b*], Zoran Salcic[a], Kevin I-K. Wang[a]

[a]*The University of Auckland, Auckland, New Zealand*
[b]*Faculty of Electrical Engineering, Universiti Teknologi MARA, Penang, Malaysia*

Abstract

Previous studies on physical activity recognition have utilized various fixed window sizes for signal segmentation targeting specific activities. Naturally, an optimum window size varies depending on the characteristics of activity signals and fixed window size will not produce good segmentation for all activities. This paper presents a novel approach to activity signal segmentation for physical activity recognition. Central to the approach is that the window size is adaptively adjusted according to the probability of the signal belongs to a particular activity to achieve the most effective segmentation. In addition, an activity transition diagram for activity recognition is developed to validate the activity transition and improve recognition accuracy. The adaptive sliding window segmentation algorithm and the role of activity transition diagram are described in the context of physical activity recognition. The approach recognizes not only well defined static and dynamic activities, but also transitional activities. The presented approach has been implemented, evaluated and compared with an existing state-of-the-art approach by using internal and public datasets which contains activity signals of dynamic, static and transitional activities. Results have shown that the proposed adaptive sliding window segmentation achieves overall accuracy of 95.4% in all activities considered in the experiments compared to the existing approach which achieved an overall accuracy of 89.9%. The proposed approach achieved an overall accuracy of 96.5% compared to 91.9% overall accuracy with the existing approach when tested on the public dataset.

Keywords: Activity Recognition, Activity Transition Diagram, Adaptive Sliding Window, Signal Segmentation.

1. Introduction

Aging and dependent population is recognized as a major social and economic issue for the coming decades. According to World Health Organization, it is estimated that there will be 2 billion people of age 60 and older by 2050 [1]. In Europe, it is expected that the elderly population of European Union (EU27) aged 65 years or over to rise to 30% in 2060 [2]. Elders who are dependent and vulnerable in different aspects due to cognitive and physical impairment require assistance in their activities of daily living (ADL). With the increase of elderly population, rise in health care cost with insufficient and ineffective care are becoming an issue in the future. One of the promising solution to mitigate the issue is known as assisted living systems [3]. The aim of such system is to allow elders to live independently at home and at the same time enhance their living quality. As a result, the cost for society and public health system could be reduced [4].

Assisted living system incorporates sensing, actuation and networking technologies and data processing techniques to provide assistance to elderly people with their daily activities and help them to be safe and healthy while living independently. One of the main components of assisted living system is human activity

* Corresponding author.
E-mail address: mmoh626@aucklanduni.ac.nz, mohalimnoor@gmail.com.