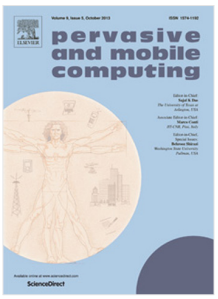
Accepted Manuscript



Detecting breathing frequency and maintaining a proper running rhythm

Fei Gu, Jianwei Niu, Sajal K. Das, Zhenxue He, Xin Jin

PII: S1574-1192(17)30317-6
DOI: http://dx.doi.org/10.1016/j.pmcj.2017.06.015
Reference: PMCJ 855

To appear in: *Pervasive and Mobile Computing*

Please cite this article as: F. Gu, J. Niu, S.K. Das, Z. He, X. Jin, Detecting breathing frequency and maintaining a proper running rhythm, *Pervasive and Mobile Computing* (2017), http://dx.doi.org/10.1016/j.pmcj.2017.06.015

Detecting Breathing Frequency and Maintaining a Proper Running Rhythm

Fei Gu[a], Jianwei Niu[a,*], Sajal K. Das[b], Zhenxue He[a], Xin Jin[a]

[a]*State Key Laboratory of Virtual Reality Technology and Systems, School of Computer Science and Engineering Beihang University, Beijing, 100191, China*[1]
[b]*Department of Computer Science, Missouri University of Science and Technology, Rolla, USA*[2]

Abstract

Running is a kind of whole body movement, which enables the whole body muscle rhythmic contraction and relaxation. A stable and harmonic running rhythm can not only postpone runners' fatigue but also improve their exercise effectiveness. The paper presents an effective method of detecting runner's breathing frequency continuously and maintaining a stable running rhythm during running. Bluetooth headsets, smartphones and heart rate belts are utilized to obtain the sensed data, such as striding frequency, breathing frequency and heart rate. We propose a novel approach to calibrate the sensed data by integrating ambient sensed data with a physiological model called Locomotor Respiratory Coupling (LRC), which indicates possible ratios between the striding and breathing frequencies. In order to help the runner maintain a stable running rhythm, we use a proper music recommended by the server based on the history of the sensed data to encourage the runner to accelerate, decelerate or keep the running speed and breathe properly. Our method has been validated by extensive experiments and the experimental results indicate that it can accurately detect the breathing frequency and maintain a stable running rhythm for runners.

*Corresponding author
Email addresses: gufei@buaa.edu.cn (Fei Gu), niujianwei@buaa.edu.cn (Jianwei Niu), sdas@mst.edu (Sajal K. Das), hezhenxue@buaa.edu.cn (Zhenxue He), 976791005@qq.com (Xin Jin)

The partial result of this work was published in IEEE SMARTCOMP 2016 conference [1].