A STUDY ON THE LONG-TERM MONITORING OF SPORTS ACTIVITIES

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INTRODUCTION: Lots of studies to analyze and classify human movement patterns using various sensors have been carried out (Mathie, 2004; Allen, 2006) because accurate information of body activity is required to provide promotion of health and health plan. Thus this study was conducted to study the classification and monitoring of various sports activities in real-time environment using single waist mounted tri-axial accelerometer.

METHOD: To find several movement patterns, various types of movement were measured with body fixed accelerometer module. Accelerometer module was made small and easily attachable on waist using wireless communication system by ourselves. Tri-axial accelerometer device(Freescale Inc., MMA7260) was selected with a range of ±6g. The battery supports the device more than 9 hours continuously, and total dimension of the device is 5.5x2.5x1.5cm. Experiments for developing an algorithm were performed on seven healthy male subjects(age : 25.1±1.5, height : 172.4±6.9, weight : 72.8±8.9) with several sports activities such as falls, walking, running, stepping upstairs/downstairs, slope walking, jumping, cycling and transition between movements(sit to stand, lie to stand, stand to sit, lie to sit, stand to lie and sit to lie). Each movement task was repeated three times. From preliminary experiments, real-time sports activity classification algorithm was deveploped using various methods of classification such as fixed threshold, peak-count and tilt angle. Developed algorithm for classifying movements used filtered acclerometer signal. Data filtering of signal was performed using moving average filtering (MVF) of 3rd order after low-pass filtering (LPF) with 1Hz. In this algorithm, fixed threshold method was used for emergency states classification such as falling and peak-count method was used for locomotion states classification and tilt angle information of sensor was used for resting states classification such as sitting, standing and lying.

RESULTS AND DISCUSSION: To evaluate proposed algorithm, experiment with 5 healthy adults was performed with several sports activities such as walking, running, cycling, falls and transition between movements. The results showed that successful detection rate of algorithm for walking, running, transition between movements and falls was 96.1%. Classification algorithm for stepping upstairs/downstairs, slope walking and jumping is currently under development.

CONCLUSION: The purpose of this study was to classify accurate sports activities and to notify emergency event such as falls. Successful detection rate of algorithm for walking, running, transition between movements and falls was 96.1%. Estimation program of accurate energy consumption of each activity is under study.

REFERENCES:

Mathie, M. J., Celler, B. G., Lovell, N. H. , and Coster, A. C. F. (2004), Classification of basic daily movements using a triaxial accelerometer. *Medical & Biological Engineering & Computing*, 24, 679 687.

Allen, F. R., Ambikairajah, E. , and Lovell, N. H. (2006), Classification of a known sequence of motions and postures from accelerometry data using adapted Gaussian mixture models. *Physiological Measurement*, 27, 935-951.

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