

Tutorial EMBC 2015: "Movement analysis via wearable inertial sensors: state of the art and perspectives"

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Abstract

Quantitative human movement analysis provides information on functions of the locomotor sub-systems and on the overall strategy upon which motor activity is executed. These outcomes contribute to the understanding and quantification of subject-specific variables that can effectively be used in early diagnosis, intervention, outcomes quantification, prevention, physical activity assessment and sport performance optimization. Magneto-inertial sensing is an emerging technology with a growing number of potential applications in human movement analysis. Several key factors are behind the success of this technology. First, magneto-inertial units are self-contained systems, second, since these sensors are heavily used in the consumer electronics market products, their price keeps dropping while their performance improves and lastly, the move from wearable measurement systems to pervasive systems made possible by the MEMS/NEMS technology opens up new perspectives for motor performance assessment and monitoring. This tutorial will focus on the methodologies, problems, solutions and challenges associated with different applications related to analysis of human movement using magneto-inertial data. In particular, the tutorial will consist of four distinct lectures: 1) Position and orientation estimates by means of magneto-inertial sensing, 2) High resolution reconstruction of Human movement via magneto-inertial sensing, 3) Methods for movement monitoring and daily-life physical activity classification, 4) In-field use of wearable inertial sensors for performance evaluation. The tutorial will be characterized by an educational style and it will provide an opportunity to be up to date on the state of the most recent technological developments and signal processing techniques and on newest applications in the clinical, industrial and sport areas.

Presentations

A. Methods for movement monitoring and classification

Dr Anisoara Ionescu, Laboratory of Movement Analysis and Measurement, Institute of Bioengineering, Ecole Polytechnique Federale de Lausanne (EPFL), anisoara.ioenscu@epfl.ch

B. Position and orientation estimates by means of magneto-inertial sensing

Prof. Angelo Maria Sabatini, Biorobotics Institute, Scuola Superiore Sant'Anna, angelo.sabatini@sssup.it

C. Kinematics analysis via magneto-inertial sensing

Dr. Andrea Cereatti, Laboratory of Movement Analysis and Measurement, University of Sassari and Interuniversity Centre of Bioengineering of the Human Neuromusculoskeletal System, acereatti@uniss.it

D. In-field use of wearable inertial sensors for performance evaluation

Dr. Valentina Camomilla, University of Rome "Foro Italico", Italy and Interuniversity Centre of Bioengineering of the Human Neuromusculoskeletal System, valentina.camomilla@uniroma4.it
