

UNDERSTANDING HUMAN MOVEMENT

MOTION





ADVANCED INERTIAL SENSORS DATA PROCESSING FOR RECOGNIZING HUMAN ACTIVITIES AND CHARACTERIZING MOVEMENTS

Motivation

The widespread of inertial measurement units, which can be found inside smartphones and wearables, along with size and cost reduction, opened the possibility to study human motion in a continuous on-person approach.

Continuously monitoring movements and activities of elderly and vulnerable people, enables the detection of life-threatening events such as falls. Moreover, quantification of ambulation activities allows to infer physical activity status and predict risk of falling, or other functional declines.

Indoor localization, a most desired tool for navigation or mapping people inside large and complex buildings, such as hospitals or shopping centres, can be equally achieved by continuously analysing inertial data from human gait, and applying dead-reckoning techniques combined with opportunistic sensing.

In the context of sports, or when learning new manual tasks, movement analysis can be brought outside the lab as a tool for measuring performances, giving feedback to the athlete or the worker.

In rehabilitation, motion characterization using data from inertial sensors is used to give feedback to the patient during autonomous execution of exercises, evaluating prescribed programmes of exercises and patients' progress.

Solution

Data streams from inertial sensors are processed and analysed using machine learning techniques for automatic recognition of human motion activities and falls.

Sensor fusion techniques are used to obtain metrics which further characterize specific movements, such as joint angles, number of steps or the step length during gait.

Template matching techniques are applied for comparing the execution of certain

specific movements and anomaly detection.

Benefit

FhP-AICOS' technology for falls detection with smartphones, is currently licensed to industry partners, and has showed an accuracy of 97% for simulated falls. Using a transfer learning approach, real-world falls are detected with an accuracy of 96%.

The continuous estimate of the risk of falling has shown strong correlation with a standard assessment test, the Timed Up and Go, as evaluated by an external partner.

FhP-AICOS' solution for Indoor localization of people, with under one meter accuracy, was awarded with two top three finishes on Microsoft's Indoor Localization Competition, has one published paper, and one granted and three pending patents.



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