UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Dibris

Thesis Project Form

Title (tentative): Development of wearable motion capture sensor based on neuromorphic event based sensor

Thesis advisor(s): Canessa Andrea, Silvio P. Sabatini Vittorio Sanguineti

E-mail: Andrea.Canessa@unige.it

Address: Via All'Opera Pia, 13 - 16145 Genova Pad E piano 1

Phone: (+39) 010 3532789

Description

Motivation and application domain

Real-time human motion tracking can be applied to numbers of biomedical applications, such as clinical gait analysis, rehabilitation, analysis of joint kinematics, and etc.
Several tracking technologies, such as mechanical tracking, magnetic tracking and visual tracking have been in used for many years.
Continuous monitoring of human movement in their natural living environment, i.e. data captured â€œin-the-wildâ€•, could be more informative and insightful and potentially provide more valuable feedback than in laboratory settings.
However, it has been extremely difficult to go beyond the laboratory and obtain accurate measurements of human physical activity in daily life environments. The complex infrastructure of these tracking technologies limits their usage in the controlled volume and is not practical in the free-living environment.
The project thus, aim to design and develop of an edge computing, low-cost, wearable motion capture system able to reconstruct human motion and collect accurate kinematic data in a timely, unobtrusive (or as least-invasive as possible), easy-to-use way in real life situation.

General objectives and main activities

The project thus, aim to design and develop of an edge computing, low-cost, wearable motion capture system able to reconstruct human motion and collect accurate kinematic data in a timely, unobtrusive (or as least-invasive as possible), easy-to-use way in real life situation.
The system will be based on new wearable sensors that will combine an inertial measurement unit (IMU) and an innovative bio-inspired event-based image sensor, which mimics the behavior of the human retina. Several sensors could be modularly integrated to form a wireless wearable body sensor network to accurately track kinematic data of the full body as well as single body parts.

To reach this goal different technological challenges (TC) should be tackled:
TC1 â€“ Pattern matching VIO for event cameras: implementation of the event-based pattern recognition and feature tracking method and the VIO estimation algorithm which fuse inertial measurement and events information to recover sensor absolute position and orientation (6DOF tracking) with high accuracy and at a high sample rate.
TC2 â€“ Self-calibration algorithm: implementation of the automatic self-calibrating sensor-to-segment algorithm to recover the relative position and orientation of each sensor with respect to the other sensors.
TC3 â€“ Network sensor fusion: implementation of the network sensor fusion algorithm to combine the tracking information of each sensor of the network to model the kinematic of the full body as well as single body parts.

Training Objectives (technical/analytical tools, experimental methodologies)

Place(s) where the thesis work will be carried out: DIBRIS

Additional information

Maximum number of students: 1