

CARING: Design of a Software Radar for the Early Identification of Gait Failure in EHPAD: Application to Fall Detection

The automatic detection of postures has given rise in recent years to intense research activity and major economic spin-offs. Kinect 3D sensors in particular have reinvented gaming by offering the possibility of taking into account the depth information and thus effectively discriminating typical movements. The challenges still recently organized on this theme nevertheless show the limitations of the current sensors, especially for the recognition of posture in various situations and in particular falls. Fall detection of people and the elderly is a public health issue. One in two seniors falls at least once. Of the 450,000 falls of elderly persons surveyed annually, 37% lead to hospitalization after a visit to the emergency department, with an average length of stay of between 12 and 14 days. Every year, more than 12,000 people die from a direct fall or the consequences of these falls. To respond to these public health issues, solutions based on sensors embedded on the person, sensors integrated in places of life or even cameras have been developed in recent years. These solutions are still limited by the ergonomics, the clutter, the invasion of the privacy (taking plain images), the sensitivity to acceleration, the consumption, the precision of recognition, the discrimination of the situations.

In this context, this project proposes to study a new paradigm based on the use of a software radar. Unlike conventional video sensors, the use of a radar solution can deliver rich information while respecting privacy. This project paves the way for a new mode of early detection of falls of elderly people in specialized institutions (EHPAD). CARING is based on the processing of micro-Doppler signatures of a software radar. The project aims to define the characteristics of a biomechanical change in behaviour, to process them with artificial intelligence and to validate the performance in EHPAD in real time. The CARING project is supported by a consortium made up of the UCP (ETIS UMR8051), the University of Glasgow, the UESTC in Chengdu and the EPINOMIS company (management of three nursing homes, Neuville, Herblay and Compiègne). A first laboratory prototype was produced as part of a PHC Xu Guangqi in 2017 to detect a fall with an average recognition rate of 96%, offline. A second prototype in real time must now be developed to perform real-life tests in EHPAD and verify hypotheses. In this context, the post-doc will be expected to :

- Perform a monitoring to keep up to date the state of knowledge on alternative solutions.
- Design an FPGA architecture for the real-time processing of spectrograms.
- Develop a hardware solution for extracting and classifying spectrograms.
- Develop an operational prototype for EHPAD tests.
- Establish the performance of the developed system.
- Promote the work (publications, scientists)

Required Skills:

- Solid knowledge in design flow on FPGA.
- Signal processing and image processing concept.
- Radar knowledge would be a plus.

- Machine learning.
- Programming in Matlab and / or Python.
- A good command of English.

Place of work:

Laboratory ETIS, UMR8051, site ENSEA, 6 av of the culvert, 95000 Cergy-Pontoise,

Date: ASAP

Salary : 2300 euros per month

Duration: 12 months with possibility of renewal.

Contact: Pr. Olivier ROMAIN

Olivier.Romain@u-cergy.fr

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