Visual Recognition of Gait parameters

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There is major interest nowadays in Moderate-High Intensity Aerobic Activities for non-pharmacological interventions in elderly suffering from neurodegenerative diseases like Alzheimer's Disease and Related Disorders [1]. Within the context of the development of serious games for this population, we have developed algorithms to interact with the virtual environment through simple gesture recognition and walking speed computation (see Figure 1).

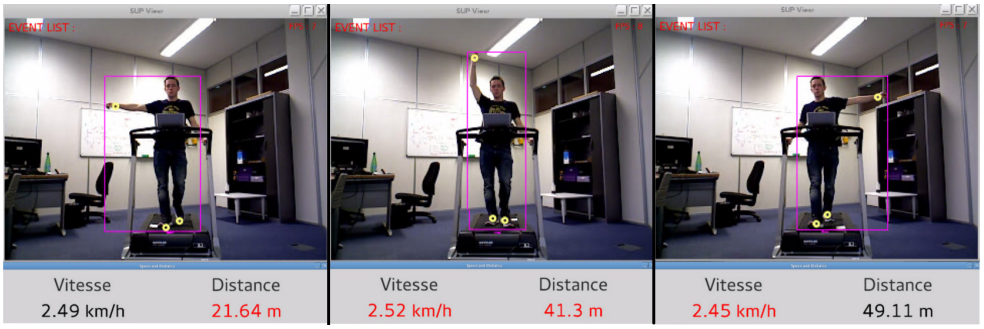

Figure 1: Gesture recognition and walking speed computation for serious game interactions. The gestures are : turning right (left picture), turning left (right picture) and action (center picture). The yellow dots show the positions of the arm and feet.

Method

Based on an RGB-D (Red Green Blue + Depth) camera such as Kinect, the walking speed computation is performed as follow. First, people on the scene are detected using a background substraction algorithm [2] and tracked using a multi-feature algorithm [3]. Then, the feet positions are estimated based on the 25% of the lowest 3D points of the person. Finally, the walking speed of the person is computed from the successive positions of the feet.

Results and discussion

With the help of a specialist in the domain of physical activities, a protocol has been set up to assess the precision of the computed walking speeds (covering the walking speed spectrum, from

1.5 km/h to 5.5 km/h) and to prove the reproducibility of these results. Based on 36 participants who performed this protocol, the system has shown an absolute mean error of 0.17 km/h with a higher accuracy for median speeds (around 4.5 km/h). A paper is actually under reviewing process in Gait and Posture journal.

Following that, we decided to study whether this system would be useful in rehabilitation. Some experts of this domain in a rehabilitation center (Centre Hélio Marin in Vallauris, France) have been interviewed and they were very enthusiasts about using this type of system to get objective gait parameters. In collaboration with them, we started to develop a proper application for rehabilitation, adding new functionnalities around gait parameters computation such as side-by-side video comparison, automatic sequencing of video or 3D display (see Figure 2).

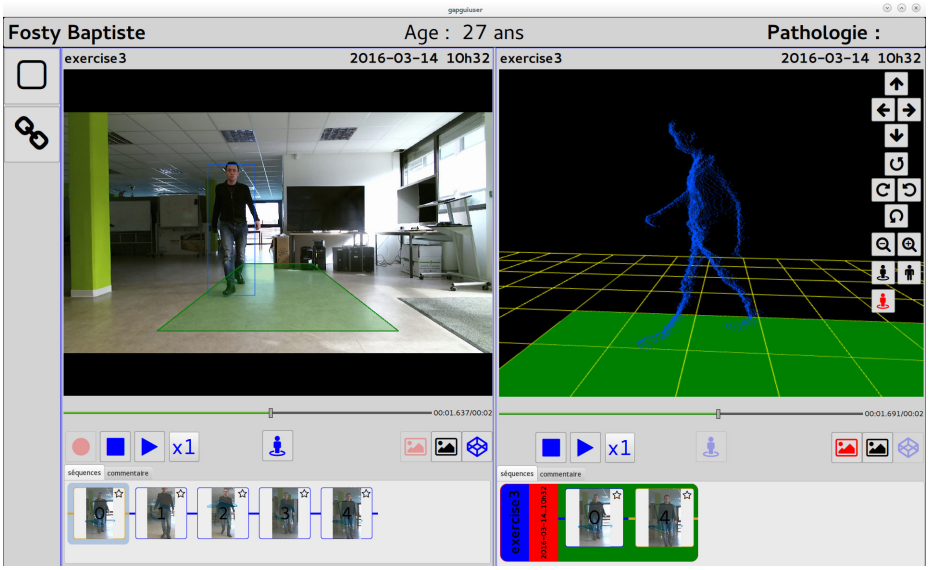

Figure 2: Screenshot of the inferface for rehabilitation application. Top : patient general information. Left image : color image of the camera. Right image : 3D side view of the cloud of point of the person. Bottom (thumbnails) : sequences detected in the video.

References

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