Intelligent Virtual Platforms for Active Ageing Therapy: Machine Learning Methods for Gesture Recognition

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PhD Research Report. This study aims to improve human-computer interaction in serious gaming systems used for clinical purposes, like cognitive rehabilitation and active ageing. The new generation interaction sensors, such as Kinect, are based on natural movements and our research aims to extract indirect input from body gestures (for example emotions [**?**] or other significant actions) in order to create a more personalized and improved game experience, that would engage the users more actively into performing their exergames [**?**].

For this purpose, we have analysed several machine learning techniques that can be used for pose and gesture recognition and the way their performance (accuracy, precision, time) is influenced by factors such as sensor input accuracy and data size (number of samples for each class, as well as sample size). Based on these results we may decide which interaction sensor to choose and how to extract and interpret the data in order to obtain the best results for a specific type of gesture recognition system.

We have compared 38 classifiers on our own database of 30 different body postures and three machine learning algorithms on a set of 14 hand gestures recorded with the Kinect for XBox 360 (Kinect 1) and Kinect for XBox One (Kinect 2) sensors. For Kinect 2 we have created a database with gestures containing the same joints as Kinect 1 and a database containing all joints – an extended version having five more joints than Kinect 1 [**?**]. The results for the two sensors have been analysed and compared in terms of precision, accuracy and time. Although Kinect 2 increases overall accuracy for most of the classifiers, it also impacts the computation time (by increasing it) and it is not the universal best solution for all gesture recognition based systems. Moreover, we propose a dynamic game difficulty balancing model, specifically designed for active ageing systems, containing cognitive games targeting elderly people [**?**].

Following the results obtained in our experiments, we conclude that this domain has a very large potential for applications in practical areas for human-computer interaction, as well as for further extension.

References

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