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Gesture Recognition for an Exergame Prototype

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Abstract

We will demonstrate a prototype exergame aimed at the serious domain of elderly fitness. The exergame incorporates straightforward means to gesture recognition, and utilises a Kinect camera to obtain 2.5D sensory data of the human user.

1 Introduction

Exergaming is a game genre that refers to utilising games and game principles for evoking a form of exercise [3]. As such, exergaming relies on technology to directly monitor the human player, typically by means of tracking body movement or reaction speed. The genre has been credited with *upending the stereotype of gaming as a sedentary activity*, and promoting an active lifestyle [4, 1]. Exergames are seen as evolving from technology changes aimed at making video games more fun [2].

Students of the Amsterdam University of Applied Sciences (HvA) have investigated an exergame prototype that incorporates a straightforward form of gesture recognition. The research has been performed in collaboration with industry partner DIGIFIT, which develops new wellness applications in the field of fitness and lifestyle, and applies smart technology to motivate people to live healthier and more active lifestyles.

The intuition in this regard is that exergames may enable (elderly) people to monitor and effect their health and wellbeing. Particularly, exergames fit in the public health vision to encourage elderly people to remain independently from care for as long as possible, by providing them with the tools for monitoring and effecting their own health, and hence, maintaining more control on the care received.

2 Exergame prototype

The Ministry of Health, Welfare and Sport (Netherlands) supports the project Online Sports Club for the Elderly. Part of this project is to utilise a 2.5D/time-of-flight camera in combination with a prototype exergame. For the prototype, the gaming system needs to (1) receive input from a 2.5D camera by means of (third-party) sensory middleware, (2) determine the pose of the human player, and (3) subsequently visualise the pose in an integrated 3D authoring tool.

Of particular interest to an exergame built on gesture recognition is investigating how a gesture can best be determined:

1. Trigger based. Is a particular gesture executed?
2. Quality based. Is a particular gesture executed *correctly*?

In this regard, the prototype incorporates measures for defining gestures such that they can be determined both absolutely as well as qualitatively. Technically, the prototype uses a 3D authoring tool to provide feedback to the user and game scripting (Unity3D), middleware for coarse interpretation of the sensor data (OpenNI), and a 2.5D camera (Microsoft Kinect). Connection between OpenNI en Unity3D is handled via a wrapper that is maintained by OpenNI, and which is feature complete with regard to skeleton tracking (joint

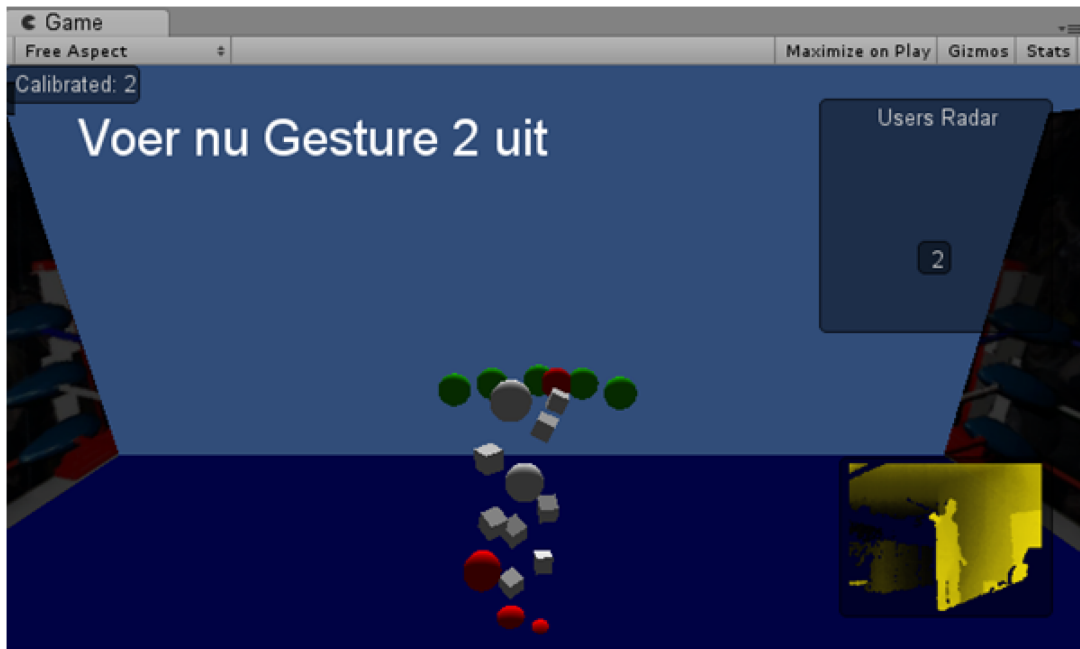


Figure 1: Screenshot of the exergame prototype. In the screenshot, the human player has to consecutively touch a series of in-game objects.

positions and orientation). Calibration of the skeleton tracking takes place via a so-called ‘psi’ position; a position which the user has to adopt initially in order to allow the middleware to calibrate itself.¹

In the gaming prototype, gestures can straightforwardly be defined as a *series* of game objects with which a collision can occur. Each game object is labelled with an order number, so the game script can determine whether the objects are touched in the correct order, and, particularly, how tolerant the game should be when for instance one out of n objects has been accidentally skipped. In addition, audio samples are added to individual game objects to provide feedback to the user. An example of a series of spheric game objects that have to be touched in series, is illustrated in Figure 1. By way of exercise, the exergame prototype presents users with increasingly more challenging gestures upon each successfully completed gesture. The score is determined by weighting how many gestures have been executed, versus how correctly the gestures have been executed.

We will demonstrate how gestures can be defined intuitively in the prototype, and how they can be utilised in a standard computer system to provide a straightforward form of gesture recognition based on 2.5D sensor data. We will note that calibration to the user is presently relatively user unfriendly, though will be improved in the next generation of the OpenNI middleware. Finally, we will explain directions for future research, namely how geometric angles in joint orientation can be applied to accurately define fine-grained motor skills.

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¹By the end of the year, OpenNI will release an update that makes it possible to initiate user skeleton tracking without requiring the ‘psi’ calibration pose. The developer’s internal milestone for this functionality is September/October, with release shortly thereafter.