

Design and implementation of a application using motion input for controlling computer games as part of physical therapy

Abstract

Using games as part of physical therapy improves patient motivation to perform the necessary exercises. The developed application allows physical therapists to choose exercises that fit the needs of the patient and record them using the Kinect 2.0 camera. When the patient executes an exercise, machine learning algorithms are used to recognize the exercise, which activates the keyboard key linked to that exercise. This makes it possible to interact with any available game relying on key inputs.

Research is conducted on the subject of human-computer interaction (HCI) involving the use of a Kinect 2.0 camera to interact with the application in what is called a natural user interface (NUI). Several prototypes are designed that focus on different interaction principles and are divided into two categories: the hints pattern and the hints pattern. The chosen implemented prototype of the interface allows users to interact with the menus and items appearing on-screen without the use of traditional buttons. Interactive elements like pulling ropes are present in the interface, providing both feedforward and feedback to the user's effort to simplify the interaction process.

As part of the user-centered design approach, the interface is evaluated by conducting a usability test with a physical therapist. Feedback is obtained both during the prototyping phase, as well as after implementing the prototype. A conclusion from this test is that it takes more time to understand the interface elements can be interacted with. With a short explanation, it is possible to decrease the time needed to achieve this. The application as a whole has a low learning curve as the focus on simplicity reduces the time for the user being familiar with all required actions after recording an exercise once.

alternative abstract

Patients are often demotivated by pain or boredom during physical therapy and previous attempts to use motion controlled games to improve this worked, but had limited exercises and monotonous interfaces that proved to make it economically inviable. In this thesis a more versatile program is developed using the Kinect 2.0 3D-camera to allow a physical therapist to train a support vector machine (SVM) to recognize any exercise and link it to an action in any game that uses keyboard input. Though the thesis is more focused on the human-computer interaction (HCI) aspect of designing a user-friendly motion controlled natural user interface (NUI) for this program.

For the development of the NUI several special paper-prototypes are designed that focus on different interaction principles. After user feedback a principle was chosen and further developed into a prototype that uses straight forward interaction with good feedforward and feedback in an effort to