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Multi-camera systems for rehabilitation therapies: a study of the precision of Microsoft Kinect sensors

Key words: Kinect sensor, Rehabilitation system, Capture precision, Multicamera system

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Motivation

- Assistive technologies have become an important research field in recent years. These systems use specialized hardware to solve an interaction problem.
- The latest advances in cameras and computer vision algorithms have now replaced the specialized hardware by tracking cameras.
- Microsoft Kinect sensor has been included in a multitude of proposals for the rehabilitation of patients, and is currently one of the most widely used sensors in assistive technologies.

Motivation

- Although mono-camera rehabilitation systems work well enough in most situations, these systems have several limitations.
- Multi-camera rehabilitation systems can be the solution to the limitations of mono-camera systems.
- Current studies did not make a thorough study of interference between multiples cameras in the same recognition area, since they did not test different sensor configurations.

Objective

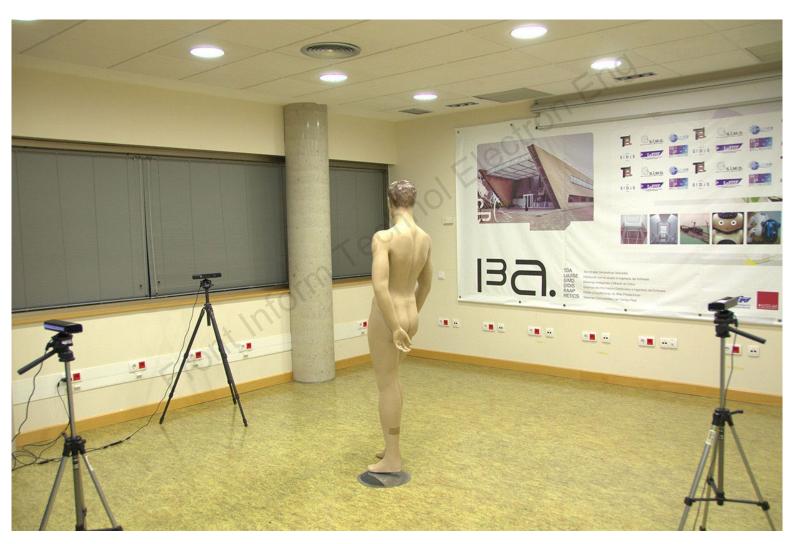
- We focus on the multi-camera system with Kinect sensors.
- We examine the problems derived from infrared saturation when using more than one depth sensor in the same workspace.
- We also analyze the effect of varying the number of devices, angles of incidence of light, and the distance between sensors and the user.

Experimental setup

 The experiments consist of measuring the position of a mannequin and determining how the number and position of the capture devices affect the precision of the data achieved.

- Test parameters:
 - 1. Up to three sensors.
 - 2. Sensors positioned at the front, side, and back of the dummy.
 - 3. Distance between sensor and dummy up to 4 m.
- We conducted tests with 18 different configurations.

Experimental setup



Conclusions

- The mono-camera rehabilitation systems work well enough in most situations, but have several limitations.
- We studied multi-camera devices and how they interfere with each other, according to:
 - 1. The distance between them;
 - The distance to the object to be measured;
 - The angle of incidence of the projected infrared light;
 - 4. The number of sensors used.
- The data obtained is consistent with the studies of other investigator.