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

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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;
 2. The distance to the object to be measured;
 3. 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.