Automated Human Balance Assessment Using Contactless Sensors

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Abstract : Balance tests are frequently used to diagnose concussions on the sidelines of sporting events. Manual scoring, however, is labor intensive and subjective, and many concussions go undetected. This study institutes a novel approach to conducting the Balance Error Scoring System (BESS) more quantitatively using Microsoft's gaming system Kinect, which uses a contactless sensor and several cameras to receive data and estimate body limb positions. Using a machine learning approach, Visual Gesture Builder, and a deterministic approach, MATLAB, we tested whether the Kinect can differentiate between "correct" and erroneous stances of the BESS. We created the two separate solutions by recording test videos to teach the Kinect correct stances and by developing a code using Java. Twenty-two subjects were asked to perform a series of BESS tests while the Kinect was collecting data. The Kinect recorded the subjects and mapped key joints onto their bodies to obtain angles and measurements that are interpreted by the software. Through VGB and MATLAB, the videos are analyzed to enumerate the number of errors committed during testing. The resulting statistics demonstrate a high correlation between manual scoring and the Kinect approaches, indicating the viability of the use of remote tracking devices in conducting concussion tests.

Keywords : automated, concussion detection, contactless sensors, microsoft kinect

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