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Fundamental Evaluation of a Single Inertial Sensor in Trunk Angle Measurement During Patient Repositioning

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Abstract:

Excessive trunk flexion of caregivers during patient handling causes lower back pain. Thus, the trunk flexion angle of caregivers should be monitored and improved in daily patient handling tasks. A single inertial sensor is considered a suitable wearable sensor for monitoring trunk posture during patient handling because it is installed on popular devices such as smartphones. However, the accuracy of a single inertial sensor has not been evaluated for trunk flexion measurements in patient handling. The objective of this study was to evaluate the accuracy of a single inertial sensor for trunk flexion measurements during patient handling. In the experiment, ten participants performed patient repositioning. The trunk flexion angle during patient repositioning was measured using an optical motion capture system as the ground truth, and a single inertial sensor on the trunk. The Madgwick filter was applied to calculate the trunk flexion angle using the acceleration and gyro data obtained from an inertial sensor. The correlation and root mean square error (RMSE) values between the optical motion capture system and inertial sensor were calculated to evaluate accuracy. The results showed that the correlation values between the inertial sensor and the ground truth were greater than 0.9. These results indicate that a single inertial sensor can be used to monitor temporal changes in trunk flexion during patient handling. On the other hand, the results showed that RMSE values were more than 10 degrees. In future work, these errors should be improved by developing novel signal processing methods.