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Effectiveness of an Automatic Tracking Software in Underwater Motion Analysis

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ABSTRACT

Tracking of markers placed on anatomical landmarks is a common practice in sports science to perform the kinematic analysis that interests both athletes and coaches. Although different software programs have been developed to automatically track markers and/or features, none of them was specifically designed to analyze underwater motion. Hence, this study aimed to evaluate the effectiveness of a software developed for automatic tracking of underwater movements (DVP), based on the Kanade-Lucas-Tomasi feature tracker. Twenty-one video recordings of different aquatic exercises (n = 2940 markers' positions) were manually tracked to determine the markers' center coordinates. Then, the videos were automatically tracked using DVP and a commercially available software (COM). Since tracking techniques may produce false targets, an operator was instructed to stop the automatic procedure and to correct the position of the cursor when the distance between the calculated marker's coordinate and the reference one was higher than 4 pixels. The proportion of manual interventions required by the software was used as a measure of the degree of automation. Overall, manual interventions were 10.4% lower for DVP (7.4%) than for COM (17.8%). Moreover, when examining the different exercise modes separately, the percentage of manual interventions was 5.6% to 29.3% lower for DVP than for COM. Similar results were observed when analyzing the type of marker rather than the type of exercise, with 9.9% less manual interventions for DVP than for COM. In conclusion, based on these results, the developed automatic tracking software presented can be used as a valid and useful tool for underwater motion analysis.

Key words: Passive markers, sport, underwater movement

Key Points

- The availability of effective software for automatic tracking would represent a significant advance for the practical use of kinematic analysis in swimming and other aquatic sports.

- An important feature of automatic tracking software is to require limited human interventions and supervision, thus allowing short processing time.

- When tracking underwater movements, the degree of automation of the tracking procedure is influenced by the capability of the algorithm to overcome difficulties linked to the small target size, the low image quality and the presence of background clutters.

- The newly developed feature-tracking algorithm has shown a good automatic tracking effectiveness in underwater motion analysis with significantly smaller percentage of required manual interventions when compared to a commercial software.