

Automatic tracking of swimming performance: analysis of its validity in 50m events

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Introduction

The competition analysis is widely used in swimming competitions to evaluate the sport performance (Arellano, 2003). The athlete or coach can use the information provided by the analysis as an aid to improve performance. In swimming, video analysis is a widespread method, however, the manual tracking is time-consuming. Therefore, the aim of the present study was to validate a novel method to track automatically times (s) after recording the swimmers performances during 50m events in a 25m swimming pool.

Methods

Eighty-six individual events were recorded during a local competition. The participants performed 50m events distributed on each stroke. A typical system of 3 cameras located laterally to the swimming pool and connected to a video switcher has been used as criterion system. The swimmer's data are obtained after detailed observations of HD videos recorded at 50Hz. Start time (10m), T15m, T20m, T25m, T35m, T45m are included in the data base. The 50m times are collected from the competition results (semi-automatic timing) and additionally compared. The system is composed by 8 cameras (Basler Aviator: 83.33Hz 1080x1080pixels) and is located on the ceiling of the swimming pool and connected through Ethernet (1Gb) to a PC Work Station. A full frame added the 8 images. It was collected in real time to a sequence of frame to analyse the swimmers activity in every lane (8 simultaneously). Algorithms of image recognition allowed the event time collection: when the head crosses every 5m section and the arm stroke actions. Linear regression has been applied to test the validity of the tracked data or practical measurement related to the criterion measure plus the standard error of estimate (SEE) (Hopkins, 2015)

Results

All the results are summarized in Table 1.

Manual tracking	T10	T15	T20	T25	T35	T45	T50
Mean (s)	5.00	8.40	11.77	15.27	21.47	28.53	31.93
SD	0.80	1.12	1.57	1.97	2.88	3.97	4.53
Automatic tracking							
Mean (s)	4.95	8.33	11.69	15.10	21.43	28.51	31.79
SD	0.84	1.18	1.61	1.98	2.94	4.03	4.52
SEE (raw units)	0.17	0.14	0.21	0.19	0.16	0.22	0.21
Pearson r	0.98	0.99	0.99	1.00	1.00	1.00	1.00

Table 1. Comparison between the results obtained by manual digitization in the different distances and the results obtained by automatic tracking using the SEE and the Pearson r.

Discussion & Conclusion

The obtained high correlation values (close to 1) and the low values of the standard error of the estimate open the possibility to use the new tool to replace the former manual data collecting and to reduce about twenty times the time of analysis.

References

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Hopkins, W. G. (2015). Spreadsheets for Analysis of Validity and Reliability. *Sportscience*, 19, 36-44.

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