A MOBILE SYSTEM TO INVESTIGATE PUTTING KINEMATICS IN MOTOR LEARNING

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Introduction Numerous monitoring and training tools for golf putting exist (Marquardt, 2007). However, they are mostly lab-based or stationary. This work presents an improved version of a mobile golf putt system and describes a research application that such a system can be used for. The system was capable of automatic putt detection and kinematic parameter extraction. Using 31 kinematic parameters, the system was used to monitor training effects and to identify relevant group differences. This knowledge delivered further insight in the process of motor learning.

Methods The presented system is an improved version of a 6-D IMU (3-D accelerometer, 3-D gyroscope) instrumented golf club with real-time analysis capabilities (Jensen et al., 2012). The sensor and the club head coordinate system were aligned and an advanced putt detection based on a Hidden Markov Model was established (Rabiner, 1989). We trained the system with data from 15 subjects putting from various distances (1.5 m, 3 m, 5 m) with two different putters. Overall, 272 putts and the same amount of training swings were collected to train the system. The final system was used in a research study to investigate motor learning. Beside the kinematic putt parameters, average hit ratios and minimal distance to hole were collected. Therefore, 11 non-experienced students completed eight training sessions within four weeks that contained an overall amount of 288 putts. All subjects passed pretest, posttest and two retention tests (one week and three weeks after posttest) with ten putts each. Furthermore, transfer capabilities regarding floor material were tested together with post and retention tests.

Results The cross-validated putt detection evaluation on the training set resulted in a putt detection rate of 96.0 %. The sensitivity was 88.8 % as 22 misdetections occurred during data collection. Misdetected putts mainly coincided with training swings. The research study targets the identification of parameters that change with training. Analysis will be performed in an intra- and inter-individual manner to identify individual as well as group-wide effects. Data mining methodologies like classification, feature selection and regression will be used to analyze the training effects.

Discussion The improved mobile golf putt system showed a high putt detection rate on the collected training data. The disjoint training group will allow insight in the true performance on previously unseen subjects. The continuous monitoring of putt parameters and hit ratios will reveal motor learning effects of the specific training program used.

References:

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