Figure 7 Example waveform of the Pitch motion feature (O_y) selected for the Arm abduction exercise. The hill-climbing parameter θ is fitted during system runtime (Teach-mode) for each exercise. The horizontal dotted line indicates the estimated duration $\frac{d}{2}$, the vertical line indicates the estimated range of motion r. Online feedback is provided in the indicated region.

Peak correction. While the hill-climbing algorithm has low runtime complexity, the detection of local maxima and minima remains susceptible to detecting additional peaks (insertion), e.g. during vibrations, or to missing peaks (deletion) if the signal amplitude decreases. In situations where there is one insertion or deletion error in sequence, the alternating order of positive and negative peaks is interrupted. If two consecutive positive or negative peaks were derived a peak correction algorithm was applied. This peak correction works by first removing redundant peaks and then inserting missing peaks that were missed during the first iteration of the hill-climbing algorithm. If two consecutive positive (negative) peaks were detected, the algorithm compare them and removes the one having a smaller (greater) amplitude, thus restoring the alternating of maxima and minima. Subsequently, time intervals Δt between two consecutive peaks were used to determine if there could be peaks missing. If an interval was larger than $m_{\Delta t}+\sigma_{\Delta t}$, where $m_{\Delta t}$ and $\sigma_{\Delta t}$ are mean and standard deviation of the intervals, it was assumed that peaks might be missing. Missing peaks were searched by applying hill-climbing within the section delimited by the consecutive peaks. A smaller threshold θ (reduced by 20% of its initial value) was then used. The hill-climbing was iterated while adjusting θ until a peak was found, or a lower limit of $\theta < \theta_{opt}/2$ was reached.

Exercise model parameter estimation. The following five parameters were derived: number of repetitions (n), mean and standard deviation of repetition duration d (m_d, σ_d), and mean and standard deviation of the range of motion r (m_r, σ_r). The repetition duration was derived from the time interval Δt between two adjacent minima. The range of motion was derived from the magnitude difference between adjacent negative and positive peaks. The number of repetitions