Quantitative comparison of movements for medical training
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Scenario
• Expert performs medical act
• Students perform the same action
• Systems automatically provides quantitative differences in performance

Challenge
• Variable speed of performance of the same valid action
→ Each point in one curve must be temporally registered to a point in other curve (no bijectivity)

Outcome
• Both, DTW and LCSS solve temporal registration problem with the same computational effort, but DTW gives superior results
• After synchronization (temporal registration) a direct comparison is possible:
  • by AR 3D visualization from different viewpoints at any speed
  • as a quantitative measure of success in reproducing actions
• Statistical comparison of many experts’ performances allows automatic classification of important parts of complex movement
• Alignment of data not limited to 3D trajectory, e.g. forces, other parameters of simulator
• First promising trials on online synchronization

Comparison of existing algorithms: LCSS vs. DTW

LCSS
- Points are matched or not (impractical for replay)
- Each point is matched only once
- Threshold matching
- Maximizes matched points (this distance measure is not optimal for different update rates of tracking systems)

DTW
- All points are matched at least once
- Minimizes sum of distance of matches

Offline synchronization for
• Comparing novice to expert
• Obtaining typical (average) movements of experts
• Finding critical parts of a performance
Online synchronization provides:
• Interactive feedback during performance
• Context dependent information

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