

# Mapping 2D Skeleton Sequences from Speed Climbing Videos onto a Virtual Reference Wall

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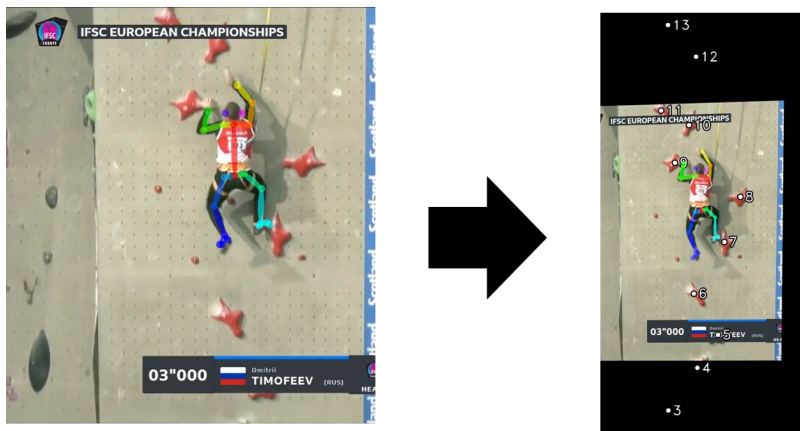
**Speed climbing** is an Olympic sport with a growing interest in **automatic performance analysis**. We design, implement, and evaluate a pipeline to compute transformations of speed climbing videos to a reference wall. (*Fig. 1*)

First, an object detection model is fine-tuned for the task of **hold detection**. (*Fig. 2*)

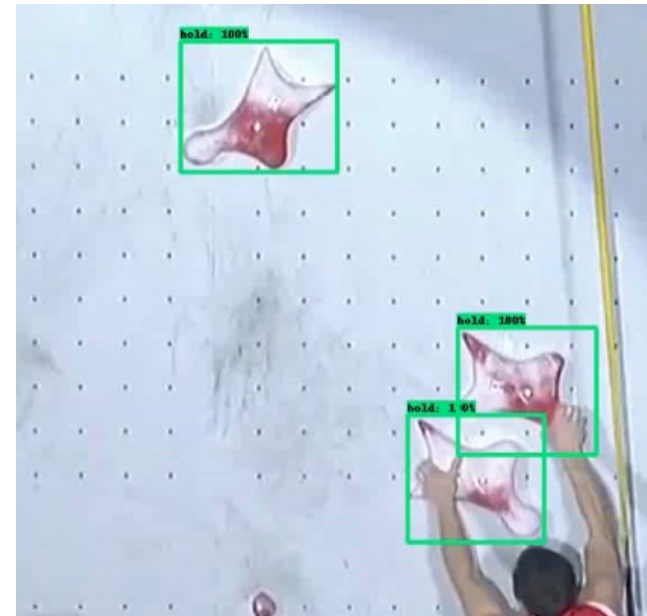
Next, the detections are tracked using **optical flow** and associated to the reference wall using **Coherent Point Drift**. (*Fig. 3*)

Finally, a **sequence of absolute transformations** is computed, cleaned, and smoothed. (*Fig. 4*)

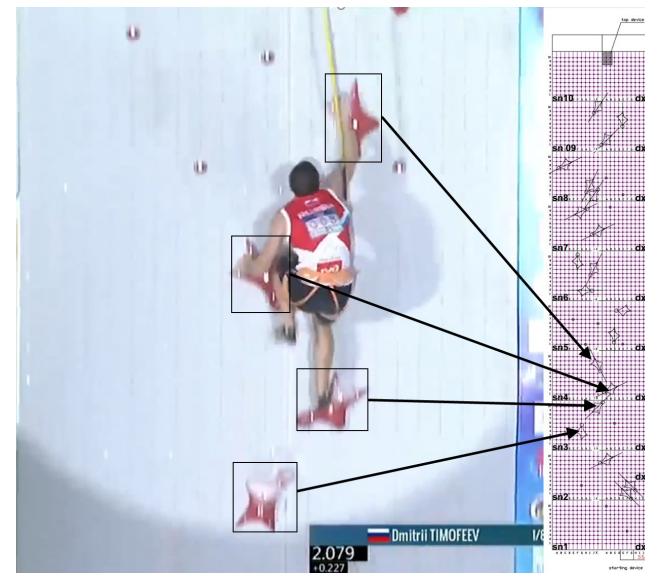
A **substitution study** is performed, evaluating multiple algorithm choices in each step of the pipeline. The resulting transformation sequence is compatible with any 2D skeleton representation, mapping the estimated pose to reference wall coordinates. The output is **an essential step in analyzing speed climbing performances without specialized equipment**.



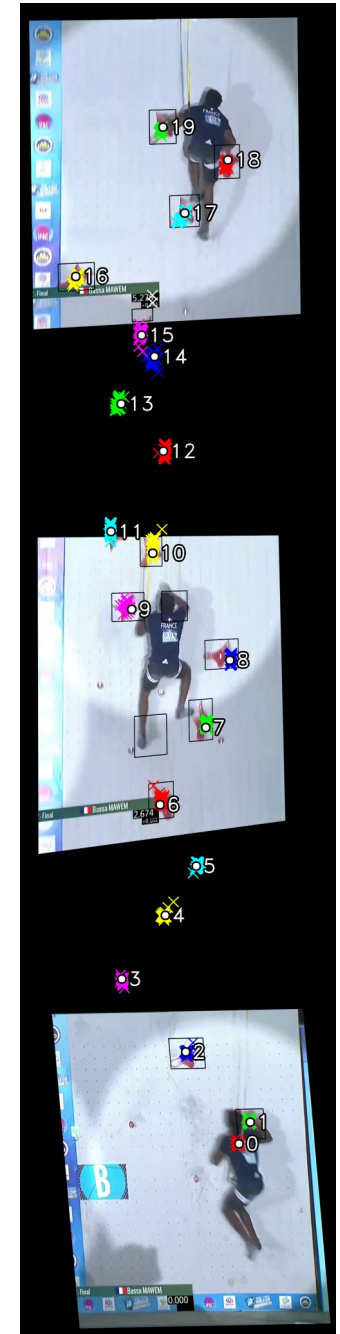
*Fig. 1: Climber overlaid with the detected skeleton, transformed from frame coordinates to wall coordinates*



*Fig. 2: Detected holds*



*Fig. 3: Hold association*



*Fig. 4: Visualisation of a computed transformation*