Articulated Motion Analysis from Motion Capture Data

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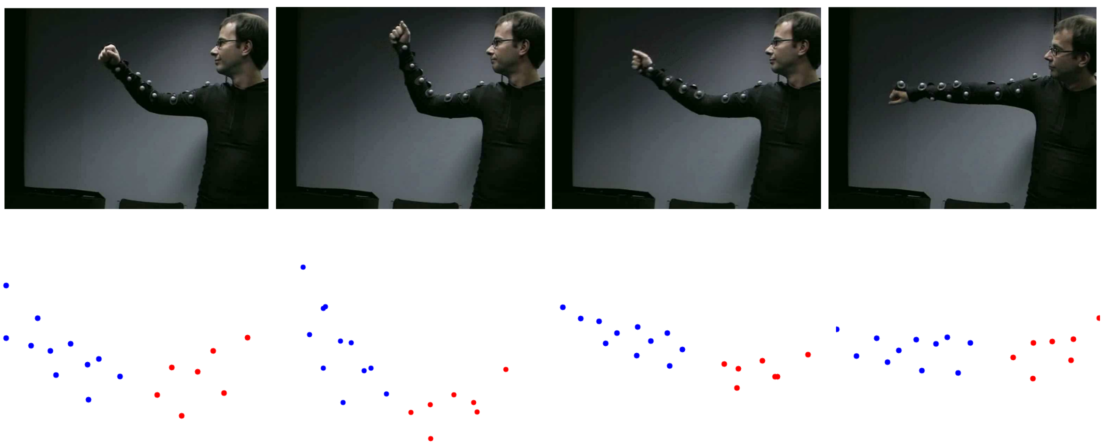
Computational models of human articulations are nowadays fundamental to perform an accurate analysis of the mechanical motion of a human body. Applications of these models span various fields, mainly in engineering and life science, where the analysis of human motion is crucial to fulfil accurate clinical analysis and credible animations of skeleton models.

Existing approaches to articulated motion analysis require a human operator to explicitly construct the model of the skeleton, including the definition and characterization of the joints. In opposition, we present computational methods to extract and model different joints from a generic subject, in an automatic way.

The input for our methods is a set of trajectories of 3D points, obtained from a motion capture system (MOCAP), as illustrated in the figure below. Due to the rigidity of the skeleton segments, these trajectories belong to different subspaces (of the space of all possible trajectories). Furthermore, the intersections of these subspaces define the properties of the joints (basically, the wider is the intersection, the more constrained is the joint). We use this knowledge to derive computationally simple algorithms that are able to infer joint properties from the trajectories of the 3D points.

Our model-free approach enables analyzing directly specific subjects, rather than using user-defined a priori models of the skeleton. Such data-driven models are useful for the analysis of human walk and/or the evaluation of the joint stress, for pathology detection. Also, these customized skeleton models, together with physiological muscular information, allow to accurately analyze high level performances in sports.



Four images and relative 3D information extracted from a MOCAP system.

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