Modeling 3D Trajectories using Bézier Curves with Application to Hand Motion

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A modeling approach for 3D trajectories with particular application to hand reaching motions is described. Bézier curves are defined by control points which have a convenient geometrical interpretation. A fitting method for the control points to trajectory data is described. These fitted control points are then linked to covariates of interest using a regression model. This allows the prediction of new trajectories and the ability to model the variability in trajectories.

The methodology is illustrated with an application to hand trajectory modeling for ergonomics. Motion capture was used to collect a total of about 2000 hand trajectories performed by 20 subjects to a variety of targets. A simple model with strong predictive performance and interpretability is developed. The use of hand trajectory models in the digital human models for virtual manufacturing applications is discussed.

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