Institut fuer Geometrie

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Subdivision on Manifolds: The Smoothness and Approximation Order Mysteries

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Abstract: Many new technological and scientific problems are generating new types of datasets which can be modelled as manifold-valued functions of time or space. A simple example is provided by human motion data, where a human body is represented in terms of all the joint rotations (eg elbow wrist, shoulder, hip, knee, neck.) Therefore, we are interested in efficient methods for approximating manifold-valued functions.

It is well-known that for traditional real-valued functions, spline interpolation, spline quasi-interpolation, or related methods can provide arbitrarily accurate and arbitrarily smooth approximants to any given smooth target function $F : R \to R$. If F is manifold-valued, i.e., if $F : R \to M$ where M is a smooth manifold, then the problem is much trickier. We shall show that a multiscale method, known as subdivision schemes, can furnish an elegant solution to this fundamental problem. A number of mysteries remain, and I shall present a number of numerical experiments pointing to several conjectures. This is joint work with Gang Xie.

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