

# A simple geometric algorithm to generate splines in Grassmann and Stiefel manifolds



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**Grupo** :: Geometria, Topologia e Aplicações

**Resumo** :: Stiefel and Grassmann manifolds have become geometrically elegant organizational tools for data applications that involve increasingly large-scale data sets, not only in terms of number of samples, but also in number of features per sample. This is the case for a wide range of computer vision applications such as dynamic textures, human activity modeling and recognition, and video-based face recognition. Due to its importance in such contemporary applications, efficient generalizations of iterative methods on Euclidean spaces to Stiefel and Grassmann manifolds have been frequently required. Our purpose here is to present a simplified geometric algorithm to generate interpolating splines on Grassmann and Stiefel manifolds, where position and orientation are required to change smoothly. Explicit expressions for geodesics in Grassmannians and quasi-geodesics in Stiefel manifolds are crucial for the spline construction. Each spline segment is computed using local data only. The

resulting spline is therefore designed as a combination of two components (left and right) and a smoothing function, responsible for guaranteeing the required degree of smoothness of the spline curve at the knot points.

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