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Connecting geodesics for the Stiefel manifold

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Several applications in optimization, image and signal processing deal with data that belong to the Stiefel manifold St(n, p), that is, the set of n × p matrices with orthonormal columns. Some applications, for example, the computation of the Karcher mean, require evaluating the geodesic distance between two arbitrary points on St(n, p). This can be done by explicitly constructing the geodesic connecting these two points. An existing method for finding geodesics is the leapfrog algorithm introduced by J. L. Noakes, which enjoys global convergence properties. We reinterpret this algorithm as a nonlinear block Gauss-Seidel process and propose a new convergence proof based on this framework for the case of St(n, p).

Co-auteur: VANDEREYCKEN, Bart

Orateur: SUTTI, Marco (University of Geneva)