Optimization on Manifolds for Models using Second Order Differences

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In many real life scenarios, measured data appears as values on a Riemannian manifold. For example in interferometric Synthetic Aperture Radar (InSAR) data is given as a phase, in electron backscattered diffraction (EBSD) as data items being from a quotient of the orientation group SO(3), and in diffusion tensor magnetic resonance imaging (DT-MRI) the measured data are symmetric positive definite matrices. These data items are often measured on a equispaced grid like usual signals and image but they also suffer from the same measurement errors like presence of noise or incompleteness. Hence there is a need to perform data processing tasks like denoising, inpainting or interpolation on these manifold-valued data.

In this talk we present variational models for these tasks involving discrete second order differences for manifold-valued data. To compute a minimizer of such a the model, we obtain a high-dimensional, possibly nonsmooth, optimization problem defined on a Riemannian manifold. We present algorithms to efficiently solve these problems and illustrate their performance.