A continuous-time perspective for modeling acceleration in Riemannian optimization

Aurelien Lucchi
University of Basel
aurelien.lucchi@unibas.ch

We propose a novel second-order ODE as the continuous-time limit of a Riemannian accelerated gradient-based method on a manifold with curvature bounded from below. This ODE can be seen as a generalization of the ODE derived for Euclidean spaces, and can also serve as an analysis tool. We analyze the convergence behavior of this ODE for different types of functions, such as geodesically convex, strongly-convex and weakly-quasi-convex. We demonstrate how such an ODE can be discretized using a semi-implicit and Nesterov-inspired numerical integrator, that empirically yields stable algorithms which are faithful to the continuous-time analysis and exhibit accelerated convergence.

Joint work with: Foivos Alimisis, Antonio Orvieto, Gary Bécigneul.