A discussion on Wasserstein geodesic extrapolation and the construction of variational second order scheme for Wasserstein gradient flows.

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We introduce a time discretization for Wasserstein gradient flows based on the classical Backward Differentiation Formula of order two. The main building block of the scheme is the notion of geodesic extrapolation in the Wasserstein space, which in general is not uniquely defined. We propose several possible definitions for such an operation, and we prove convergence of the resulting scheme to the limit PDE, in the case of the Fokker-Planck equation. For a specific choice of extrapolation we also prove a more general result, that is convergence towards EVI flows. Finally, we propose a variational finite volume discretization of the scheme which numerically achieves second order accuracy in both space and time.

Joint work with Andrea Natale (Inria Lille, France) and Gabriele Todeschi (Université Grenoble-Alpes, France).