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Parameter estimation in the eikonal equation

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Electrical waves propagate at the surface of the heart, the simplest modelling is to describe them as a front propagating according to the eikonal equation. The propagation velocity is anisotropic since it occurs along fibers. For medical diagnosis purposes, we aim at finding the source location and the parameters of the velocity, either from measurements directly on the surface of the heart, or through an observation operator that models an electrocardiogram. The parameters to be recovered are thus a point x on a manifold and a small number of scalar quantities. We implemented a least squares minimization using Gauss-Newton algorithm on a manifold. It is necessary to obtain Exp_x the exponential map based at x on the manifold (or more precisely its reciprocal Log_x). This quantity can be efficiently computed using techniques borrowed from the field of image synthesis. We illustrate our approach using sunthetic data.

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