Dynamic Magnetic Particle Imaging: Accurate reconstructions by simultaneous motion estimation

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Abstract

Magnetic Particle Imaging (MPI) is a relatively new pre-clinical tracer-based tomographic imaging method. It is non-invasive and doesn't use ionizing radiation, moreover it has high spatial and temporal resolution. Potential applications include dynamic imaging tasks as blood flow imaging and instrument tracking during interventions. However, the image reconstruction task poses a severely ill-posed inverse problem even for static tracer concentrations and we face an even more challenging problem in case of dynamic concentrations.
In this talk, we propose to solve the image reconstruction task jointly with motion estimation in between the time frames, as both processes endorse each other and motion estimates are of interest in many dynamic applications. We use different motion models depending on the specific application and start from a fairly general variational problem formulation. The problem is solved by primal-dual splitting using stochastic algorithms, multi-scale approaches and image warping. We present numerical results on simulated as well as measured data.