

Aggregated Motion Estimation for Imaging in Real-Time MRI

Housen Li*

Max Planck Institute for Biophysical Chemistry, Göttingen, Germany

housen.li@mpibpc.mpg.de

Markus Haltmeier

Department for Mathematics, University of Innsbruck, Innsbruck, Austria

markus.haltmeier@uibk.ac.at

Axel Munk

Institute for Mathematical Stochastics, Department of Mathematics and Computer

Science, Georg August University Göttingen and Max Planck Institute for

Biophysical Chemistry, Göttingen, Germany munk@math.uni-goettingen.de

Magnetic resonance imaging (MRI), as a non-invasive imaging technique, plays an important role in interventional, functional, metabolic and quantitative imaging studies of diverse tissues. The imaging speed is crucial in most of MRI application, which is fundamentally limited by physical and physiological constraints. The challenge lies in finding methods to reduce the amount of acquisitions without deteriorating the image quality. In pursuance of reasonable reconstructions, many techniques have been developed by incorporating into regularisations very strong *a priori* assumptions about the unknown object, which not only limits their usage but also introduces often undesirable artefacts in the image. By contrast, here we propose a novel approach based on an improved data consistency term to reconstruct dynamic MRI data with high temporal and spatial resolution. It integrates motions between nearby frames into the data consistency term to exploit multiple measurements for recovering one single frame. It is shown that the motion is not restricted to be affine or rigid, and can be estimated without additional measurements. Moreover, it adapts itself to parallel imaging by simultaneously determining proton density and coil profiles in a nonlinear formulation. Experimental results on moving phantom and *in vivo* measurements demonstrate the significant improvement in removing the temporal flickering artefacts and reducing the under-sampling artefacts for high acceleration factors.

Key Words: Inverse problems, parallel imaging, nonlinear inversion, aggregated sampling