

Motion Correction Techniques for Three-dimensional Magnetic Resonance Imaging Acquired with the Elliptical Centric View Order or the Shells Trajectory

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10 This thesis work developed several new motion correction algorithms to salvage motion-
corrupted three-dimensional (3D) clinical MR images retrospectively. A retrospective
motion correction method was developed for 3D MR images acquired with the elliptical-
centric (EC) view ordering. Rigid body motion in the y-z plane can be detected with the
use of a pair of cylindrical markers and corrected with k -space manipulation in the post-
15 processing. Both phantom and volunteer studies were performed to validate the method's
capability to reduce the in-plane motion artifacts by tracking the motion values through
the fiducial markers. The method was then extended into 3D arbitrary motion correction
through the implementation of a shells k -space trajectory, which uses a group of
concentric shells to cover the k -space. The shells trajectory is a true center-out trajectory,
20 which is a generalization of the EC view ordering. It also has motion correction
properties that enable the tracking and compensation of arbitrary rigid-body motion with
six degrees of freedom. Phantom and in vivo studies have shown that, when used in
conjunction with three point-markers, the method can effectively reduce motion artifacts.
Furthermore, an undersampling scheme was developed to reduce the acquisition time
25 with the shells trajectory. It was demonstrated that, when up to a two-fold acceleration
was achieved, the image quality is still reasonable with only minor artifacts.