4D MR Imaging of Respiratory Organ Motion and its Variability

Author(s) von Siebenthal, M.; Szekely, G.; Gamper, U.; Boesiger, P.; Lomax, A.; Cattin, Ph
Author(s) at UniBasel Cattin, Philippe Claude ;
Year 2007
Title 4D MR Imaging of Respiratory Organ Motion and its Variability
Journal Physics in medicine and biology
Volume 52
Number 6
Pages / **Article-Number** 1547-1564
This paper describes a method for 4D imaging, which is used to study respiratory organ motion, a key problem in various treatments. Whilst the commonly used imaging methods rely on simplified breathing patterns to acquire one breathing cycle, the proposed method was developed to study irregularities in organ motion during free breathing over tens of minutes. The method does not assume a constant breathing depth or even strict periodicity and does not depend on an external respiratory signal. Time-resolved 3D image sequences were reconstructed by retrospective stacking of dynamic 2D images using internal image- based sorting. The generic method is demonstrated for the liver and for the lung. Quantitative evaluations of the volume consistency show the advantages over one-dimensional measurements for image sorting. Dense deformation fields describing the respiratory motion were estimated from the reconstructed volumes using non-rigid 3D registration. All obtained motion fields showed variations in the range of minutes such as drifts and deformations, which changed both the exhalation position of the liver and the breathing pattern. The obtained motion data are used in proton therapy planning to evaluate dose deliverymethodologies with respect to theirmotion sensitivity. Besides this application, the new possibilities of studying respiratory motion are valuable for other applications such as the evaluation of gating techniques with respect to residual motion.
Publisher IOP Publishing
ISSN/ISBN 0031-9155
edoc-URL http://edoc.unibas.ch/dok/A5250275
Full Text on edoc No;
Digital Object Identifier DOI 10.1088/0031-9155/52/6/001
ISI-Number WOS:000244714300002
Document type (ISI) Article