# A Bayesian Framework for Estimating Respiratory Liver Motion from Sparse Measurements



**ID** 2250102
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**Year** 2012
**Title** A Bayesian Framework for Estimating Respiratory Liver Motion from Sparse Measurements
**Editor(s)** Yoshida, Hiroyuki; Sakas, Georgios; Linguraru, Marius George
**Book title** Abdominal Imaging : Computational and Clinical Applications
**Publisher** Springer
**Place of publication** Berlin, Heidelberg
**Pages** S. 207-214
**ISSN/ISBN** 978-3-642-28557-8 (E-Book) ; 978-3-642-28556-1 (Print)
**Series title** Lecture Notes in Computer Science
**Number** 7029
In this paper, we present an approach for modelling and predicting organ motion from partial information. We used 4D-MRI sequences of 12 subjects to build a statistical population model for respiratory motion of the liver. Using a Bayesian reconstruction approach, a pre-operative CT scan and a few known surrogate markers, we are able to accurately predict the position of the entire liver at all times. The surrogates may, for example, come from ultrasound, portal images captured during radiotherapy or from implanted electromagnetic beacons. In leave-one-out experiments, we achieve an average prediction error of 1.2 mm over sequences of 20 min with only three surrogates. Our model is accurate enough for clinically relevant treatment intervals and has the potential to be used for adapting the gating window in tumour therapy or even for tracking a tumour continuously during irradiation.

**Digital Object Identifier DOI** 10.1007/978-3-642-28557-8_26
**ISI-number** INSPEC:12618582