An Optimized Model-Based Tissue Segmentation Form Incomplete MR data

Abstract
Pixel values in MR images are linear combinations of contributions from multiple tissue fractions. The tissue fractions can be recovered using the Moore-Penrose pseudo-inverse if the tissue parameters are known, or can be deduced using machine learning. Acquiring sufficiently many source images may be too time consuming for some applications. In this paper, we show how tissue fractions can be recovered from partial k-space data, collected in a fraction of the time required for a full set of experiments. The key to reaching significant sample reductions is the use of regularization. As an additional benefit, regularizing the inverse problem for tissue fractions also reduces the sensitivity to measurement noise. Numerical simulations are presented showing the effectiveness of the method, showing three tissue types. Clinically, this corresponds to liver imaging, in which normal liver, fatty liver and blood would need to be included in a model, in order to get an accurate fatty liver ratio, because all three overlap in liver pixels (via partial voluming).