"Contextual Kinetics" - Bayesian Modelling of Dynamic Images

Volker J. Schmid

BioImaging group
Department of Statistics
LMU Münichen

Perfusion imaging aims to investigate the kinetics in human tissue in vivo. This is of interest in particular in oncology, cardiology and neurology. Using a contrast agent, a series of images is obtained, which show the distribution of contrast agent in the tissue over time. Similar data structures can be seen in other imaging modalities, e.g., in FRAP microscopy.

Such scans are typically analysed using kinetic models composed of a input function and a response function. In order to assess the tissue perfusion, one has to perform deconvolution or optimize the highly non-linear convolved model. The latter approach is typically prone to convergence problems, whereas deconvolution often is affected by numerical instability.

We present a Bayesian approach to model perfusion images. Prior knowledge about the context of the local kinetic models allows for a more robust estimation of these parameters and the computation of interval estimators. Here, context can refer to either spatial information, potentially including edges in the tissue. Patient or study specific information can be used, to develop a comprehensive model for the analysis of complete drug studies with perfusion imaging.