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Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

Methods and algorithms for the characterization of brain activity using fMRI measurements

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Diskussionsleitung: PD Dr. Joachim Deutscher

Understanding the brain function and monitoring its activity is of great importance, particularly for detecting and treating neurological diseases. However due to its inherent complexity and inaccessibility, many questions remain open. Thanks to the recent advances in neuroimaging, a diverse set of data is available. However, efficient methods and algorithms are required to interpret the data and extract useful information. This talk focuses on model-based methods proposed for the characterization of the hemodynamic response using functional Resonance Magnetic Imaging (fMRI) data. I will start by an efficient numerical procedure for calibrating the hemodynamic model, which consist of a regularized iterative method equipped with a Kalman filtering-type procedure. Then I will introduce a fractional model for the neurovascular coupling and describe an algorithm based on the modulating functions method to calibrate the model and estimate the unknown neural activity. Finally, I will present a spatiotemporal model of the hemodynamic response, which consists of a coupled wave PDE and infinite dimensional ODE system and propose an observer-based approach to estimate jointly relevant physiological parameters and the cerebral blood flow.