ASMRM & ICMRI 2020
November 03 - 04, 2020 Virtual Congress http://2020.ksmrm.org
ASMRM Korean Society of Magnetic Resonance in Medicine

MD-PhD Session

SY16-5

High Definition DCE MRI for Concurrent Estimation of Perfusion and Microvascular Permeability

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This work introduces a model-based, high-definition dynamic contrast enhanced (DCE) MRI for concurrent estimation of perfusion and microvascular permeability over the whole brain. A time series of reference-subtracted signals is decomposed into one component that reflects main contrast dynamics and the other one that includes residual contrast agents (CA) and background signals. The former is described by linear superposition of a finite number of basic vectors trained from an augmented set of data that consists of tracer-kinetic model driven signal vectors and patient-specific measured ones. Contrast dynamics is estimated by solving a constrained optimization problem that incorporates the linearized signal decomposition into the measurement model of DCE MRI and then combining the main component with the background-suppressed, residual CA signals. Simulations and experiments are performed to demonstrate the effectiveness of the proposed method in patients with brain cancer.

Keywords: High Definition, DCE MRI, Perfusion, Permeability