Diffuse optical imaging of the preterm neonate brain with a full-term neonate atlas model

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Abstract

Diffuse optical tomography (DOT) is a relatively convenient method for imaging the hemodynamic changes related to neuronal activity or injury in the brain cortex. Newborns can be imaged at bedside or while laying on their parent's lap, and the smaller brain and the thinner extracerebral layers increase the penetration of light into the brain.

The inverse problem of DOT image reconstruction is often solved in an atlas model of the head anatomy, meaning that the subject's head shape and sensor locations are combined with the inner anatomy from another individual or a population-level average. In newborns, the importance of the correspondence of the gestational ages of the imaged subject and the atlas model is highlighted due to the rapid brain growth and maturation during the last trimester of pregnancy.

In this talk, we observe how the usage of a full-term individual's atlas model affects the reconstruction of an activity simulated in a very preterm neonate's model. We use the Monte Carlo method as the forward solver, and present our approach for image reconstruction from frequency-domain amplitude and phase shift measurements.