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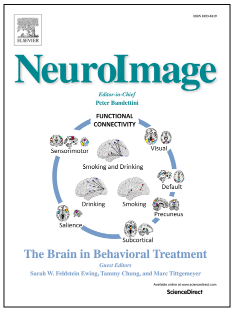

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A realistic, accurate and fast source modeling approach for the EEG forward problem

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Abstract

The aim of this paper is to advance electroencephalography (EEG) source analysis using finite element method (FEM) head volume conductor models that go beyond the standard three compartment (skin, skull, brain) approach and take brain tissue inhomogeneity (gray and white matter and cerebrospinal fluid) into account. The new approach should enable accurate EEG forward modeling in the thin human cortical structures and, more specifically, in the especially thin cortices in children brain research or in pathological applications. The source model should thus be focal enough to be usable in the thin cortices, but should on the other side be more realistic than the current standard mathematical point dipole. Furthermore, it should be numerically accurate and computationally fast. We propose to achieve the best balance between these demands with a current preserving (divergence conforming) dipolar source model. We develop and investigate a varying number of current preserving source basis elements n ($n = 1, \ldots, n = 5$). For validation, we conducted numerical experiments within a multi-layered spherical domain, where an analytical solution exists. We show that the accuracy increases along with the number of basis elements, while focality

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