Weighted sparsity regularization for solving the inverse EEG problem

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We study the potential of detecting brain activity in terms of dipoles using weighted sparsity regularization for a very specific choice of weighting matrix. The work is based on theoretical results that we have proven in previous studies that require modifications to fit into the classical EEG framework. More precisely, to represent a dipole with an arbitrary rotation at a given position, we need three basis dipoles. Our previous results guarantee recovery of any one of these basis dipoles, but not a linear combination of these. We will explain why this is the case before suggesting a remedy by introducing more than three dipoles at each position, i.e., a redundant basis (a frame). This will, in fact, provide a framework that is more in line with the theoretical assumptions needed to guarantee the recovery of a single dipole with arbitrary orientation. The performance of our method is demonstrated through several different experiments, and we illustrate that the method does not suffer from depth bias and has a low dipole localization error and low spatial dispersion. We will also show that the dipole localization error decreases with the addition of extra basis dipoles.

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