Sparse EEG Source Localization via Range Space Rotation

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We address the problem of sparse Electroencephalography (EEG) source localization. The dictionary matrix (Lead Field) of a realistic head model has high coherence, which indicate that there is no guarantee that we will get the desirable solution using sparse signal recovery. In spite of the high coherence in EEG dictionary matrix, we can estimate the underlying source signal if the problem satisfies the Range Space Property (RSP). In this paper, we propose an algorithm that uses an initial estimate of the sparse solution, to rotate the range of the sensing matrix transpose and obtain high quality source localization. We derive the conditions that the rotation matrix should meet in order to make the unique L-1 minimization solution match the actual source signal in the sense of the L-0 norm. We also validate our algorithm using simulation and real EEG experiment, and compare it with other methods that have been used for EEG source localization.