Maximum Likelihood Estimation Applied to Multiepoch MEG/EEG Analysis

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Magnetoencephalography (MEG) is a relatively new method of recording brain activity, while its electrical counterpart, electroencephalography (EEG), has been known and used for over seventy years. In this talk, I will first present an overview of MEG, emphasizing its advantages and shortcomings. As might be expected, MEG signals are extremely weak and are contaminated by noise and interference, resulting in very low signal-to-noise ratio (SNR). In evoked response experiments, averaging is used to improve the SNR. However, it is well known that the noise in such experiments, while being independent from measurement to measurement, is not spatially or temporally white. Hence appropriate processing can exploit this to improve SNR. We have developed a novel maximum likelihood algorithm for estimating the repeatable component of evoked responses. The effectiveness of the approach lies in its ability to exploit differences in the covariance structure of the averaged and the single-trial data while making very few assumptions. We demonstrate the effectiveness of the algorithm using simulated and real visual evoked MEG recordings.