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PDF文档

基于最小模估计及Tikhonov正则方法的脑磁源重建

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脑磁图(magnetoencephalogram,MEG)研究中的磁源分布图象重建,属于不适定问题,需要引入合适的先验约束,把它转化为适定问题。采用非参数的分布源模型,磁源成象问题即为求解一病态的欠定的线性方程组。这里采用的方法是建立在最小模估计和Tikhonov正则的基础上,从数学算法本身及相关的解剖学和神经生理学的信息,对解空间加以限制,提出了区域加权算子,再结合深度加权,以期得到合理的神经电流分布。通过仿真实验表明能得出理想的重建结果,同时讨论了该方法的局限性以及下一步的工作方向。

MAGNETOENCEPHALOGRAPHIC SOURCE RECONSTRUCTION BASED ON MINIMUM-NORM ESTIMATION AND TIKHONOV REGULARIZATION TECHNIQUE

Magnetoencephalographic source reconstruction is physically ill-posed, regularization is therefore necessary adding a priori constraint to make it well-posed. Using distributed source model, this imaging problem can be formulated as an ill-conditioned and highly underdetermined linear inverse problem. In this paper, the proposed method is based on the minimum norm estimation with Tikhonov regularization, imposing constraints assumptions on the solution from the view-point of the mathematical nature and anatomical and physiological knowledge. In order to obtain unique and physiologically justified solution, an operator of region weighing is introduced, meanwhile incorporating the depth weighing in the reconstruction procedure. Computer experiments show the method presented here is promising. Finally, limitations of the proposed method and future work are discussed.

关键词

磁源重建(Magnetoencephalographic source reconstruction); 不适定(Ill-posed); 最小模估计(Minimum-norm estimation); Tikhonov正则化(Tikhonov regularization); 区域加权(Region weighing)