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خلاصه مقاله:

An integrated modelmagnetoencephalography (MEG) and functional Magnetic Resonance Imaging (fMRI) is proposed. In the proposed model, MEG and fMRI outputs are related to the corresponding aspects of neural activities in a voxel. Post synaptic potentials (PSPs) and action potentials (APs) are two main signals generated by neural activities. In the model, both of MEG and fMRI are related to the PSPs without any correlation to the APs. Each PSP is modeled by the direction and strength of its current flow, which are treated as random variables. The overall neural activity in each voxel is used for equivalent current dipole in MEG and as input of the extended Balloon model for producing Blood Oxygen Level Dependent (BOLD) signal in fMRI. The proposed model shows possibility of detecting activation by fMRI in a voxel while the voxel is silent for MEG and vice versa. This is according to the fact that fMRI signal reflects the sum of PSPs' strengths (independent of their directions) but MEG signal reflects the vector sum of the PSPs (which depends on their directions). The model also shows that the crosstalk from neural activities of adjacent voxels in fMRI and properties of the inverse problem in MEG generate different spatial responses in the two modalities. We use real auditory MEG and Fmri datasets from 2 normal subjects to estimate the parameters of the model. Goodness of the real data our model shows the possibility of using the proposed model to simulate realistic datasets.

کلمات کلیدی:

Blood Oxygen Level Dependent (BOLD); Equivalent Current Dipole (ECD); Post Synaptic Potential (PSP); Action Potential (AP); extended Balloon model

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