An extended Kalman filtering approach for the estimation of human head tissue conductivities by using EEG data: a simulation study

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Abstract

In this study, we propose an extended Kalman filter approach for the estimation of the human head tissue conductivities in vivo by using electroencephalogram (EEG) data. Since the relationship between the surface potentials and conductivity distribution is nonlinear, the proposed algorithm first linearizes the system and applies extended Kalman filtering. By using a three-compartment realistic head model obtained from the magnetic resonance images of a real subject, a known dipole assumption and 32 electrode positions, the performance of the proposed method is tested in simulation studies and it is shown that the proposed algorithm estimates the tissue conductivities with less than 1% error in noiseless measurements and less than 5% error when the signal-to-noise ratio is 40 dB or higher. We conclude that the proposed extended Kalman filter approach successfully estimates the tissue conductivities in vivo.