Avoiding the Inverse Crime in the Inverse Problem of Electrocardiography

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The Inverse Problem of electrocardiography (IPE) can be summarized as the characterization of the electrical behavior of the heart using measurements obtained by electrodes that are not directly in contact with the cardiac surfaces. Given a data ensemble provided by electrodes, the solution of the IPE requires the design of a mathematical procedure that matches a theoretical model of estimated measurements with that ensemble of data. Earlier tests of the inversion procedure were often made with synthetic data using the same model for computing both predicted and estimated measurements, yielding into an unreal and optimistic result; this is called Inverse Crime. In practice, the test of an inversion process avoiding the Inverse Crime could be done using a model for the numerically produced simulated data and a different one to invert the data. This work shows the behavior of a procedure designed to characterize regions in the heart with a lack of blood supply (ischemia) avoiding the Inverse Crime. Realistics and experimentally supported models constitute the forward procedure (the Luo-Rudy model for the electrical activity and the volume conductor theroy for simulating the electrode measurements) while a simple phenomenological model (the two-current model proposed by Mitchell and Schaeffer) is used during the inversion process.