Jiang, Mingfeng; Wang, Yaming; Xia, Ling; Liu, Feng; Jiang, Shanshan; Huang, Wenqing

The combination of self-organizing feature maps and support vector regression for solving the inverse ECG problem.  
(English) Zbl 1381.92056

Summary: Noninvasive electrical imaging of the heart aims to quantitatively reconstruct transmembrane potentials (TMPs) from body surface potentials (BSPs), which is a typical inverse problem. Classically, electrocardiography (ECG) inverse problem is solved by regularization techniques. In this study, it is treated as a regression problem with multi-inputs (BSPs) and multi-outputs (TMPs). Then the resultant regression problem is solved by a hybrid method, which combines the support vector regression (SVR) method with self-organizing feature map (SOFM) techniques. The hybrid SOFM-SVR method conducts a two-step process: SOFM algorithm is used to cluster the training samples and the individual SVR method is employed to construct the regression model. For each testing sample, the cluster operation can effectively improve the efficiency of the regression algorithm, and also helps the setup of the corresponding SVR model for the TMPs reconstruction. The performance of the developed SOFM-SVR model is tested using our previously developed realistic heart-torso model. The experiment results show that, compared with traditional single SVR method in solving the inverse ECG problem, the proposed method can reduce the cost of training time and improve the reconstruction accuracy in solving the inverse ECG problem.

MSC:
92C55 Biomedical imaging and signal processing
62H30 Classification and discrimination; cluster analysis (statistical aspects)

Keywords:
support vector regression; self-organizing feature map; inverse ECG problem; transmembrane potentials

Software:
LIBSVM; GPUSVM

Full Text: DOI

References:


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.