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Direct and Simultaneous Estimation of Cardiac Four Chamber Volumes by Multioutput Sparse Regression

Xiantong Zhen, Heye Zhang, Ali Islam, Mousumi Bhaduri, Ian Chan, Shuo Li

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**Highlights**

- We achieve direct and simultaneous cardiac four chamber volume estimation, which avoids unreliable segmentation and enables more accurate and convenient whole heart functional analysis. The method can be conveniently extended to other clinical data prediction for automated diagnosis;
- We formulate volume estimation as a multi-output regression problem, which enables volume estimation to be conducted in a unified framework rather than as specific problems. Traditional challenging tasks, e.g., model personalization, can be reformulated as multi-output regression problems and solved efficiently in the same way;
- We propose multi-output sparse latent regression (MSLR) to achieve direct and simultaneous four chamber volume estimation. The MSLR can jointly handle the highly non-linear relationship between image appearance and four chamber volumes while capturing the interdependency of four chambers;
- We have conducted extensive experimental evaluation on both MR and CT datasets, which validates the generality of the proposed methods for direct and simultaneous cardiac four-chamber volume estimation. The success of our method on both MR and CT in this work will change the way to handle multi-modality image analysis and inspire new clinical applications.

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