通道扩维与FastICA算法相融合用于BCI运动想象脑电信号识别

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摘 要:FastICA是独立成分分析法(ICA)中的一种快速算法,因其收敛速度快而备受关注.本文将基于负熵判据的FastICA算法应用于运动想象脑电信号的识别中,并根据ICA算法的特点设计了数据处理的实验流程.针对2003年国际BCI竞赛data set III中通道数较少的问题,提出一种通道扩维算法,在不增加采集电极数的情况下,可成倍地增加相似通道的数量,提供更丰富的脑电信息.将通道扩维与FastICA算法相融合应用于国际BCI竞赛数据的处理中,实验结果表明通道扩维算法提升了FastICA算法的分类准确率,同时FastICA算法处理信息速度较快的特点也弥补了通道扩维算法耗时较多的缺陷.

关键词:独立成分分析;负熵;通道扩维;脑机接口
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Combination of the Channel Dimension Expansion and FastICA for the Recognition of BCI Motor Imagery EEG

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Abstract: As a fast algorithm of independent analysis (ICA), FastICA is drawing attention due to its rapid convergence speed. Based on the application of FastICA algorithm with the criterion of neg-entropy to the recognition of motor imagery electroencephalogram (EEG), and the characteristics of ICA, this paper designs the experimental process for data treatment. Concerning the problem of few channels in the data set III in the BCI Competition 2003, a channel dimension expansion algorithm is put forward in this paper, which can exponentially increase the number of similar channels and provide more brain electricityinformation without increasing the number of electrodeplates to be collected. In this paper, the channel dimension expansion is combined with the algorithm of FastICA to be applied to the data treatment of BCI Competition. The experiment results suggest that the channel dimension expansion algorithm can improve the classification accuracy of FastICA, and that the fast information treatment of FastICAcan make up for the time-consuming side of the channel dimension expansion algorithm.

Key words: independent component analysis (ICA); neg-entropy; channel dimension expansion; brain-computer interface (BCI)

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