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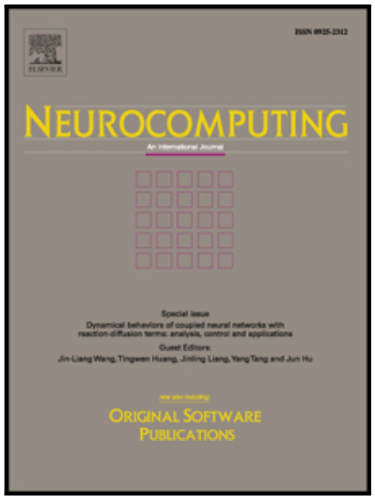

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Discrete ripplet-II transform and modified PSO based improved evolutionary extreme learning machine for pathological brain detection

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Abstract

Recently there has been remarkable advances in computer-aided diagnosis (CAD) system development for detection of the pathological brain through MR images. Feature extractors like wavelet and its variants, and classifiers like feed-forward neural network (FNN) and support vector machine (SVM) are very often used in these systems despite the fact that they suffer from many limitations. This paper presents an efficient and improved pathological brain detection system (PBDS) that overcomes the problems faced by other PBDSs in the recent literature. First, we support the use of contrast limited adaptive histogram equalization (CLAHE) to enhance the quality of the input MR images. Second, we use discrete ripplet-II transform (DR2T) with degree 2 as the feature extractor. Third, in order to reduce the huge number of coefficients obtained from DR2T, we employ PCA+LDA approach. Finally, an improved hybrid learning algorithm called MPSO-ELM has been proposed that combines modified particle swarm optimization (MPSO) and extreme learning machine (ELM) for segregation of MR images as pathological or healthy. In MPSO-ELM, MPSO is utilized to optimize the hidden node parameters (input weights and hidden biases) of single-hidden-layer feedforward neural networks (SLFN) and the output weights are determined analytically. The proposed method is contrasted with the current state-of-the-art methods on three benchmark datasets. Experimental results indicate that our proposed scheme brings potential improvements in terms of classification accuracy and number of features. Additionally, it is observed that the proposed MPSO-ELM algorithm achieves higher accuracy and obtains compact network architecture compared to conventional ELM and BPNN classifier.

Keywords: Computer-aided diagnosis (CAD), Magnetic resonance imaging (MRI), Discrete ripplet-II transform (DR2T), Extreme learning machine (ELM), Modified PSO (MPSO)

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