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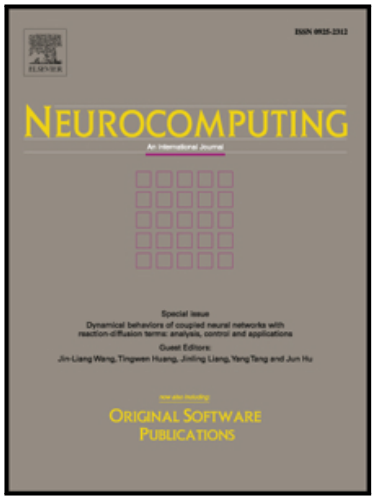

The Augmented Complex-Valued Extreme Learning Machine

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The Augmented Complex-Valued Extreme Learning Machine ☆

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Abstract

As an emerging learning model, extreme learning machine (ELM) has attracted more and more attention due to its fast learning and powerful data processing ability. By extending ELM to complex domain, complex ELM (CELM) has been proposed to process complex-valued data. However, the existing CELMs can not fully capture the second-order statistics of complex signals, thus providing only suboptimal solutions in real world applications when dealing with noncircular (or improper) signals. To this end, this paper proposes two augmented CELM models by incorporating the conjugate information of the complex input and the hidden layer, respectively. The approximation capability and the ability to capture the second-order statistics of signals are theoretically analysed. Moreover, based on Wirtinger calculus, the corresponding regularized models are derived for the sake of overcoming the possible overfitting problem. The superiority of the proposed models is verified by simulation results.

Keywords: Complex extreme learning machine; Widely linear estimation; Noncircular signals; Augmented statistics; Approximation capability;

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