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EDITORIAL

Editorial

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This special issue puts together 15 papers selected carefully from 93 submissions to the international symposium on extreme learning machines (ELM2011, http://www.extreme-learning-machines.org/ELM2011) held in Hangzhou, China, on 6–8 December 2011. ELM, as an emergent technique for training feed-forward neural networks without iterations, has great potential to deal with large-scale regression and classification tasks and overcomes many challenges faced by other computational intelligence methods such as feed-forward neural networks and support vector machines. This symposium provides a forum for academics, researchers and engineers to share and exchange research and development experience on both theoretical studies and practical applications of ELM techniques. All papers are strictly peer reviewed, and most of them are reviewed more than 3 times, which ensures the paper quality. The following is a categorized description on the content of this special issue.

1. One paper discusses the properties inherent in ELM with experimental analysis.
   The paper "*A study on random weights between input and hidden layers in extreme learning machine*" authored by Ran Wang, Sam Kwong, and Xizhao Wang, investigates the impact of random weights during the training of ELM. It focuses on the randomness of weights between input and hidden layers, and the dimension change from input layer to hidden layer. Experimental results show that for many classification and regression problems, the dimension increase caused by random weights in ELM has a performance better than the dimension increase caused by some kernel mappings.

2. Four papers try to extend the learning mechanism of the original ELM algorithm.
   In the paper "*Variable Activation Function Extreme Learning Machine Based on Residual Prediction Compensation*", for solving the problem that ELM algorithm uses fixed activation function and cannot be residual compensation, a new learning algorithm called variable activation function extreme learning machine based on residual prediction compensation is proposed by Gaitang Wang, Ping Li and Jiangtao Cao. In the learning process, the proposed method adjusts the steep degree, position and mapping scope simultaneously. Simulation results verified the effectiveness and feasibility of the method on some datasets.
   The paper "*Evolutionary Selection Extreme Learning Machine Optimization for Regression*" authored by Guorui Feng, Zhenxing Qian and Xinpeng Zhang, refers the idea of evolutionary algorithm to seek an alternative mechanism to learn the input connections of single-hidden layer feed-forward network. The hidden nodes in original ELM model are ranked as their weights. The hidden nodes with lower weights are put in a candidate reservoir and the new hidden nodes are generated using the fitness-proportional selection and recombining evolutionary selection ELM (ES-ELM).

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The verification on the large-scale dataset regression shows that the regression performance is better than the traditional ELM and Bayesian ELM (BELM) under less cost gain.

In the paper "*Dynamic Ensemble Extreme Learning Machine Based on Sample Entropy*" by Junhai Zhai, Hongyu Xu, and Xizhao Wang, a dynamic ensemble extreme learning machine (DE-ELM) based on sample entropy is proposed, which can alleviate to some extent the problems of instability and over-fitting, and increase the prediction accuracy. In DE-ELM, N different training subsets are generated from training set using Adaboost, and a special ELM classifier is trained on each of training subsets. In this way, N classifiers can be obtained in all. Finally, based on the strategy of dynamic ensemble with sample entropy, an unseen instance can be classified.

Authored by Jianwei Zhao, Dong Sun Park, Joonwhoan Lee, and Feilong Cao, the paper "*Generalized Extreme Learning Machine Acting on a Metric Space*" focuses on the functional data learning by means of the generalized single-hidden layer feed-forward neural networks (GSLFNs) acting on the metric spaces. Three learning algorithms are designed to train GSLFNs: Hilbert parallel over-relaxation back-propagation (H-PORBP) algorithm, v-generalized support vector regression (v-GSVR) algorithm and generalized extreme learning machine (G-ELM) algorithm. The proposed G-ELM algorithm can extend the applications of original ELM to some metric spaces.

3. Five papers introduce the successful applications of ELM in image processing fields, including face recognition, fingerprint recognition and image segmentation.

   In the paper "*Face Recognition* via *Local Preserving Average Neighborhood Margin Maximization and Extreme Learning Machine*" by Xiaoming Chen, etc., average neighborhood maximum margin (ANMM) is extended to locality preserving average neighborhood margin maximization (LPANMM) to maintain the local structure on the original data manifold in the discriminant feature space. Experimental results on some face databases demonstrate that the scheme LPANMM/ELM can achieve better performance than ANMM and other traditional schemes for face recognition.

   In the paper "*Face recognition with Lattice Independent Component Analysis and Extreme Learning Machines*", the authors focus on two aspects of the face recognition: feature extraction and classification. A two component system, introducing lattice-independent component analysis (LICA) for feature extraction and ELM for classification, is proposed. The LICA-ELM system has been tested against state-of-the-art feature extraction methods and classifiers, outperforming them when performing cross-validation on four large unbalanced face databases.

   Authored by Kwontaeg Choi, Karann Toh, Youngjung Uh, and Hyeran Byun, the paper "*Service Oriented Architecture based on Biometric using Random Features and Incremental Neural Networks*" proposes an online sequential extreme learning machine (OSELM)-based service-oriented architecture where the training and classification tasks are used by millions of users via internet connection. In the designed system, the issues of template protection, accuracy and efficiency are considered via extracting both global and local features and controlling the sparsity of random bases without training. The experimental results show that the proposed method is robust over severe local deformation with efficient computation for simultaneous transactions.

   The paper "*Intelligent Fingerprint Quality Analysis using Online Sequential Extreme Learning Machine"* authored by Shanjuan Xie, Jucheng Yang, Hui Gong, Sook Yoon, and Dongsun Park, proposes an effective fingerprint quality analysis approach based on the online OS-ELM. The proposed method is based not only on basic fingerprint properties but also on the physical properties of the various sensors. Instead of splitting a fingerprint image into traditional small blocks, direction-based segmentation using the Gabor filter is used. The selected feature set is robust against various factors responsible for quality degradation and can satisfy the requirements of different types of capture sensors. The experimental comparisons with the traditional methods show that the proposed method can achieve the higher fingerprint recognition quality.

   In the paper "*Color image segmentation by fixation-based active learning with ELM*", Chen Pan, Dong Sun Park, Huijuan Lu, and Xiangping Wu present a novel framework for color image segmentation by fixation-based active learning with ELM. This idea involves fixation-based sampling and redefining the boundary of object region. The former is utilized to get a few positive and negative samples and the latter is to provide more accurate samples/pixels that involve object and background for the next training phrase. The proposed algorithm based on ELM runs faster than state-of-the-art method, and can cope with the complexity and uncertainty of the scene.

4. Five papers use ELM to reduce the computational load in fields of bioinformatics technology, human-centric pervasive applications, and real time strategy games.

   Authored by Jian Tang, Dianhui Wang, and Tianyou

Chai, the paper "*Predicting Mill Load Using Partial Least Squares and Extreme Learning Machines*" aims to develop a computational intelligence approach for predicting the mill load. Extreme learning machines are employed as learner models to implement the map between frequency spectral features and the mill load parameters. The inputs of the ELM model are reduced features, which are extracted and selected from the vibration frequency spectrum of the mill shell using partial least squares (PLS) algorithm. The experimental results indicate that the reduced feature-based ELM can perform reasonably well at mill load parameter estimation, and it outperforms other learner models in terms of generalization capability.

The paper "*Computational Localization of Transcription Factor Binding Sites Using Extreme Learning Machines*" authored by Dianhui Wang and Hai Thanh Do aims to develop an ELM-based ensemble classifier for transcription factor binding sites (TFBSs) location prediction in DNA sequences. In order to achieve the computational localization more accurately, three key operations are included: extracting the specific features, generating dummy positives, and constructing an ensemble classifier. Comparative studies demonstrate that the ELM-based ensemble classifier outperforms the other learner models in terms of overall prediction accuracy and computational complexity.

The work "*Update Strategy Based on Region Classification Using ELM for Mobile Object Index*" introduced by Botao Wang, Guoren Wang, Jiajia Li and Biao Wang, designed a new mobile object indexing architecture which incorporates the statistical information of the regions covered by the mobile objects into feature vectors, uses R-tree to the occupied regions, and classify the regions with ELM. The experiments demonstrate that the proposed update strategy based on region classification using ELM can achieve higher performance with respect to I/O operations. Compared to the strategy without region classification, the proposed method can reduce the number of I/O operations more than 80%.

Authored by Yiqiang Chen, Zhongtang Zhao, Shuangquan Wang, and Zhenyu Chen, the paper "*Extreme Learning Machine Based Device Displacement Free Activity Recognition Model*" proposes a fast, robust and device displacement free activity recognition model to solve mobile device-based activity recognition. The new method integrates principal component analysis (PCA) and ELM to handle the variations of device locations and orientations. The experimental simulations indicate that their developed model can obtain the fast adaptation capability and good recognition performance.

In the paper "*RTS Game Strategy Evaluation Using Extreme Learning Machine*", the authors proposed an ELM model for real time strategy game strategy evaluation. The ELM model is trained based on real data to obtain the combined power of units in different types. Experimental results show that ELM is fast and effective in evaluating the unit generation strategies.

The Guest Editors would like to take this opportunity and express their sincere thanks to the reviewers for their detailed comments as well as constructive suggestions on how to improve the quality of the manuscripts. We would like to thank the Editor-in-Chief of Soft Computing Journal for the encouragement, support and guidance during the realization of this special issue.