Editorial

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The purpose of this special issue is to collect excellent articles on innovative computational intelligence for knowledge representation and learning. The papers in this issue are extended versions of selected papers presented at 2017 IEEE 10th International Workshop on Computational Intelligence and Applications (IEEE IWCIA2017), which was held in Hiroshima, Japan by the sponsorship of the IEEE Systems, Man and Cybernetics Society (SMC) Hiroshima Chapter. The IWCIA covers the broad spectrum of research fields ranging from computational intelligence methodologies such as deep learning, neural networks, evolutionary computation, etc. to their practical applications like knowledge acquisition or data prediction from big data. High quality technical papers were presented at IEEE IWCIA2017, and the seven papers were selected from among all the accepted papers for this special issue. To provide readers with a quick overview of the seven papers, a brief summary for each of them is presented as below.

1 'Fast training of adaptive structural learning method of deep learning for multi modal data' by S. Kamada and T. Ichimura

   This paper proposes an adaptive structural learning method for multi modal data which consists of two or more kinds of data such as a pair of image and text of giving an explanation of the image. The main characteristics of the proposed method is to modify the squared array of the multi modal data, according to the similarity of input-output pattern of adaptive structural learning method of deep belief network (DBN). This paper conducted some experiments to show that the computational time of deep learning decreases by their method.

2 'Time series classification using MACD-histogram-based recurrence plot' by K. Tamura and T. Ichimura

   Following three simple but important things are focused to consider time series classification; time series representation, distance measurement, and assignment strategy. This paper proposes a new time series representation for the time series classification utilising the recurrence plot technique which is developed by combining moving average convergence divergence (MACD) histogram-based recurrent plot (MHRP). Numerical experiments are conducted to show the proposed classifier outperforms other existing methods.

3 'A generative model approach for visualising convolutional neural networks' by M. Kobayashi, M. Suganuma and T. Nagao

   Convolutional neural networks (CNN) show outstanding performance in various tasks. But the models are regarded as black-box systems since their network structure is too deep and complex to interpret functions of the respective units. Authors have proposed a new visualisation method based on generative adversarial networks (GAN) to observe how a CNN works. By some experiments, the authors showed that the generator of the GAN can produce recognisable images that activate particular units in the CNN. The authors also evaluated the correlation between the trustworthiness of the CNN and the visualisation quality of the proposed method.

4 'Search performance analysis of qubit convergence measure for quantum-inspired evolutionary algorithm introducing on maximum cut problem' by Y. Moriyama, I. Iimura and S. Nakayama

Quantum-inspired evolutionary algorithm (QEA) is an evolutionary method incorporating principles of quantum computation, where each gene is represented by a quantum bit in superposition of 0 and 1. To keep a good balance between diversification and intensification of search is an important issue for evolutionary computation. Authors have proposed a new measure for estimating a convergence degree of search and an initialisation process based on the convergence rate using Noah's ark strategy, where any individuals in the subpopulation are initialised except the best individual. The proposed method can maintain the diversity of the population for escaping from local minima. The authors showed the effectiveness of the proposed method in several maximum-cut problems.

5 'Mining non-redundant recurrent rules from a sequence database' by S. Yoon and H. Seki

Mining sequential patterns from a sequence database is one of the most attractive topics in the big-data era, because this technique covers a broad range of application areas. This paper proposes a new algorithm for extracting non-redundant recurrent rules, called Loop-fused NR^3 ($LF - NR^3$). To make extracting rules from a sequence database more efficient, the new algorithm utilises loop fusion that is a familiar program transformation. The authors explain the detailed algorithm and also show experimental results on synthetic and real world datasets. This technique has a potential that can be applied for other algorithms of sequence mining.

6 'Acquisition of characteristic sets of block preserving outerplanar graph patterns by a two-stage evolutionary learning method for graph pattern sets' by F. Tokuhara, T. Miyahara, T. Kuboyama, Y. Suzuki and T. Uchida

This paper proposes a learning method for acquiring characteristic sets of block preserving outerplanar graph patterns by a two-stage evolutionary learning method from positive and negative outerplanar graph data with reference to a specific phenomenon. In this paper, some numerical experiments using real outerplanar graph data of chemical compounds having a field label about an antiviral screen result from NCI database (1999) are conducted. The experimental results indicate that the proposed method successfully obtains characteristic sets of block preserving outerplanar graph patterns, which have higher fitness than single bpo-graph patterns obtained by the previous methods.

7 'Characteristics of contrastive Hebbian learning with pseudorehearsal for multilayer neural networks on reduction of catastrophic forgetting' by M. Hattori and S. Nakano

Learning process on neural networks when data is added sequentially encounters catastrophic forgetting. Catastrophic forgetting is one of the most important problems to improve learning process on neural networks, because the characteristics of data change dynamically. The authors apply the pseudorehearsal method to multilayer neural networks with weak feedback connections trained by the contrastive Hebbian learning (CHL) algorithm to prevent performance degression.

The experimental results using benchmark datasets show that CHL with pseudorehearsal can contribute to reduce catastrophic forgetting. This technique has a great impact on learning process on neural networks.

We sincerely hope that the above seven papers provide the readers with state-of-the-art information of their interest, and this issue will also bring their attention to the IEEE IWCIAs.

We wish to express our gratitude to the people who make this special issue possible. First, we would like to thank all the reviewers for their timely and thoughtful comments on the papers. Of course, we would like to thank all the authors for providing excellent papers and modifying them based on the reviewers' comments. Finally, we gratefully acknowledge the support of Professor George A. Tsihrintzis, the Editor-in-Chief of this journal, for giving us the opportunity to compile this special issue.