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## **Editorial: Innovative computational intelligence methods for data sciences and applications**

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### **Takumi Ichimura**

Faculty of Management and Information Systems,  
Prefectural University of Hiroshima,  
1-1-71, Ujina-Higashi, Minami-ku,  
Hiroshima 731-8558, Japan  
Email: [ichimura@pu-hiroshima.ac.jp](mailto:ichimura@pu-hiroshima.ac.jp)

### **Akira Hara\* and Keiichi Tamura**

Graduate School of Information Sciences,  
Hiroshima City University,  
3-4-1, Ozuka-Higashi, Asa-Minami-ku,  
Hiroshima 731-3194, Japan  
Email: [ahara@hiroshima-cu.ac.jp](mailto:ahara@hiroshima-cu.ac.jp)  
Email: [ktamura@hiroshima-cu.ac.jp](mailto:ktamura@hiroshima-cu.ac.jp)  
\*Corresponding author

**Biographical notes:** Takumi Ichimura is a Professor with the Faculty of Management and Information Systems, Prefectural University of Hiroshima, Hiroshima, Japan. He is also the Director of Community Liaison Center in Prefectural University of Hiroshima for promoting cooperation among industry, government and universities. He established Advanced Artificial Intelligence Project Research Center in Prefectural University of Hiroshima. He received his ME and DE in Engineering at the Toin University of Yokohama, Japan, in 1994 and 1997, respectively. His current research interests are deep learning architecture of AI and its data analysis through internet of things. He served as the Chair of IEEE SMC Hiroshima Chapter from 2011 to 2014.

Akira Hara received his BEng, MEng, and PhD in Engineering from the Tokyo Institute of Technology, Tokyo, Japan, in 1997, 1999, and 2002, respectively. He is presently an Associate Professor in the Department of Intelligent Systems, Graduate School of Information Sciences, Hiroshima City University, Hiroshima, Japan. His areas of interest are evolutionary computation and swarm intelligence. He has served as the Chair of IEEE SMC Hiroshima Chapter from 2015.

Keiichi Tamura received his BEng, MEng, and PhD in Information Science from Kyushu University, Fukuoka, Japan, in 1998, 2000, and 2005, respectively. He is presently an Associate Professor in the Department of Intelligent Systems, Graduate School of Information Sciences, Hiroshima City University, Hiroshima, Japan. His research interests include data engineering, data mining, computational intelligence and high performance computing. He is also an officer of IEEE SMC Hiroshima Chapter.

## 1 Introduction

The purpose of this special issue is to collect excellent articles on innovative computational intelligence methods for data sciences and applications. The papers in this issue are extended versions of selected papers presented at 2016 IEEE 9th International Workshop on Computational Intelligence and Applications (IEEE IWCIA2016), 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 field of computational intelligence technologies such as deep learning, evolutionary computation, swarm intelligence, etc., and their applications like knowledge acquisition or data prediction from big data. High quality technical papers were presented at IEEE IWCIA2016, and the six papers were selected from among all the accepted papers for this special issue. To provide readers a quick overview of the six papers, a brief summary for each of them is presented as below:

- 1 ‘Altruistic behaviours-based recommendation system of tourist information from smartphone application to SNS community’ by T. Ichimura, T. Uemoto and S. Kamada.

The activity of a community in social networking service is often depends on a small number of active persons. Authors have proposed a new method to vitalise the community, which was inspired by altruistic behaviour in army ants. In this context, altruistic behaviour corresponds to a recommendation of the article posted by a user to the other users. A field study to investigate the efficiency of the vitalisation process was performed in the recommendation system of sightseeing information by using smartphone-based user participatory sensing system linked with Facebook, which has previously developed by the authors.

- 2 ‘Adaptive distributed modified extremal optimisation for maximising contact map overlap and its performance evaluation’ by K. Tamura, H. Kitakami and T. Sakai.

In life science domain, the detection of similar structures in proteins has attracted attention, since it enables people to predict functions or discover new functions of proteins. Identifying similarities between proteins is formulated as the problem finding an alignment which maximises the number of common edges in the two undirected graphs, which are called contact maps. To solve the problem, authors have proposed adaptive distributed modified extremal optimisation (ADMEO), which is one of the island model-based evolutionary algorithms. In ADMEO, diversification of search can be maintained by selecting different generation alternation model according to the degree of stagnation.

- 3 ‘Particle swarm optimisation with dynamic search strategies based on rank correlation’ by T. Nishio, J-i. Kushida, A. Hara and T. Takahama.

It is an important issue for meta-heuristic method to control search strategies according to characteristics of search space. In this paper, authors have proposed an improved particle swarm optimisation, which can switch search strategies adaptively according to the fitness landscape. The method can estimate whether the landscape of the objective function is uni-modal or multi-modal, and separable or non-separable by examining the correlation between rankings of search points. Based

on the estimated landscape, appropriate search strategies can be adopted from available four strategies, control of inertia weight, elitist learning strategy, multi-dimensional mutation, and mutation by difference vector.

- 4 'Fine tuning of adaptive learning of deep belief network for misclassification and its knowledge acquisition' by S. Kamada and T. Ichimura.

The performance of deep learning largely depends on parameter settings like network structure. Authors have previously proposed adaptive deep belief network, which can optimise network structure as well as connection weights. In this paper, to further improve the search performance, the authors have proposed a fine tuning method of a trained network so that the network can correct outputs to misclassified data. In the method, activated neurons for misclassified data are visualised, and knowledge of conditions of the misclassifications is acquired as IF THEN rules. The classification system can switch its response from forward calculations in the trained network to inferences by the matched rules in case the misclassification conditions are satisfied.

- 5 'Portfolio theory application to prediction correction of train arrival times' by T. Yamada and T. Sato.

For railway companies, predicting train arrival times correctly is an important issue for keeping timetable punctual and for reducing energy consumption. In this paper, authors have proposed a new prediction method using a portfolio of the two methods, the prediction based on the operation conditions in the current day and the prediction based on the history data in the previous days. The optimal ratio of the two methods is determined by portfolio theory. The effectiveness of the proposed method was shown by applying it to actual data taken from dense train timetables.

- 6 'An FCA approach to mining quantitative association rules from multi-relational data' by M. Nagao and H. Seki.

When applying association rule mining to numerical data, a vast number of patterns are generated in the mining process. The pattern flooding causes expensive computational costs. In this paper, for extracting quantitative association rules in multi-relational database, authors have proposed a new approach using closed interval patterns, which were introduced by Formal Concept Analysis. The authors showed its effectiveness empirically by comparing with a genetic algorithm-based approach and a discretisation-based approach.

We are confident that the above six papers will be of interest and relevance to a broad range of the scientific researchers and engineers. We hope that the readers enjoy this special issue, and this issue will also bring their attention to the IEEE IWCIAs.

This issue would not have been possible without the support of many people. First, we would like to thank all the reviewers for their constructive 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. Tsihrantzis, the Editor-in-Chief of this journal, for giving us the opportunity to compile this special issue.