

Advanced Data Analysis & Biomedical Applications

Special edition guest-edited by M Aladjem* and F Steimann**

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What do profile analysis, multiple prototype classifier design, detection of wake-sleep transitions, hidden Markov models, target tracking, and mathematical models of human circulation have in common? They are all methods, or applications, that fit under the umbrella term *computational intelligence*, the common theme of the four symposia held at the 2nd International ICSC Congress on Computational Intelligence; Methods & Applications (CIMA 2001) at Bangor, Wales, UK.

This special edition is a compilation of six articles that have emerged from work presented at the CIMA 2001. As is always the case, the selection was not easy and the work presented here can give only a rough impression of the diversity of methods and applications we had to make our choice amongst.

The first article by Brazier et al. describes an automatic camera-based system that monitors the skin pigmentation of neonates. It relies on a rolling feature buffer for the high level classification task of target selection and presents some encouraging initial practical results. The second article by Sommer and Golz attacks another practical problem, the detection of wake-sleeps transitions in subjects exposed to tiring situations. They show that prototype vector-based neural networks are capable of performing cluster and discrimination analysis on complex physiological signals, and that these are advantageous over discrete Fourier transforms in certain cases. In the third paper Naujokat et al. propose a mathematical model of the human circulatory system under extracorporeal circulation as the basis for the estimation of parameters which are not included in standard monitoring. Awareness of these parameters and appropriate action can improve the overall outcome of cardiac surgery. The fourth paper by Summers et al. reports on the efficacy of multiresolution wavelet transformation and two-sample profile analysis as a technique to diminish the effects of noise and to reduce the dimensionality of original input data, such as are acquired from

magnetic resonance spectrometers. The authors evaluate their work on a brain neoplasm and on a urine MR spectral data set.

Medicine is by far not the only application domain for the methods of computational intelligence. The fifth paper included in this issue by Li and Biswas addresses problems of clustering temporal data, which is inherently more difficult than the clustering of unrelated individual snapshots. They propose a methodology to automatically partition temporal data into homogeneous groups, and to construct Hidden Markov Models (HMMs) for each group. The novelty of this methodology lies in a Bayesian model selection of the HMM for each cluster, which not only generates more accurate model structure, but also improves the quality of the partitions generated. The final paper by Cerverón et al. empirically evaluates some recently proposed methods for multiple prototype classifier design based on several different metaheuristics. According to the comparative experiments carried out in this work, Tabu Search seems to be a very appealing alternative because of its flexibility and its efficiency in the search for global optima.

The guest editors wish to express their gratitude to the General Chair of the conference, Ludmila I. Kuncheva, and her Co-chair Tim Porter (both University of Bangor) as well as their colleague symposia chairs and program committee members that helped make this conference happen.

June 2002

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