
Introduction

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Biographical notes: Nazmul H. Siddique obtained his Dipl-Ing in Cybernetics from TU Dresden, Germany, MSc in Computer Science from BUET, Bangladesh and PhD in Intelligent Control from the University of Sheffield in 1989, 1995 and 2003 respectively. He is a Lecturer in the School of Computing and Intelligent Systems, University of Ulster. His research interests relate to computational intelligence, stochastic systems and robotics. He authored/co-authored three books and 120 research papers. He is a senior member of IEEE. He is on the editorial board of the *International Journal of Neural Systems*, *Journal of Behavioural Robotics*, *Engineering Letters* and *International Journal of Automation and Control Engineering*.

Richard J. Mitchell received his BSc (hons.) in Cybernetics and Control Engineering and PhD in Cybernetics from the University of Reading, Reading, UK, in 1980 and 1987, respectively. He was appointed Lecturer in Cybernetics in 1983 and is now Senior Lecturer in Cybernetics and also Senior Tutor in the School of Systems Engineering, University of Reading. He won a University Teaching Fellowship in 2011. He has published four textbooks, edited two custom book on cybernetics, and has over 100 research papers in control engineering, robotics, and learning systems. He was Lead Academic on the Classification KTP project.

Michael O'Grady is a Senior Research Fellow Researcher in the School of Computer Science and Informatics at the University College Dublin. His research interests include the applicability of intelligent systems in pervasive computing and how these may be harnessed in a multiple of application

domains including pervasive health and environmental informatics. Currently, he is researching citizen observatories and how these may be designed to support citizen science and participatory sensing projects. He has published in a range of international journals and conferences, contributed to over 100 peer reviewed publications. He is a senior member of both the ACM and IEEE.

Pattern recognition is a branch of artificial intelligence that focuses on the recognition of patterns and regularities in data. In many cases, these patterns are learned from labelled training data (supervised learning), but when no labelled data are available other algorithms can be used to discover previously unknown patterns (unsupervised learning).

Pattern recognition and analysis have a wide range of applications in science, engineering, medical technology, diagnosis, security systems and many other fields. Intelligent techniques are also becoming popular and finding application in this emerging field because of their advantages over traditional mathematical and statistical techniques. This special issue is based on selected papers from the 11th International Conference on Cybernetic Intelligent Systems organised by the UK and Republic of Ireland Chapter of the IEEE Systems, Man and Cybernetics Society held at University of Limerick, Ireland in August 2012.

The special issue consists of five papers with original research contributions applying intelligent techniques, hybridisation with traditional techniques and their synergies, which demonstrate the enhancement of pattern recognition, analysis and their applications to various fields such as environmental sounds, speech recognition, fingerprint images, features of visible and infrared imaging and classification problems.

In sound environment systems, the observed data often contain several fluctuating noises. In general, a noise cancellation method is applied to estimate the specific signal from the observed data. The first paper, contributed by Akira Ikuta and Nazmul H. Siddique, proposes a noise cancellation method of additive external noise and state dependent noise in sound environment systems. In this study, a sound environment system considering both the external noise, based on the additive property of energy variable, and the internal noise, dependent on the state variable, is first investigated. The noise cancellation method is derived to estimate recursively the specific signal on the basis of Bayes' theorem in an expansion series. The validity of the proposed method is experimentally confirmed by applying it to the actual data observed in a real-world sound environment.

The second paper, concerning a blind watermarking algorithm for fingerprint images based on the contourlet transform, is authored by N.K. Kishore Kumar and V.S. Sheeba. In their approach, the host image is decomposed into a series of multiscale, local and directional sub-images using the contourlet transform. A high frequency directional sub-band which has the highest energy is used for watermarking. At the same time, the original binary watermark is scrambled by the two-dimensional Arnold transform, which is then embedded into the selected directional sub-band. The signs of the contourlet coefficients are modified depending on the watermark bit. The watermark retrieving algorithm is a blind detection process, and it does not need the original image. Iris code is taken as the watermark and finger print image is taken as the host image. The simulation results show that the proposed watermarking algorithm gives good perceptual transparency and is able to resist additive channel noise attacks, cropping, histogram equalisation, gamma correction, and so on.

Robustness has become an important research issue in many automatic speech recognition (ASR) applications due to noisy background conditions. The automated recognition of human speech using features from the visual domain along with audio has proved to be useful under these conditions. With this view in mind, the authors Priyanka Varshney, Omar Farooq, and Prashant Upadhyaya developed a method for the Hindi viseme recognition using subspace discrete cosine transform (DCT) features. A database has been prepared comprising of ten Hindi sentences uttered by different speakers. The audio feature based on mel frequency cepstral coefficient (MFCC) has been extracted and subspace-based DCT is applied to extract visual features. The video-based features were integrated with audio features before using a discriminant function-based classifier. Integration of visual features gave an improvement in viseme recognition in case of clean as well as noisy speech.

The fourth paper, on comparative analysis on SIFT features in visible and infrared aerial imaging, is authored by Xiaodong Li, Nabil Aouf and Mark Richardson. This paper addresses an in-depth analysis on the features extracted from both visual and infrared images in characterising natural environments for vision-based airborne navigation problems, in particular, the performance of feature extraction algorithms and matching when variant SIFT feature detection and matching techniques were utilised successfully. The application of both feature extraction and matching methods on various characteristic aerial images are investigated based on the performance metrics including processing time, number of matched features and matching rates with and without RANSAC outlier rejection applied, etc., and relevant discussion and conclusion are given.

The final paper, on a classification system for e-procurement, is authored by Paul J. Roberts, Richard J. Mitchell, Virginie F. Ruiz and J. Mark Bishop. This paper describes a pattern recognition technique to enable e-procurers to analyse their purchases and identify potentially significant savings. For example, the National Audit Office reports that this system could save the National Health Service £500 m per annum. An extension to the system, GreenInsight, allows the environmental impact of procurements to be assessed and savings made. Both systems require suitable products to be discovered and equivalent products recognised, for which classification is a key component. Successful automatic classification has been demonstrated on purchase order data, where the best methods to use are k-nearest neighbour and naïve Bayes, not a support vector machine, usually used for text classification.

This edition is dedicated to our colleague John St. Quinton who sadly died in 2013. John attended all the conferences organised by the UK and Eire IEEE Systems Man and Cybernetics chapter, joining our committee and becoming its secretary.

John received his PhD from the Department of Cybernetics at the University of Reading, under the supervision of Dr. Alex Andrew in 1981: his thesis entitled Zetetics and concerned the use of artificial intelligence methods for problem solving. He then pursued an independent research career founding his own company Zetetic systems. In recent years, he developed semantic category theory, which he presented at our Cybernetic Intelligent Systems Conferences. He was appointed honorary professor at the University of Birmingham in 2010.

He also brought to our conferences great enthusiasm, empathy for all participants, particularly the younger researchers, and stimulation particularly through his series of end of conference debates. We miss him.