GUEST EDITORIAL

This special issue of JIFS contains a collection of papers which mainly focus on signal and image processing by using fuzzy logic. Signal processing is a very important technique in almost all fields of science and technology. For example, those are acoustics, speech processing, vibration, sonar, remote sensing, biomedical engineering, neuroscience, geophysics, astrophysics, and many others.

Signal has in itself uncertainty. We cannot exactly observe the physical phenomenon by any precise instrument. The observed signal may be interfered by noise as well. No signal is noise-free. The field of signal processing is a good application area of soft computing which involves fuzzy logic, neural nets, genetic algorithms, probabilistic reasoning, and so on. It is expected that soft computing brings a breakthrough to a signal processing field, especially in nonlinear signal processing, just like a fuzzy logic did sensationally to a nonlinear control field.

It was decided at the Third International Conference on Fuzzy Logic, Neural Nets and Soft Computing (IIZUKA'94), August 1994, Iizuka, Japan, to organize this special issue. This is one of the special issues which were planned by the program committee of IIZUKA'94. It was decided also at IIZUKA'96 to publish 10 diverse special issues which cover a wide area of soft computing.

We hope this special issue will be of most benefit to the readers whose work is related to signal and image processing.

The first paper, by Nie and Lee, presents, with the aid of fuzzy concepts and fuzzy operators, a rule-based approach to the problem known as channel equalization. This problem is concerned with reconstructing binary signals being transmitted through a dispersive communication channel and then corrupted by additive noise. A self-organizing algorithm consisting of learning, pruning, and refining processes is developed aiming at building the rule-base from labeled observations.

The second paper, by Cheung, takes up the fuzzy one-mean (FOM) algorithm, that can be considered to be an extension of the fuzzy c-means (FCM) algorithm to one-class clustering. Given N scalar input values, the FOM algorithm yields the one-mean value bounded by the arithmetic-mean and the median values. The optimal one-mean value is determined by the exponent value in the FOM algorithm. An analysis of the convergence behavior of the FOM algorithm is also presented.

The third paper, by Uchino, Yamakawa and Hirakawa, proposes a combinatorial fuzzy Hough transform. Hough transform is an effective method for line detection in a digital image. However, the conventional Hough transform can not be applied well enough for an image corrupted by heavy noise. This paper describes a combinatorial fuzzy Hough transform, which enables a detection of not only a blurred line, but also a segment of a line in a very noisy image. It is then extended in order that it can further detect a blurred circle. It has been successfully applied to an actual microphotograph for cytodiagnosis.

The fourth paper, by Kasabov, discusses a general engineering model of a hybrid neuro-fuzzy system and its application to phoneme-based speech recognition and information retrieval. The speech recognition part consists of a low-level neural network module for phoneme recognition and a higher-level fuzzy reasoning module for word recognition and language modeling. Both low and high level modules are multi-modular, having a separate unit for each of the English phonemes. This architecture makes possible exploring different learning strategies to improve the recognition rate.

The fifth paper, by Ikuta and Ohta, is a theoretical paper which deals with a stochastic evaluation of a complicated sound environment, that usually shows non-linear, non-stationary, and non-Gaussian properties, by using fuzzy probability. The effectiveness and validity of the proposed method are confirmed by applying it to the observed data in the actual acoustic environment.

The sixth paper, by Russo, concerns the image processing by using fuzzy techniques. It discusses FIRE (Fuzzy Inference Ruled by Else-action) filters, which are a family of nonlinear operators that process image data by adopting fuzzy rules. This work presents two new filters of this family and their application to image data corrupted by different noise distributions. The proposed filters are favourably compared to other operators.

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The seventh paper, by Mouzouris and Mendel, describes the extension of the theory of nonsingleton fuzzy logic systems (NSFLSs) by presenting an algorithm to design and train such systems. Since NSFLSs are a generalization of singleton fuzzy logic systems, the algorithm is equally applicable to both types of systems. The proposed SVD-QR (Singular Value Decomposition) method selects subsets of independent basis functions which are sufficient to represent a given system, through operations on a nonsingleton fuzzy basis function matrix. Several examples are presented to illustrate the ability of the SVD-QR method to operate in uncertain environments.

As a guest editor of this special issue I would like to thank all the authors who have submitted papers. Thanks are also due to many reviewers who have contributed their time and provided useful comments to the papers in this special issue. Other than the authors and the reviewers, special thanks have been earned by the Editors-in-Chief Dr. Mo Jamshidi and Dr. Timothy Ross, and Editorial Manager Ms. Valerie Steinmaus and Ms. Karen Koletar. Without their help, we cannot publish this special issue.

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