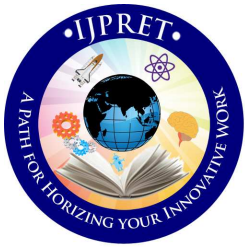
Research Article *ISSN: 2319-507X*
Akash Mohod, IJPRET, 2013; Volume 1(8): 733-738 *IJPRET*



INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

SOFT COMPUTING AND INDUSTRIAL APPLICATIONS WITHIN AEROSPACE & COMMUNICATION SYSTEM

AKASH G. MOHOD[1], ANIKET K. SHAHADE[2], SATISH J. ALASPURKAR[3]

1. G. H. Raisoni College of Engineering and Management, Amravati.
2. Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Dist. Buldana.
3. G. H. Raisoni College of Engineering and Management, Amravati.

Accepted Date:

27/02/2013

Publish Date:

01/04/2013

Keywords

Soft Computing,
Chaos computing,
Industrial applications,
Immune networks,
Evolutionary Computation

Corresponding Author

Mr. Akash G. Mohod

Abstract

This dissertation documents a hybrid research in the areas of Soft Computing, Quality of Service networking, and their integration to develop intelligent adaptive communication systems. Soft Computing is a new multidisciplinary field that was proposed by Dr. Lotfi Zadeh, whose goal was to construct new generation Artificial Intelligence, known as Computational Intelligence. The neuro–fuzzy approach, symbiotically combining the merits of connectionist and fuzzy approaches, constitutes a key component of soft computing at this stage. Soft computing (SC) is an evolving collection of methodologies, which aims to exploit tolerance for imprecision, uncertainty, and partial truth to achieve robustness, tractability, and low cost.

INTRODUCTION

Soft Computing is a multi-disciplinary field. Quality of Service Networking and Distributed Computing are also multi-disciplinary fields. Combining those broad multi-disciplinary areas under one topic in a dissertation is a great writing challenge. The challenge here is not what may be written. Rather, it is how to structure such a dissertation and control the flow of topics in a way that does not lack the broad coverage, but does not drown in endless writing that may go beyond the scope.

Most of the attempts for defining the evolving term Soft Computing coincide in that it is a collection of techniques which uses the human mind as a model and aims at formalizing our cognitive processes. These methods are meant to operate in an environment that is subject to uncertainty and imprecision. The objective is to study, model and analyze complex phenomena for which more conventional methods have not yielded low cost, analytic, and complete solutions. According to Zadeh [9] the guiding principle of soft computing is to exploit the tolerance for imprecision and uncertainty to achieve tractability, robustness, and low solution cost. The notion soft computing is to computational intelligence as traditional hard computing is to artificial intelligence, and usually is viewed as a foundation component for the emerging field of conceptual intelligence.

Soft Computing is a new science and the fields that comprise Soft Computing are also rather new. Though, a tendency toward the expansion of Soft Computing beyond what Dr. Zadeh initiated has been rapidly progressing. For example, Soft Computing has been given a broader definition in the literature to include Fuzzy Sets, Rough Sets, Neural Networks, Evolutionary Computing, Probabilistic and Evidential Reasoning, Multi-valued Logic, and related fields. Other scientists [Dote et al. 2000] proposed the notion of Extended Soft Computing (ESC) as a new discipline developed by adding Chaos Computing and Immune Network Theory to the classical Soft Computing, as defined and proposed by Lotfi Zadeh. ESC was proposed for explaining complex systems and cognitive and reactive AIs. Moreover, Fuzzy Logic, which is the basis on which Soft Computing is built, has been expanded into what is known today as Type-2 Fuzzy Logic. Now on the rise is the new science of Bios and Biotic Systems. The author of this dissertation proposes, and expects, the inclusion of Bios

Computing to become one of the pillars of Soft Computing.

INDUSTRIAL INNOVATION USING SOFT COMPUTING

Soft computing (SC) was proposed for construction of new generation artificial intelligence (high machine intelligence quotient (HMIQ), human-like information processing) and for solving nonlinear and mathematically un modeled systems (tractability) TR [9]. In addition, SC can be implemented at low cost (LC). SC is the fusion or combination of fuzzy, neuro, and evolutional computing [6].

The new wave of theoretical contributions and practical applications that followed the seminal works by Zadeh has had a remarkable inspirational effect on numerous disciplines. Activities in soft computing have increased since the field started. They do not only focus on theoretical descriptions, but also provide a collection of real-world problems and techniques that are used to solve them. Industry has benefited from adopting these techniques to address a variety of problems that can be seen also by the diverse range of products developed. Lately, it has been noticed that publications tend to combine the different sub-n fields which seems to indicate that there are much more applications to come.

The applications range from the purely theoretical ones, those which develop new lines in abstract mathematics or logic, passing across the areas of multi- media, preference modeling, information retrieval, hybrid intelligent systems, image processing, etc., to practical applications domains such as robotics and manufacturing, actuarial science, nuclear or medical engineering.

I.AEROSPACE APPLICATIONS

A. General View

In the early 1990s, Werbos developed nonlinear optimal neuro control (adaptive critics). It has been applied to aerospace and aircraft control systems [11]. Soft computing (neuro, fuzzy, and evolutionary computing) is used for aerospace systems because of the high degrees of nonlinearity, uncertainty, and complexity of these problems and because of the involvement of human beings [7].

B. Application Fields

Neuro control is very effective in aerodynamics, since aerodynamics characteristics are usually highly nonlinear and uncertain (varying), and

data is available for learning. Evolutionary computation is useful when optimization solutions for complex systems are required.

C. Aircrafts and Air Traffic

Calise proposed the use of neural networks for flight control of an aircraft. One network is used to obtain inverse dynamic models off-line, and another neural network is used on-line to behave as an inverse controller [8].

D. Spacecrafts

Berenji proposed the application of soft computing to NASA space projects such as the orbital operations of the space shuttle, including attitude control and rendezvous/ docking operations [7].

II. COMMUNICATIONS SYSTEMS

A. General View

Since communication systems involve human beings, soft computing can be effectively applied to such systems. Soft computing enables solutions to be obtained for problems that have not been able to be solved satisfactorily by hard computing methods.

B. Application Fields

Chaos computing is effectively used for modulation and synchronization of spread sequences in digital communication systems. Neuro-fuzzy approaches are utilized for equalizers and data compression. Network topologies are determined using evolutionary computation. Soft computing is also expected to play an important role in the development of wireless communication systems.

C. Data Communications

Kolumban et al. applied chaos computation to a synchronized coherent receiver, which has advantages over noncoherent ones in terms of noise performance and bandwidth efficiency. The performance of chaos computing-based communications systems is compared with those of conventional ones in [5]. Patra et al. developed a fuzzy implemented channel equalizer that showed performance close to that of an optimal equalizer with a substantial reduction in computational complexity [4].

Cramer et al. developed a neuro post-processor that could be used for any existing video compression scheme. Their approach was to interpolate video sequences and compensate for frames that may have been lost or deliberately dropped. [2].

Jou et al. proposed an online lossless data compression method using an adaptive fuzzy-tuning modeler with fuzzy inference. The performance was better than that of other lossless coding schemes and satisfactory for various types of source data [3].

D. Communication Networks

Gelenbe et al. proposed intelligent techniques and used them in high-speed networks. The use of neural networks for multimedia traffic prediction for the purpose of traffic shaping or reserving resources was shown to be much more accurate and simpler than traditional linear predictors. Similarly, it was shown that the extraction of features and rules from incomplete data sets to compute the bandwidth or anticipate congestion episodes in switches could be performed simply and effectively using neuro-fuzzy approaches. The uncertainties in estimating statistical parameters were also overcome through the use of several neuro and fuzzy solutions. The advantages of intelligent techniques, notably learning from experience, scalability, adaptability, and ability to extract rules without the need for detailed or precise mathematical modeling, are numerous. Genetic algorithms provided optimal solutions for channel reuse in multiple access telecommunication networks and in other communication networks [1].

CONCLUSION

Soft computing is already a major area of academic research. However, the concept is still evolving, and new methodologies are nowadays considered to belong to SC. In this paper we mainly concentrate on industrial innovation using soft computing, aerospace application and communication system.

REFERENCES

1. E. Gelenbe, I.W. Habib, S. Palazzo, and C. Douligeris, “Guest editorial: Intelligent techniques in high speed networks,” IEEE J. Select. Areas Commun., vol. 18, pp. 145–149, Feb. 2000.

2. C. E. Cramer and E. Gelenbe, “Video quality and traffic QoS in learning-based sub-sampled and receiver interpolated video sequences,” IEEE J. Select. Areas Commun., vol. 18, pp. 150–167, Feb. 2000.

3. J. M. Jou and P.-Y. Chen, “A fast and efficient lossless data-compression method,” IEEE Trans. Commun., vol. 47, pp. 1278–1283, Sept. 1999.

4. S. K. Patra and B. Mulgrew, “Fuzzy implementation of a Bayesian equaliser in the

presence of inter-symbol and co-channel interference," Inst. Elect. Eng. Proc. Commun., vol. 145, no. 5, pp. 323–330, 1998.

5. G. Kolumban, M. P. Kennedy, and L. O. Chua, "The role of synchronization in digital communications using chaos—Part I: Fundamentals of digital communications," IEEE Trans. Circuits Syst. I, vol. 44, pp. 927–936, Oct. 1997.

6. H. Takagi, "R&D in intelligent technologies: Fusion of NN, FL, GA, chaos, and human," in Half-Day Tutorial/Workshop, IEEE Int. Conf. Systems, Man, and Cybernetics, Orlando, FL, 1997.

7. H. R. Berenji, "Computational intelligence and soft computing for space applications," IEEE Aerosp. Electron. Syst. Mag., vol. 11, no.8, pp. 8–10, 1996.

8. A. J. Calise, "Neural networks in nonlinear aircraft flight control,"IEEE Aerosp. Electron. Syst. Mag., vol. 11, no. 7, pp. 5–10, 1996.

9. L. A. Zadeh. Soft computing and fuzzy logic. Software, IEEE, 11(6):48{56, 1994.

10. L. A. Zadeh, "Fuzzy logic, neural networks and soft computing,"in Proc. IEEE Int. Workshop Neuro Fuzzy Control, Muroran, Japan, 1993, p. 1.

11. P. J. Werbos, "Neuro-control and elastic fuzzy logic: Capabilities, concepts, and applications," IEEE Trans. Ind. Electron., vol. 40, pp. 170–180, Apr. 1993