Proposal of a half-day workshop on

Modeling and Analysis of Fuzzy Systems in The Frequency Domain

Organizar: Ebrahim Navid Sadjadi, Universidad Carlos III de Madrid

The objective of this half-day workshop is to cover the state-of-the-art in modeling and analysis of fuzzy systems in the frequency domain. During the last years, we have witnessed major successes of fuzzy logic systems in the academia and industries. From beating professionals at games like chess, to fast detection of diseases like cancer, classification of complex images, and generation of captions for images in the personalized media of the incomplete and noisy information. In many AI fields, fuzzy systems could outperform all the existing machine learning and model-based control methods. Hence, they are one of the few areas that received on-going interest of the researchers and engineers.

Although fuzzy models have been employed for a long time so far, however, the recent research in the fuzzy systems demonstrated that some kinds of fuzzy compositions can enlarge the design space into the higher dimensions through the Fourier expansion of the membership functions and thereby, facilitate the frequency analysis and modeling of the fuzzy systems.

Frequency analysis of the fuzzy systems could facilitate the modeling and analysis of fuzzy systems in different aspects. The first is the dedication of the sufficient number of rules to the fuzzy system, without making the fuzzy structure complicated beyond what is really required. The contribution in this area could facilitate the understanding, utilization, tuning, and performance of the consequent algorithms. The second challenge is the ability to handle the system disturbances and noises soft and smoothly. The increase of the system robustness will facilitate the operation of the industrial processes inside their margins and operational limits. The third aspect is the ability to perform on-line and fast processing and decision makings for the processes, considering their affordable computational complexities.

Hence, the purpose of providing this workshop is to give a detailed introduction to the fundamental developments in the recent field of fuzzy systems for the researchers, graduate students and practitioners. The main focus of the course is on comprehensive study of the new achievements on the structural properties of fuzzy models in the frequency domain for various applications which include control, identification and signal processing as well as, the design of smooth fuzzy models for various applications in image processing and biomedical engineering.

Course Materials:

1. Introduction of the basic theory and algorithms of the fuzzy systems
2. Presentation of the smooth fuzzy models for the dynamical system control
3. The properties of the smooth fuzzy systems for system modeling, robustness, stability
4. Applications of Smooth fuzzy models for signal processing, frequency domain, analysis, Fourier expansion
6. Image processing upon the frequency analysis, modified fuzzy filters
7. Applications of fuzzy models for time varying systems, data clouds, evolving fuzzy structures.

Target audience:

The purpose of providing this workshop is to give a detailed introduction to the fundamental developments in this field for the researchers, graduate students and practitioners. Upon the proposed structure of the workshop, we will initiate with the review of the basics of fuzzy models and hence, beside the background in optimization theories and image processing, no prior experience of fuzzy modeling will be required. The minimum number of 15 participants are expected in the workshop.

Biography of the speakers:

Ebrahim Navid Sadjadi has studied a first degree and then a master degree in Engineering at Technology University of Madrid. He continued Ph.D. in Information Systems at University of Carlos III in Madrid. He has contributed on the literature of the smooth fuzzy systems through working on the structural approximation properties of the smooth fuzzy model, and on their applications for systems modeling, optimization, control and signal processing.

Mohammad Bagher Menhaj received the Ph.D. degree from Oklahoma State University (OSU), Stillwater, in 1992. Then, he became a Postdoctoral Fellow with OSU. In 1993, he joined Amirkabir University of Technology, Tehran, Iran, where he is a Professor now. From December 2000 to August 2003, he was with the School of Electrical and Computer Engineering, Department of Computer Science, OSU, as a Visiting Faculty Member and a Research Scholar. He has also been a Project Director for projects in the areas such as computational intelligence, cognitive science, real-time simulator design, and adaptive control, sponsored by private and government institutions. He is author and coauthor of more than 350 technical papers, and four books: Fundamentals of Neural Networks, application of Computational Intelligence in Control, Neural Networks and Fuzzy Computations.

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