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Title: Hybrid Intelligent Systems based on Neural Networks, Fuzzy Logic and Bioinspired Optimization Algorithms and their application to Pattern Recognition.

Abstract: Hybrid intelligent systems are formed by prudent combinations of intelligent models, such as neural networks, fuzzy models and others, to achieve efficient solutions to real-world problems. The main idea is to take advantage of the main characteristics of the individual models. For example, neural networks are good for learning from training data, while fuzzy logic is good for representing expert knowledge and uncertainty management, and evolutionary computing is good for search and optimization. Pattern recognition is challenging due to its complexity and the uncertainty involved in the inherent decision-making process required for achieving recognition. In our work the proposed approach is to build powerful hybrid intelligent systems for achieving the automated pattern recognition. The proposed hybrid architecture is based on modular neural networks for learning from large datasets. Then for combining the outputs of the modules an integration based on type-2 fuzzy rules is performed for modeling the involved decision-making process, as well as the inherent uncertainty in making the decisions. Finally, evolutionary or bio-inspired optimization techniques are used for optimizing the architectures of the neural networks, as well as the structures of the type-2 fuzzy systems. In addition, applications of type-2 fuzzy systems in pattern recognition and image processing will be used to illustrate the good performance of general type-2 fuzzy logic, as well as comparison with interval type-2 and type-1 fuzzy systems to verify the significant advantage obtained in using general type-2 fuzzy logic. Pattern recognition and image processing problems often have high levels of uncertainty due to noise and changing environments in real world situations and for this reason is a good area for using type-2 fuzzy logic. We believe that the proposed hybrid intelligent approach can also be used for other diagnosis problem in the future.

-Preferred date for the plenary talk: December 15th 2022.

Biography: Prof. Patricia Melin is a Professor of Computer Science in the Graduate Division, Tijuana Institute of Technology, Tijuana, Mexico, since 1998. In addition, she is serving as Director of Graduate Studies in Computer Science and is head of the research group on Hybrid Neural Intelligent Systems (2000-present). She holds the Doctor in Science degree (Doctor Habilitatus D.Sc.) in Computer Science from the Polish Academy of Sciences. She has also been advisor of more than 90 graduate students in computer science at the Ph.D. and masters levels. Prof. Melin has published nearly 900 publications in indexed journals, book chapters, and conference proceedings, as well as nearly 50 books, and as consequence of this she has achieved more than 19500 citations with an h index of 77 in Google Scholar, and h index of 65 in Scopus. In addition, she has been awarded the Highly Cited Researcher recognition in the area of Computer Science in 2017 and 2018 by Clarivate Analytics-Web of Science because she is in the top 1% cited author in this area. She has also been awarded with the IFSA 2021 Award on Outstanding Applications of Fuzzy Technology for the contribution of Development and Application of Fuzzy Models in Medical Diagnosis and the NAFIPS 2022 K. S. Fu Award for contributions to the North American Fuzzy Information Processing Society. She is past President of NAFIPS (North American Fuzzy Information Processing Society) 2019-2020. Prof. Melin is the founding Chair of the Mexican Chapter of the IEEE Computational Intelligence Society. She

is member of the IEEE Neural Network Technical Committee (2007 to present), the IEEE Fuzzy System Technical Committee (2014 to present) and is Chair of the Task Force on Hybrid Intelligent Systems (2007 to present) and she is currently Associate Editor of the Information Sciences Journal, IEEE Transactions on Fuzzy Systems and Journal of Complex and Intelligent Systems. She is member of NAFIPS, IFSA, and IEEE. She belongs to the Mexican Research System with level III (highest level). Her research interests are in Modular Neural Networks, Type-2 Fuzzy Logic, Pattern Recognition, Fuzzy Control, Neuro-Fuzzy and Genetic-Fuzzy hybrid approaches.