Innovative Applications of Artificial Intelligence in Software Engineering

Masoud Mohammadian

School of Information Systems and Accounting
University of Canberra, ACT, Australia
Masoud.mohammadian@canberra.edu.au

Abstract: Hierarchical fuzzy logic systems are increasingly applied to complex systems. There is a need for a structured and methodological approach for the design and development of hierarchical fuzzy logic systems. In this talk a review of a method developed by the author for design and development of hierarchical fuzzy logic systems is considered. The proposed method is based on the integration of genetic algorithms and fuzzy logic to provide an integrated knowledge base for modelling, control and prediction. Issues related to the design and construction of hierarchical fuzzy logic systems using several applications are considered and methods for the decomposition of complex systems into hierarchical fuzzy logic systems are proposed. Decomposition and conversion of systems into hierarchical fuzzy logic systems reduces the number of fuzzy rules and improves the learning speed for such systems. Decomposition of these systems is not a trivial task for applications considered. Application areas considered are: the prediction of interest rate and hierarchical robotic control. The aim of this talk is to review and highlight the research work completed in the area of hierarchical fuzzy logic system by the author. The talk will benefit researchers interested in the application of hierarchical fuzzy logic systems in modelling, control and prediction.

In this talk an innovative method is explained for design and development of hierarchical fuzzy logic systems. Genetic algorithms are used as an adaptive learning method to design hierarchical fuzzy logic systems to predict the fluctuations of the 10-year Australian Treasury bond using Australian economic data. Using hierarchical fuzzy logic systems the number of fuzzy rules in the fuzzy knowledge base is reduced dramatically hence computational times are decreased resulting in a more efficient system. The application of the proposed method to modelling and prediction of interest rate using Australian economic indicators is considered. Genetic algorithms are also used to obtain the fuzzy rules for each fuzzy logic system of a hierarchical fuzzy logic system. From simulation results it was found that the hierarchical fuzzy logic system is capable of making accurate predictions of the following quarter’s interest rate. The hierarchical fuzzy logic systems used a fuzzy knowledge base which contains all the rules of the system, this allows an expert to inspect and make any modifications if necessary.

A hierarchical fuzzy logic for multi-robot control problem will also be considered in this talk. The complexity of the multi-robot control problem was tackled by using decomposition of hierarchical fuzzy logic by dividing the problem into smaller manageable parts. This talk will explore how using hierarchical concept learning using the proposed method makes the development of fuzzy logic control systems possible, by encouraging the development of fuzzy logic controllers where the large number of systems parameters inhibits the construction of such controllers.

The research work presented in this talk is unique in the way the hierarchical fuzzy logic systems are developed. The application of this method to several industrial problems such as robotic control and collision avoidance of multi-robot systems will also be explained.

BIOGRAPHY

Associate Professor Masoud Mohammadian graduated with a PhD degree from the University of Central Queensland, an MSc degree from the University of Central Queensland, Australia and his undergraduate degree at the Flinders University, Australia.

He taught various undergraduate and postgraduate courses in the areas of computer science and information systems at Edith Cowan University, Monash University for almost 5 years before joining the University of Canberra in late 1998.

Besides teaching, he has been actively pursuing research related to neural networks, fuzzy logic, evolutionary computing, intelligent agents, optimisation, data analytics, modeling of complex adaptive systems, decision support systems and data security and privacy and their applications in industrial, financial and business problems which involve real time data processing, planning and decision making. His current research interests lies in adaptive self-learning systems, fuzzy logic, genetic algorithms, neural networks and application of computational intelligence techniques for learning and adaptation of intelligent systems and intelligent agents for decision making, data security and privacy, web-based information filtering, data mining and cloud computing in public sector. He has successfully completed many industry
projects related to real-time data processing, planning, and decision-making.

To date, he has edited 24 books and conference proceedings in the area of Computational Intelligence and Intelligent Agents. He has written more than 140 refereed publications in the form of books, book chapters, journal articles and conference papers, among others.

He has chaired fourteen international conferences on Computational Intelligence, Intelligent Agents and Software Engineering. Associate Professor Masoud Mohammadian has twenty six years of academic experience and he has served as program committee member and/or co-chair of a large number of national and international conferences. He was the chair of IEEE ACT Section and he was the recipient of awards from IEEE from USA and Ministry of Commerce from Austria and several awards for his academic services in Australia.