

Chapter 15

Measuring Human Intelligence by Applying Soft Computing Techniques: A Genetic Fuzzy Approach

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ABSTRACT

The chapter focuses on Genetic-Fuzzy Rule Based Systems of soft computing in order to deal with uncertainty and imprecision with evolving nature for different domains. It has been observed that major professional domains such as education and technology, human resources, psychology, etc, still lack intelligent decision support system with self evolving nature. The chapter proposes a novel framework implementing Theory of Multiple Intelligence of education to identify students' technical and managerial skills. Detail methodology of proposed system architecture which includes the design of rule bases for technical and managerial skills, encoding strategy, fitness function, cross-over and mutation operations for evolving populations is presented in this chapter. The outcome and the supporting experimental results are also presented to justify the significance of the proposed framework. It concludes by discussing advantages and future scope in different domains.

INTRODUCTION

Soft Computing techniques employ Artificial Intelligence techniques such as Fuzzy Logic (FL), Genetic Algorithm (GA), Artificial Neural Network (ANN), etc. to provide efficient and

feasible solutions in comparison with traditional computing (hard computing). Out of various Soft Computing techniques, Fuzzy Logic is the most important technique to handle imprecision and uncertainty. With a notion of linguistic variable and their relative fuzzy membership functions, representation of knowledge can be made better and human oriented. However, major limitation

DOI: 10.4018/978-1-4666-2455-9.ch015

of FL based systems is lack of self learning and parallel computation. Given a big set of data, FL based system does not offer generalized rules or evolve solutions. This leads to the hybridization of Fuzzy Logic with Soft Computing technology that supports learning and evolution. Genetic Algorithm is one such example technique that supports automatic evolution. Clever combinations of genetic algorithm and fuzzy logic offer advantages of both the fields. The proposed chapter presents a general architecture and evolving process using genetic and fuzzy hybridization.

Major goal of education is to increase level of intelligence in every individual to progress in all areas. Technological advancements increase the efficiency of decision making and problem solving. To deal with real life problems, certain level of intelligence is essential for every individual. Genetically, individuals are blessed with multiple types of intelligence in different capacities; however results of many researchers have shown that appropriate training and development methods can increase the level of intelligence by utilizing instructional technologies. Theory of Multiple Intelligence is pioneer among available theories to identify and enhance human intelligence. According to this theory, every human being has different types of intelligence. There are many computer based applications developed to enhance different types of intelligence using the theory of Multiple Intelligence. The proposed application considers a novel approach of automatic evolution of fuzzy rule base using genetic algorithm in order to analyze technical and managerial skills of human being.

First section of the chapter discusses hard and soft computing techniques including major constituents of soft computing. Second section describes need and hybridization of fuzzy logic based system and popular applications developed in different areas. It also includes rule based fuzzy expert systems, fuzzy membership functions and limitations of fuzzy systems. The third section describes importance of evolutionary computing

and advantages of Genetic Algorithm. It presents general structure of genetic algorithms, types of encoding schemes, genetic operators as well as application areas. The fourth section highlights approaches and established model, learning process with genetic algorithm, and literature review in the area of genetic fuzzy systems. The fifth section describes architecture of proposed system as well as proposed evolving procedure using genetic algorithm for analyzing human intelligence. Here, the role of education in human life, types and importance of multiple intelligence as well as related work done using Theory of Multiple Intelligence are presented. The implementation of genetic procedure is also shown in the same section. The sample input/output screens and results are presented and discussed in the sixth section. The chapter concludes with the scope and applications of the proposed work to other application areas.

Hard Computing and Soft Computing

Hard Computing is basically conventional computing. Akerkar, & Sajja (2008) state that Hard Computing techniques deal with precise, complete and full truth based system. It is capable of solving the problem which requires a precisely stated analytical model but at the same time it consumes a lot of computation time to handle real life problems dealing with imprecise and uncertain information. There are various analytical models available for handling predetermined requirements of real life problems but at the same time, it has been observed that following types of real world problems exist in a non ideal environment (Cordon et al., 2001).

- Pattern Recognition problems e.g. handwriting, speech, objects, images;
- Mobile robot coordination, control systems;
- Classification, forecasting, etc.

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