Abstract of the Research Work

Modern Artificial Intelligence (AI) methods provide effective solutions of real life problems in human oriented and intelligent manner. With the ever increasing demands of users in various domains have become challenging to develop and maintain systems that provide solutions. Hence utilization of technologies such as Fuzzy Logic (FL), Artificial Neural Network (ANN) and hybrid approaches like Neuro-Fuzzy (NF) have become very crucial. Such techniques are also known as soft computing techniques. The major advantages offered by such technology are imparting partial intelligence in problem solving, more human oriented approach in handling transactions of the domain, self learning, dealing with uncertainty and explanation/reasoning etc. In spite of these appealing advantages, there are some major challenges in the development of such systems. Some of these challenges are like difficulties in development, knowledge acquisition and learning.

The thesis “Design of Neuro-Fuzzy Advisory System Using Type 2 Fuzzy Logic” contributes to the development of a generic library and framework that aids in development of various systems that utilize modern AI methods. The architecture presented here considers automatic development of various advisory systems using fuzzy, neural network and neuro-fuzzy techniques in user friendly way. Such automatic and user friendly development reduces development time, cost and development efforts. The system interacts with their users using graphical user interface (GUI) features allowing vague input and provides human like intelligent advisory in different domains.

The intelligent system developed through this framework will support day to day routine activities as well as aid crucial advisory for decision support. This will save time and effort and hence increases overall quality and productivity. The design and development of the library and framework is illustrated in form of different chapters as mentioned below.

Chapter 1 introduces to the problem under research providing a background of underlying architecture and designed methodology. The chapter also discusses about the main objectives of thesis and provides overview of the methodology that is
used to solve the problem. The chapter focuses on the need and usage of neuro-fuzzy advisory systems in day to day life.

Chapter 2 elaborates literature survey on artificial neural network and its essential components like learning algorithms, activation functions, error propagations, different topologies of artificial neural network, and training approach depending upon the situation under consideration. The chapter specifies literature review on fuzzy logic and its components like fuzzification and defuzzification approach, inference engine and rule base, also in case of type 2 fuzzy logic an additional components known as type reducer is also presented. Based on this various fuzzy inference model are also discussed indicating their advantages and disadvantages for their practical applicability. The chapter also mentions about the existing neuro-fuzzy models and their effectiveness regarding a certain class of situation under consideration. Again these neuro-fuzzy models also have their drawback and limitations, which are also discussed as a part of literature review. Literature survey presented in this chapter enlists different tools/technique/software to design intelligent systems. The survey also evaluates the enlisted tools and software for their utility in terms of ease of development and utilization of intelligent systems.

Chapter 3 focuses on design to develop a library which includes source codes for artificial neural network and fuzzy logic. This design of library works as a key instrument to develop the interactive framework which automatically develops three different types of systems in the respective areas of artificial neural network, fuzzy (type 2) logic and neuro-fuzzy advisory systems. Further, the chapter also focuses on detail design for every components of the library. Above this, the library incorporates the facility of hybridizing the two components to produce expert neuro-fuzzy advisory system in the given domain area.

Chapter 4 focuses on detailed development approach of a generic framework based on the library developed. The chapter illustrates interface designing of the framework, detailed database design for framework, validations and check points to be noted while developing a neuro-fuzzy advisory system. The chapter also focuses on the key mechanism of hybridizing artificial neural network with fuzzy logic.
practically. The chapter also discusses various applicable areas where the generated systems from the framework are applicable.

Chapter 5 focuses on practical applicability of the developed framework to develop artificial neural network based applications and systems. The chapter focuses on the technical details while developing the artificial neural network based systems through the framework. It includes designing and development of artificial neural network by specifying input and output broad categories, selection of learning algorithm, parameters and an activation function to be used by learning algorithm.

Chapter 6 focuses on development of fuzzy logic based systems through the framework which include extendibility of the fuzzy logic to type 2 fuzzy logic. The chapter focuses on technical details of fuzzy logic based systems, which includes its component like fuzzifier, defuzzifier, inference engine, rule base, applicability of rule base to generate a knowledge base, and a type reducer for type 2 fuzzy logic. The chapter elaborates on fuzzification and defuzzification methods, membership functions, fuzzy sets, linguistic variable and their applicability to deduce advice in the given domain area.

Chapter 7 focuses on the development of neuro-fuzzy advisory systems in various domain areas through the framework. The chapter highlights the importance of the hybridization of artificial neural network with fuzzy logic, which is responsible in generating the optimal advice in the given domain area. To demonstrate working of the framework a case study of neuro-fuzzy based course advisory system is developed.

Chapter 8 focuses on the usage of library functionalities as well as the framework in development of various advisory systems and algorithms in different domains. To show wide applicability of the developed framework, various systems’ design and development in domains such as finance, banking, operating system, games and education are illustrated. Hence it is deduced that the research work carried can be used as a tool for automatic development of intelligent systems in variety of domains.
Chapter 9 focuses on the contributions that the research work has made in the field of computer science and society as whole. The chapter highlights possibilities of future research and use of the framework for the benefit of society and industry. Finally the chapter concludes with the aims and objectives achieved by the thesis.