Preface

The concept of fuzzy set and intuitionistic fuzzy matrix (IFM) are one of the recent topics developed for dealing with the uncertainties present in most of our real life situations. The parameterizations tool of intuitionistic fuzzy matrix enhances the flexibility of its applications. Most of our real life problems in medical sciences, engineering, management, environment and social sciences often involve data which are not necessarily crisp, precise and deterministic in character due to various uncertainties associated with the problems. Such uncertainties are usually being handled with the help of the topics like probability, fuzzy sets, intuitionistic fuzzy sets, interval-valued intuitionistic fuzzy sets, etc.

This book will be very useful for the undergraduate students, post graduate students, decision makers and researchers in private sectors, universities and industries in the fields of various sciences and management. It is well known that uncertainty is invertible in every field of engineering, management and science. This book aims to become significant and very helpful for humankind.

The book is organized into 15 chapters. A brief description of each of the chapters is as follows:

Chapter 1 discusses four separations of generalized interval-valued intuitionistic fuzzy sets (GIVIFSs). Also, authors studied some properties of the four separated subsets of GIVIFSs.

Chapter 2 presents the notions of neutrosophic sets and logic. They studied neutrosophic sets with some of their basic properties and the hybrid structure neutrosophic crisp sets and their associated properties and notions have been studied.

Chapter 3 says that if in an interval-valued intuitionistic fuzzy matrix each element is again a smaller interval-valued intuitionistic fuzzy matrix then the interval-valued intuitionistic fuzzy matrix is called interval-valued intuitionistic fuzzy partition matrix (IVIFPMs). T concept of interval-valued intuitionistic fuzzy partition matrices (IVIFPMs) are introduced and defined different types of interval-valued intuitionistic fuzzy partition matrices (IVIFPMs).

Chapter 4 investigates the concepts P-F fuzzy rings and normal fuzzy rings. Several basic results related to these concepts have given and studied. The relationship between them has also been given. Moreover, some properties of t-pure fuzzy ideal of a fuzzy ring have been given which need it later.

Chapter 5 solves the difference equation with intuitionistic fuzzy initial value. The all possible cases are defined and found the exact solution. The intuitionistic fuzzy numbers are also taken are trapezoidal intuitionistic fuzzy number. The problem are illustrated by two different numerical examples.

Chapter 6 introduces semiring of generalized interval-valued intuitionistic fuzzy matrices and shows that the set of GIVIFMs forms a distributive lattice. Also, prove that the GIVIFMs form a generalized interval valued intuitionistic fuzzy algebra and vector space over [0,1]. Some properties of GIVIFMs are studied using the definition of comparability of GIVIFMs.
Chapter 7 says that learning is the ability to improve behavior based on former experiences and observations. Nowadays, mankind continuously attempts to train computers for his purpose, and make them smarter through trainings and experiments. Learning machines are a branch of artificial intelligence with the aim of reaching machines able to extract knowledge (learning) from the environment. Classical, fuzzy classification, as a subcategory of machine learning, has an important role in reaching these goals in this area. In the present chapter, we undertake to elaborate and explain some useful and efficient methods of classical versus fuzzy classification. Moreover, we compare them, investigating their advantages and disadvantages.

Chapter 8 considers the sizing and design optimization of the solar powered irrigation system. This problem is multivariate, noisy, nonlinear and multi-objective. This design problem was tackled by first using the Fuzzy Type II approach to model the noise factors. Consequently, the Bacterial Foraging Algorithm (BFA) (in the context of a weighted sum framework) was employed to solve this multiobjective fuzzy design problem. This method was then used to construct the approximate Pareto frontier as well as to identify the best solution option in a fuzzy setting. Comprehensive analyses and discussions were performed on the generated numerical results with respect to the implemented solution methods.

Chapter 9 introduces non-linear intuitionistic fuzzy number (NIFN). The arithmetic operation of this type number is also done here. All the operation is done by max-min principle. Finally we solve partial differential equation with NIFN. The defuzzification or crispification of the solution is done by max-min operator method.

In Chapter 10, measures of Intuitionistic fuzzy metric and fuzzy similarity do work satisfactorily as is evidenced from the results of $S_1$, $S_2$ and $S_3$, $S_4$. As supported biologically distance between the first pair should be less than the next pair and consequently the similarity of the first pair should be greater than the next pair. Actually this has happened in the present case for each value of $\alpha$. The measures are of multiple choices. They vary as $\alpha$ varies. Again as $\alpha$ increases, distance measures increase and similarity measures decrease. This suggests that better is the result, larger is the value of $\alpha$ taken. Although the problem 1 is solved, normally it cannot be claimed that the metrics will behave equivalently for sequences other the ones used as counter examples. But as some value of the parameter $\theta$ is always involved in the calculations, so if some contradictory result appears at all, it is only apparent.

Chapter 11 gives some characterizations of bipolar fuzzy B-subalgebras of B-algebras. It is seen that the intersection of two bipolar fuzzy B-subalgebras is also a bipolar fuzzy B-subalgebra, but for the union it is not always true. We have also shown that if every bipolar fuzzy B-subalgebras has the finite image, then every descending chain of B-subalgebras terminates at finite step.

Chapter 12 defines the notions of fuzzy rough set and intuitionistic fuzzy rough (IFR) sets, and its properties are studied. Thereafter rough set on two universal sets has been studied. In addition, intuitionistic fuzzy rough set on two universal sets has been extensively studied. Furthermore, we would like to give an application, which shows that intuitionistic fuzzy rough set on two universal sets can be successfully applied to decision making problems.

Chapter 13 applies forecasting using fuzzy time series in several areas including forecasting university enrollments, sales, road accidents, financial forecasting, weather forecasting, etc. Recently, many researchers have paid attention to apply fuzzy time series in time series forecasting problems. In this paper, we present a new model to forecast the enrollments in the University of Alabama and the daily average temperature in Taipei, based on one-factor fuzzy time series.

Chapter 14 contains a vertical information sharing in terms of inventory replenishment / requirement from the customer(s)→ retailer(s)→ producer→ supplier(s) has been done. The constant imprecise fuzzy
demands of the goods are made to the retailers by the customers. This chapter attempts to provide the reader a complete picture of supply chain management through a systematic literature review.

Chapter 15 gives an overview of computational iterative schemes for fuzzy system of linear equations. We also consider fully fuzzy linear systems (FFLS) and demonstrate a class of the existing iterative methods using the splitting approach for calculating the solution. Furthermore, the main aim in this work is to design a numerical procedure for improving this algorithm. Some numerical experiments are illustrated to show the applicability of the methods and to show the efficiency of proposed algorithm, we report the numerical results of large-scaled fuzzy problems.