Review of Literature

REVIEW OF LITERATURE

Matrices provide a very powerful tool for dealing with linear models. Bimatrices are still a powerful and an advanced tool which can handle over one linear model at a time. Bimatrices will be useful when time bound comparisons are needed in the analysis of the model.

The notion of neutrosophic logic is created by Florentin Smarandache [8], which is an extension / combination of the fuzzy logic in which indeterminacy is included. The notion of neutrosophic logic play a vital role in several of the real world problems like law, medicine, industry, finance, IT, stocks and shares etc. Study of neutrosophic algebraic structures is very recent. The introduction of neutrosophic theory has put forth a significant concept by giving representation to indeterminates. Uncertainty or indeterminacy happen to be one of the major factors in almost all real-world problems. When uncertainty is modeled one uses fuzzy theory and when indeterminacy is involved one uses neutrosophic theory.

Using indeterminacy, neutrosophic bimatrices are constructed by Florentin Smarandache, Vasantha Kandasamy W.B., and Ilanthenral, K., of [10] which can be used in neutrosophic models. They also constructed fuzzy interval matrices and neutrosophic interval matrices which are mainly useful when the data is an unsupervised one and when one needs a multi-expert model.

Most of the fuzzy models which deal with the analysis and study of unsupervised data make use of bimatrices and bigraphs. The neutrosophic models play a significant role and utilizes the concepts of neutrosophic matrices and neutrosophic graphs.

Fuzzy cognitive maps are fuzzy structures that strongly resemble neutral networks and they have powerful and far-reaching consequences as a mathematical tool for modeling complex systems. Bart Kosko the guru of fuzzy logic, introduced fuzzy cognitive maps [54] in the year 1986. It was a

fuzzy extension of the cognitive maps pioneered in 1976 by Robert Axelrod [5], who used it to represent knowledge as an inter connected, directed, bilevel-logic graph. Till today there are over a hundred research papers which deal with fuzzy cognitive maps and the tool has been used to study real-world situations as varied as stock-investment analysis to supervisory system control and child labor to community mobilization against the AIDS epidemic.

In this review of literature, a brief survey of some of the articles and books published on Bimatrices, Interval bimatrices, Bigraphs, Neutrosophic bigraphs, Fuzzy cognitive maps, Neutrosophic cognitive maps and some of their applications are given.

1. **Fuzzy cognitive maps.**

   Kosko, B, (1986) [3]

   Fuzzy cognitive maps (FCMs) are fuzzy-graph structures for representing causal reasoning. Their fuzziness allows hazy degrees of causality between hazy causal objects (concepts). Their graph structure allows systematic causal propagation, in particular forward and backward chaining and it allows knowledge bases to be grown by connectind different FCMs. FCMs are especially applicable to soft knowledge domains and several example FCMs are given. Causality is represented as a fuzzy relation on causal concepts. A fuzzy causal algebra for governing causal propagation on FCMs is developed. FCM matrix representation and matrix operations are presented.

2. **Pure bigraphs : structure and dynamics.**

   Robin Milner, (2006)[7]

   Bigraphs are graphs whose nodes may be nested, representing locality independently of the edges connecting them. They may be equipped with reaction rules, forming a biographical reactive system (Brs) in which bigraphs can reconfigure themselves. Following an earlier paper describing

link graphs, a constituent of bigraphs, this paper is devoted to pure bigraphs, which in turn underlie various more refined forms.

3. **Interval bigraphs and circular arc graphs.**

   Pavol Hell and Jing Huang, (2004) [5]

   The authors prove that the complements of interval bigraphs are precisely those circular arc graphs of clique covering number two, which admit a representation without two arcs covering the whole circle. They give another characterization of interval bigraphs, interms of a vertex ordering and use these results to show equality, amongst bipartite graphs, of several classes of structured graphs. (Proper interval bigraphs, complements of proper circular arc graphs, asteriodal – triple – free graphs, permutation graphs and co – comparability graphs).

4. **Bigraphs as a model for mobile interaction.**

   Robin Milner, (2002)[6]

   A bigraphical reactive system (BRS) involves bigraphs, in which the nesting of nodes represents locality, independently of the edges connecting them. BRSs represent a wide variety of calculi for mobility, including the π- calculus to illustrate how they already provide elements of a unifying theory for calculi of mobile interactive processes.

5. **Regular interval valued fuzzy matrices.**

   AR. Meenakshi and M. Aliraja, (2010)[4]

   In this paper, the concept of regular interval valued fuzzy matrices (IVFM) are introduced as a generalization of regular fuzzy matrices. The structure of row space and column space of an IVFM are obtained.

6. **Regularity of interval matrices and theorems of the alternatives.**

   Jiri Rohn, (2006)[2]

   Several characterizations of regularity of interval matrices are given. All of them have to do with solvability of certain systems of non – linear

equations or inequalities. These results are then applied to drive two theorems of the alternatives for inequalities with absolute values.

7. **On the semi – convergence of interval matrices.**

   Hans – Robert Arndt and Giinter Mayer, (2004)[1]

   A Necessary and sufficient criterion for the convergence of powers of interval matrices [A] to a limit which may differ from O is derived.

8. **Necessary and sufficient conditions for the regularity of an interval matrix.**

   Yousef, M., M.B.M. Elgindi and M.A. El – gebility, (1999)[20]

   Necessary and sufficient conditions for the regularity of an interval matrix are given. Based on these conditions an algorithm for checking the regularity of an interval matrix is developed. It is shown that this algorithm can be modified to determine the stability of a class of interval matrices.

9. **A Unifying field in logics : Neutrosophic logic.**

   Smarandache and Florentin, (1990)[8]

   The author makes an introduction to non-standard analysis, then extends the dialectics to " neutrosophy " – which became a new branch of philosophy. Thus new concept helps in generalizing the intuitionstic, Para consistent, dialothoiem, fuzzy logic to " neutrosophic logic " which is the first logic that comprises paradoxes and distinguishes between relative and absolute truth. Similarly, the fuzzy set is generalized to "neutrosophic set ". Also, the classical and imprecise probabilities are generalized to " neutrosophic probability ".

10. **Analysis of social aspects of migrant laborers living with HIV/AIDS using fuzzy theory and neutrosophic cognitive maps.**

    Vasantha Kandasamy, W.B and Florentin Smarandache, (2004)[15]

    The first chapter of this book is introductory in nature and it speaks about the migrant laborers. In chapter two fuzzy cognitive maps are used to analyze the socio-economic problems of HIV/AIDS infected migrant

laborers in rural areas of Tamil Nadu. In chapter three the role played by the government helping these migrant laborers with HIV/AIDS and factors of migration and their vulnerability in catching HIV/AIDS are analyzed. In chapter four socio-economic problems of HIV/AIDS affected migrant laborers are studied using neutrosophic cognitive

11. **Elementary fuzzy matrix theory and fuzzy models for social scientists. Vasantha Kandasamy, W.B., Florentin Smarandache and Ilanthenral, K, (2007)[12].**

This book aims to assist social scientists to analyze their problems using fuzzy models. The basic and essential fuzzy matrix theory is again.

This book has two chapters. In chapter one, basic concepts about fuzzy matrices are introduced. Basic properties of fuzzy matrices are given.

In chapter two deals with the description of simple fuzzy models and their applications to real-world problems.

12. **Hidden patterns of diseases in children using fuzzy cognitive maps. Vasantha Kandasamy, W.B and Ram Kishore, (1998)[19]**

In this paper, the hidden pattern depicting the interrelations between disease in children using fuzzy cognitive maps (FCMs) are obtained. FCMs are basically matrices, which predict the feelings of all attributes under considerations. The symptoms of the diseases are considered as attributes and using the opinions of the experts the hidden patterns are obtained.

13. **Applications of fuzzy cognitive maps to study drop outs in primary education.**

Vasantha Kandasamy, W.B and Promodth, P, (1999)[18]

In this paper, fuzzy cognitive maps are used to study the drop outs in primary education.

Using some basic nature of teachers – like devoted teacher, trained teacher, untrained teacher, friendly approach of the teacher towards the student etc., a teacher student model in primary education is constructed.