

Chapter 1

Fuzziness: A Mathematical Tool

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ABSTRACT

The fuzzy sets theory is observed as an important and powerful tool, which aids numerous researchers and learners in a variety of ways and in countless disciplines by transforming oral information into mathematical data. The majority of our conventional tools for computing, analysis and modeling are based on clear cut, defined, deterministic and precise information (generally crisp in nature) and concentrate on true yes or true no type information rather than more or less type information. It is very easy to deal with the cases, where the statement refers true yes or true no type information, however it is critical to deal with more or less type of data information, which can be easily overcome by fuzzy sets theory. The presented chapter tries to give an idea to the learners and researcher about: the basic concepts of fuzzy, what is fuzzy and fuzzy number, what are the application fields of the developed fuzzy theory, how to import fuzzy data, what is linguistic and importance of linguistic in fuzzy theory, what are the existing developed techniques that integrate the fuzzy theory effectively, etc. The main objective of the presented chapter is to impart fuzzy knowledge to the new learners and readers, so that they augment and disseminate the fuzzy sets theory into new application fields to benefit the society and mankind.

AT A GLANCE

In today's era, majority of the work fields require decisions, which are pertaining to information which is unclear, vagueness, inconsistent. In this type of situation, information can be easily collect in terms of fuzzy scale. This chapter addresses the significance, necessity, use and applicability of fuzzy sets theory.

DOI: 10.4018/978-1-5225-1848-8.ch001

INTRODUCTION

The fuzzy sets theory was introduced by L. A. Zadeh (1965), to handle decision making problems, where a sense of vagueness, unclear, inaccurate and impreciseness information or data set is present. It has always been considered as a natural oral language of the decision maker to model the approximate situations or circumstances, because the fuzzy information can be easily generated by using linguistic scale. Fuzzy phenomena and indices exist in almost every work field's i.e.:

- Manufacturing,
- Decision theory,
- Quality,
- Computer science,
- Operations research information management,
- Robotics,
- Inspection,
- Artificial intelligence production control,
- Scheduling etc.

A small decision in the aforesaid fields can improve the performance and gain of such fields, but the basic problem to take small decision in these fields lies in collecting data information and data analysis, which can be easily diagnosed by collecting data information via exploring fuzzy sets theory. The presented work reveals the generation and applicability of fuzzy sets theory in different application fields. Li and Chang (2002) introduced the concept of fuzzy logic in game theory and proposed a computational method for auxiliary fuzzy linear programming for each player. Mula et al. (2015) proposed the concept of bi rough programming to measure the uncertainty of the variable. Fuzzy logic can effectively deals with the concept of completely true, completely false and partial information (where the gathered information may range between completely true and completely false). The information can be easily collected by fuzzy number. For example if someone wants to collect fuzzy information in case of a glass of water which is fully filled with water. The fuzzy number assigned should be 1, because it is completely filled with water, which represents the completely true information case and the assigned fuzzy number should be 0, to represents completely false information i.e. glass is empty, because the glass is completely filled with water.

Fuzzy logic also found their extended application where the captured information is neither completely true nor completely false or consists of partly true and partly false information. Suppose the water is filled more than half but less than completely full in the glass. In this case, the assigned fuzzy number can be 0.6, 0.7, 0.8, 0.9, which depends on the capability and analytical view of the decision maker. Fuzzy logic is an idea, which requires further extension, explanation and elaboration to understand the significance and applicability. Fuzzy sets theory can effectively handle the ambiguous and the vague property involved in the captured data via linguistic expression (Zadeh, 1975). As the complexity of a system increases, our ability to make precise and significant statements about its behavior diminishes. In this type of situations, the theories of probability are the principles theories to model the uncertainties of reality. Yu et al. (2015) highlights the role and the importance of fuzzy information aggregation operators in supplier selection application under group decision making (GDM). Li (2014) proposed a series of representation theorem, extension principle, ranking methods, linear and non-linear program-

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