ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

Critical Study of Fuzzy Topology, Fuzzy Set Theory and Fuzzy Technology

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Received : 05.10.2020 Revised : 04.11.2020 Accepted : 05.12.2020

ABSTRACT:

Mathematicians study topology to better understand and investigate the concept of continuity as it pertains to mathematics. In general topology, one subfield of topology deals with the study of topological spaces, their continuous mappings, and their general characteristics in general. Zadeh's notion of fuzzy sets, which has several applications in modern science and technology, is well-known. Fuzzy sets are the subject of a lot of study these days because of how widely applicable they may be. Chang and other mathematicians introduced the concept of fuzzy topology. For the first time, Balasubramanian and Sundaram proposed the concept of "generalised fuzzy closed sets" and "generalisation of fuzzy continuous functions" for fuzzy topological spaces. Since then, several alterations have been made and are now being researched by other people. This paper reflects critical study of Fuzzy Topology, Fuzzy Set Theory and Fuzzy Technology.

Keywords: Topology, Mathematicians, Fuzzy Sets, Technology, Mathematics

I FUZZY TOPOLOGY:

Although the term "topology" was not created until the 1930s, it has had a significant impact on many areas of pure mathematics, including geometry and analysis, as well certain applications. Only in its most basic meaning as a subject area of mathematics have, we used the term topology. The name comes from two Greek roots and means "the science of location" in its literal sense. It has recently become critical in Mathematics for both graduate and undergraduate students to have a solid grounding in generic topology. Topology has long been recognised as a foundational area of pure mathematics. It's also sparked a lot of interest in fields like fuzzy math and abstract algebra.

In order to operate on fuzzy sets, we must presume that a universal set exists as the fuzzy

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

topological building block for the fuzzy sets we are dealing with. In order to imply a fuzzy topological formation, the following beginning conditions are used:

The set of elements in the fuzzy sets that are members of precisely one of F_1 F_2 is designated as F_1 F_2.

First, we'll establish what a topological space is by using the conventional definition.

Definition 2.1 $F \subseteq X$, then $\phi_F(x)$ is the membership grade function of element of $x \in F \subseteq X : \phi_F(x) : X \to [0,1]$.

Definition 2.2 fuzzy set is based on the fuzzy topological space, and fuzzy set is defined by the ordered pair $F = (x, \phi_F(x) \mid x \in X)$.

II BASIC IDEAS AND DEFINITIONS

Suppose X be a non-empty set, a class τ which is a subset of X is defined a topology if it satisfies the following conditions:

(i) X and ϕ belong to τ .

(ii) The union and intersection of any number of sets in τ belongs to τ .

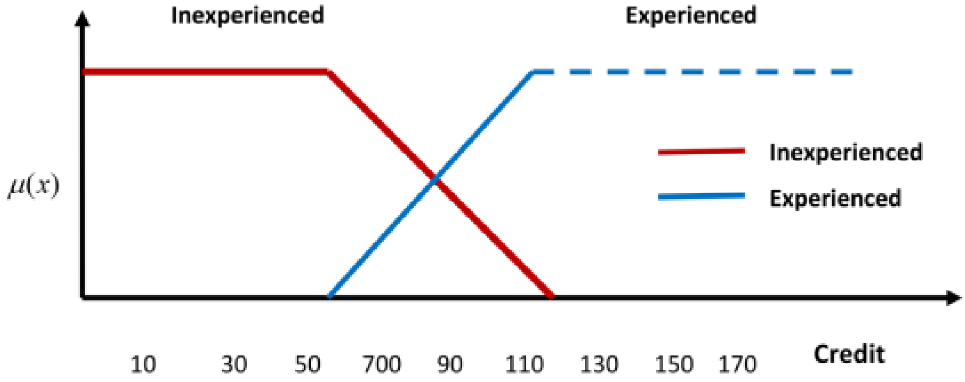

Figure 1. The set of experienced undergraduate students and its complement

The pair (X ,τ) is called a topological space and the number of τ are described as τ -open sets in X

Example:

For any subsets of

$$X = \{1,2,3,4,5\}.$$

$$\tau_1 = \{X, \varphi, \{1\}, \{3,4\}, \{1,3,4\}, \{2,3,4,5\}\}$$

$$\tau_2 = \{X, \varphi, \{1\}, \{3,4\}, \{1,3,4\}, \{2,3,4\}\}$$

$$\tau_3 = \{X, \varphi, \{1\}, \{3,4\}, \{1,3,4\}, \{1,2,4,5\}\}$$

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

We noticed that 1 τ is a topology on X but 2 τ and 3 τ is not a topology on X. Since 1 τ satisfies the necessary two conditions (i), and (ii) whereas the union {1,3, 4 2,3, 4 1, 2,3, 4 }{ } = { } does not belong to 2 τ and the intersection {1,3, 4 1, 2, 4,5 1, 4 }{ } = { } of two sets in 3 τ does not belong to 3 τ i.e. 2 τ and 3 τ does not satisfy the condition (ii).

Discrete topology

Assume X be a nonempty set. Then the group of all subsets including the empty set, of X, known as Power set P X is a topology on X and is define as discrete topology.

Example:

$$\text{If } X = \{p, q\}, \text{ and } \tau = \{X, \{p\}, \{q\}\}$$

Then τ is discrete topology on X

Indiscrete topology

For any non-empty set X the collection of set consisting φ and X is a topology on X, is defined as indiscrete topology.

Example:

Let, X = { pqr , , } then τ = {X ,φ} is a topology on X and is known as indiscrete topology.

III FUZZY SET THEORY

The authors' goal to broaden the traditional idea of process may be seen in the early articles in fuzzy set theory by Zadeh (1965) and Goguen (1967, 1969). Probability theory and fuzzy set theory aren't the only modelling methods at one's disposal.

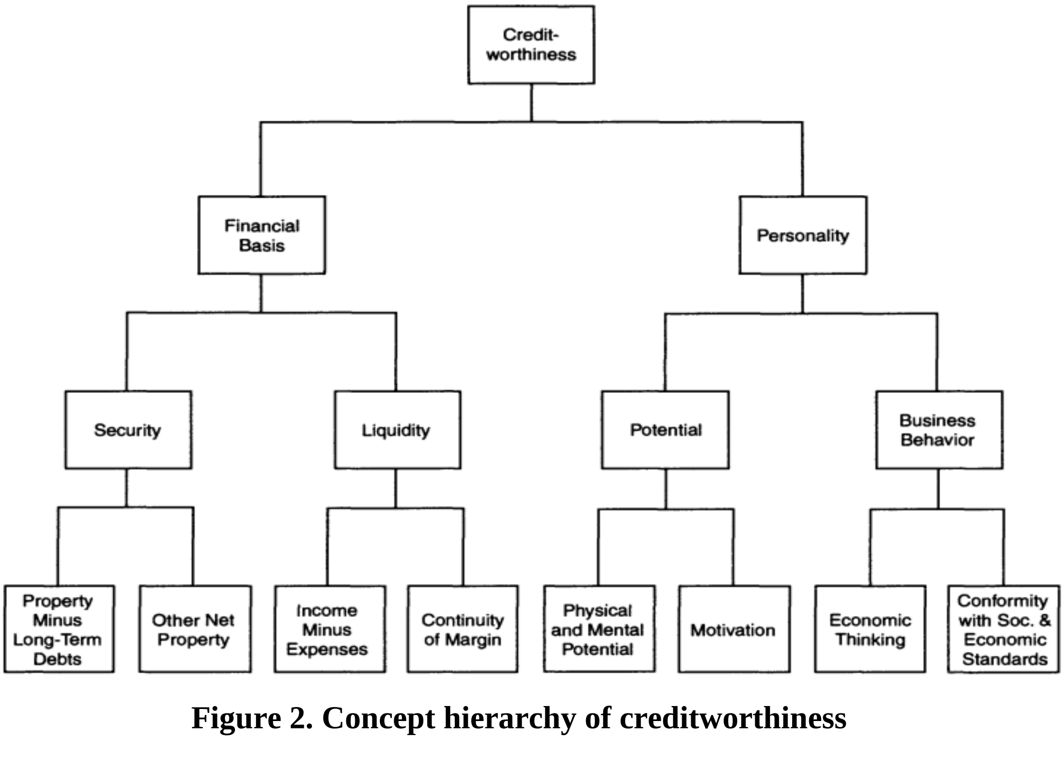

Figure 2. Concept hierarchy of creditworthiness

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

To incorporate fuzziness, Zadeh and Goguen's initial papers in fuzzy set theory (published in 1965 and 1967, respectively) extended the conventional notions of a set and a proposition [statement].

According to Zadeh [1965, p. 339], "The concept of a fuzzy set serves as a good starting point for developing a conceptual framework that is similar to the framework used in the case of ordinary sets, but is more general and, therefore, may have a much broader range of applications, particularly in the fields of pattern classification and information processing. Essentially, a framework like this offers a logical solution to issues where the lack of well-defined class membership criteria is the cause of imprecision rather than the existence of random variables."

When we talk about "imprecision," we don't imply that we don't know what a parameter is worth; we mean ambiguity. To study hazy conceptual phenomena explicitly, fuzzy set theory offers a rigorous mathematical framework (there is nothing fuzzy about fuzzy set theory!). A modelling language, it is well-suited to scenarios with ambiguous connections, criteria, or phenomena.

It's unlikely that fuzzy will ever have a single conceptual definition. According on the field of use and the measurement method, it means various things. Since then, a slew of writers have added to this hypothesis. The number of publications has increased steadily between 1984, when there were just 4,000, to over 30,000 in 2000.

Fuzzy set theory and fuzzy technology are neither just or mainly beneficial to represent uncertainty, as is often believed.

IV APPLICATION OF FUZZY SET THEORY AND FUZZY TECHNOLOGY

a) Modeling of uncertainty

This is, without a doubt, the most well-known and earliest objective. However, I'm not sure whether it's still the most essential objective of fuzzy set theory. For countless centuries, uncertainty has been a major issue of discussion. Modeling uncertainty is difficult since there are so many different ways and ideas. However, in general, they do not even define "uncertainty" properly or just in a narrow and specialised meaning. As a subjective phenomenon, uncertainty, in my opinion, may and should be modelled by a variety of theories based on the underlying causes, the kind and amount of accessible information, and the observer's expectations, among other things. When it comes to modelling certain sorts of uncertainty under specific situations, fuzzy set theory is unquestionably one theory that may be applied. It may thus be in competition with other theories, but it may also be the best

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

technique to represent this phenomenon in certain scenarios.

b) Relaxation

Dual logic is often used in classical models and approaches. Consequently, feasible and infeasible situations are distinguished as are those that belong to a cluster or not, as well as optimum and suboptimal situations. This point of view often misses the mark when it comes to describing reality. There have been several applications of fuzzy set theory to loosen or broaden classical approaches from a dichotomous to a gradual nature. fuzzy mathematical programming [Zimmermann 1996] is an example of this. Other examples include fuzzy clustering [Bezdek and Pal 1992] and fuzzy Petri Nets [Lipp et al. 1989].

c) Compactification

Many problems arise when attempting to store or show a large amount of data to a human observer in such a manner that he or she can make sense of the information contained therein due to the limited capacity of human short-term memory or technological systems. Using fuzzy technology, data may be simplified to a manageable level, either via the use of linguistic variables or through the use of fuzzy data analysis.

d) Meaning Preserving Reasoning

More than two decades of expert system usage have resulted in many disappointed customers. Because dual logic inference engines execute symbol processing (truth values true or false) rather than knowledge processing, it's possible that expert systems are to blame. Words and phrases are associated with meanings through linguistic factors in approximation reasoning. This requires that inference engines can interpret meaningful language expressions rather than symbols and arrive at membership functions of fuzzy sets that may subsequently be retranslated into words and sentences by means of approximation in linguistics

e) Efficient Determination of Approximate Solutions

Prof. Zadeh's desire for fuzzy set theory to be treated as a tool for determining approximations of real-world situations on an efficient or inexpensive basis dates back to the 1970s. To yet, no one has succeeded in achieving this objective. Some extremely excellent instances of this purpose have recently entered public knowledge, though. For example, in the context of water flow modelling, Bardossy [1996] demonstrated that fuzzy rule based systems may solve problems far more efficiently than systems of differential equations. The precision of the findings was almost identical for all practical purposes when these two methodologies' outcomes were compared. This is especially true in light of the fact that the input data is rife with errors and uncertainties.

Students may benefit from having access to an introductory textbook to assist them get

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

started and navigate the system. Obviously, a textbook of this size will not be able to adequately cover all of the theory. Because of this, the novel will continue as follows:

Part I of this book, which includes chapters 2 to 8, will lay forth the foundations of fuzzy mathematics in formal terms. Two constraints will be enforced due to space restraints and didactical considerations:

For this reason, we will not explore topics of great mathematical interest that do not have a clear link to applications or that need a strong mathematical background.

There will be a lot of discussion on the early ideas in fuzzy set theory. Various axiomatic frameworks, resulting in other operators, will be used to identify or characterize the extra fuzzy set theory possibilities at suitable periods. These chapters must have a formal tone to them.

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