



Chapter 14

QSVN Soft Sets and Their Applications in Student Classification

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ABSTRACT

For a learner, grades are very important. However, our modern educational system cannot provide correct grades to a student. In the current grading system, overall educational activities are not measured perfectly. Different letter grades are given to students in different subjects. The class rank is determined by considering average grade of these subjects. All these well-known methods of grading are not errorless. Thus, modern grading systems cannot be a proper reflection of student knowledge. In recent years, several authors have studied problems regarding educational measurement, particularly student assessments and grading. But most of the new methods are based on statistical techniques. Here, the authors have introduced Quadripartitioned single valued neutrosophic soft set (QSVNSS) for the first time. The authors have studied some set theoretic properties of QSVNSS. Also, several distance measures on QSVNSS are introduced. Based on the distance measures on QSVNSS, this chapter proposes some similarity measures on QSVNSS. Finally, these similarity measures are applied to a MADM real life problem.

INTRODUCTION

Prof. Zadeh initiated the concept of Fuzzy set (FS) theory in his paper [Zadeh, 1965]. Basically FS was the first step of generalizing the ancient concept of classical set theory to combat with the uncertainty. However there were limitations of FS too. To overcome the limitations Atanassov [Atanassov, 1986]

DOI: 10.4018/978-1-6684-7836-3.ch014

further generalized FS theory and introduced the concept of Intuitionistic Fuzzy Set (IFS) theory. It is quite clear that IFS are more helpful than fuzzy set theory to deal the various types of uncertainty model. In 2005, Smarandache [Smarandache 2011, 2014, 2018] introduced the concept of a Neutrosophic set (NS) as a further generalization of IFS from philosophical point of view. Gradually Neutrosophic sets become more powerful technique to represent incomplete, inconsistent and indeterminate information which exists in our real world. In NS truth membership functions (t_A), indeterminacy membership functions (i_A), and falsity membership functions (f_A) are represented independently. But in case of NS, all components lie in $]0; 1+[$. Thus it is very tough to apply NS sets in real life problems. To solve this problem Wang et al. [Wang et al. 2010] introduced single valued NS (SVNS) in 2010. On the other hand another extension of SVNS, i.e. Quadripartitioned single valued Neutrosophic (QSVN) set was introduced by R. Chatterjee et al. [Chatterjee et al., 2016] in 2016. It is four valued logic set A consisting truth-membership t_A , a contradiction membership c_A , an ignorance-membership u_A and a falsity membership f_A for each $x \in X$. Now QSVN set becomes an important tool in solving various types of decision making problems, medical diagnosis problems, clustering problems etc. Again a soft set is a parameterized family of subsets of universal set. The theory of soft sets was introduced by Molodtsov [Molodtsov, 1999] in 1999. He has shown several potential applications of soft set in different fields including game theory, operations research, integration theory etc. Again in recent years a lot of work [Attas et al., 2006, Maji et al., 2013, Maji, 2013, Majumdar and Samanta 2008, 2011, 2013, Majumdar 2015, Sahin et al., 2014, Smarandache 2006, 2011, 2014a, 2014b, 2015, 2018, 2019, 2022a, 2022b] has been done in the field of soft set theory and its generalizations. In this chapter we have introduced the QSVN Soft (QSVNS) set for the first time. Naturally QSVNS set is a hybrid structure of QSVN Set as well as Soft set. Thus it is expected that the new structural set can provide a stronger tool to deal with the various practical problems. We firstly define the QSVNS set and illustrated it with examples. After that we have studied some properties of QSVNS set. Also a set theoretic study of the new set is accomplished. We have proposed various types of similarity measures of our proposed set theoretic model. Finally a QSVNS set based technique for determination of outstanding student has been developed. This technique has been tested on real data set and a comparison has been made with the conventional grading system.

MATHEMATICAL BACKGROUND

Neutrosophic sets (NS), QSVN sets are the hybrid version of FS. Both the sets have set a bench mark against the uncertainty oriented real world problem. As a result several applications in different areas of these sets are found. Most of the preliminary ideas can be easily found in any standard reference say [Broumi and Smarandache 2014, Jongsma 1991, McMillan et al, 2002, Maji et al., 2007]. However for our purposes we will recall some definitions as well as properties for smooth understandings of our readers. First of all we consider $X \neq \emptyset$ as a universal set and E as a set of parameters throughout this section.

Definition 2.1: A NS A on X is characterized by a truth membership function t_A , an indeterminacy function i_A and a falsity function f_A , where, $t_A, i_A, f_A: X \rightarrow [0,1]$, are functions and $\forall x \in X$, $x = x(t_A(x), i_A(x), f_A(x))$ A is a single valued neutrosophic element of A .

Definition 2.2: A QSVN set A on X is characterized by a truth membership function t_A , a contradiction membership function c_A , an ignorance function u_A and a falsity function f_A , where $t_A, c_A, u_A, f_A: X \rightarrow [0,1]$, are functions and $\forall x \in X$, $x = x(t_A(x), c_A(x), i_A(x), f_A(x))$ A is a QSVN element of A .

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