

ON DEVELOPMENT OF NEUTROSOPHIC MATHEMATICS

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ABSTRACT

This paper highlights the importance of Neutrosophic Mathematics in our decision making process. Also the evolution and current developments of the subject is outlined.

Keywords : Neutrosophic Mathematics

I. INTRODUCTION

Decision Making with multicriteria approach plays important in our daily routine life. This approach is known as the MCDM. In the present scenario, the major goal of decision maker is to make a process to identify the best alternative which examine the numerous criteria. Nevertheless, in many cases, it is not easy to select the best fit alternative because of the presence of various uncertainty in data set. There can be a lot of reasons which leads an inadequate information and knowledge or human error in the model. Hence, the methodology of Multi criteria decision making under with the basic model of Neutrosophic mathematics generally incorporate the following phases.

- 1- Selecting a suitable scale to evaluate the given variable or object
- 2- By using the suitable technique, aggregate the information to calculate the tendency value of each variable or objects.
- 3- Give the number or rank to the variable/object to choose the best one.

For applying the Neutrosophic mathematics to apply in the several areas to get the best alternative from the given option, defining Neutrosophic mathematics is very important. So, we can define Neutrosophy as a new discipline of philosophy which study the foundation point, features and scope of neutralities. This discipline also explains the interaction of these dimensions with different ideational spectra.

To get more idea of the Neutrosophy theory, let suppose there is an entity $\langle A \rangle$, with its negation $\langle \text{anti}A \rangle$ and the spectrum of neutralities $\langle \text{neut}A \rangle$. Then this theory does have a hypothesis that every entity $\langle A \rangle$ with its negation $\langle \text{anti}A \rangle$ and their spectrum neutralities

<neutA> does exist between them which refers that entity favoring neither <A> nor <antiA>.

The ideas of <neutA> and <antiA> together inferred as <nonA>

This theory is considered as a generalization of “Hegel’s dialectic. As per the Neutrosophy theory every entity does have tendency to be neutralized by <antiA> and <nonA> entities. This state known as the equilibrium state. As per the classical studies <A>, <neutA> and <antiA> are supposed to be disjoint or mutually exclusive two by two. However, As various cases shows that the differences between the notions are not clear, then there is chances of having similar parts two by two between <A>, <neutA>, and <antiA>. Even it can be possible having all three of them as well.

In 1995, Neutrosophic theories were developed in very few areas like Neutrosophic set, Neutrosophic Logic and Neutrosophic probability and statistics. But in recent times it has developed in the areas of precalculus and calculus and applied in decision making process to reach the optimization of the problem.

Neutrosophic set and logic are applied in the generalization of fuzzy set and logic. Moreover, in Neutrosophic probability and statistics it is applied for generalizing in the classical probability and uncertain vague probability.

Discussion of literature and work done

Harish Garg (2020) elaborated about the Single-valued neutrosophic set (SVNS). He assumed this as an important contrivance for instructing the decision-making enquiries with indefinite and open-ended data by using a level of “acceptance”, “indeterminacy”, and “non-acceptance” in codified quantitative terms. In this set, he stressed upon to suggest some innovative measure to determine the distance to assess differences between the SVNSs. The main property of the measures have been emphasized and examined. Moreover, to observe the significance of suggested measures, an prolonged TOPSIS (“Technique for Order Preference by Similarity to Ideal Solution”) technique is presented to resolve the group decision-making complications. Furthermore, a novel clustering technique is projected on the basis of specified measures to categorize the objects. The comparative analysis as well as superiority analysis are very useful to demonstrations its effect over current methods.

Florentin Smarandache (2014) introduced the first time the discounting of a neutrosophic

mass in the sense of reliability and explained the significance of the source. Further he added that reliability and importance discounts commute when trade with classical masses.

UsamaAfzal1 (2021) in his study proposed a neutrosophic statistical approach for the assessment of resistance of conducting material based on the temperature variance. He developed a neutrosophic method and practiced that on resistance data. Further he used classical statistical approach for comparing these two approaches. Further, he observed that the neutrosophic statistical approach is more supple and informative. Additionally he presented an amendment that the neutrosophic statistical approach examines the resistance of conducting material for huge data set.

Hefnawy (2016) stated in his study that world is full of indeterminacy therefore neutrosophic branches are demanded more various studies. The main objective of his paper was to emphasize the important notions of neutrosophic mathematics and elaborate the its application. In his study he found a lot of application in all field like It sector, finance sectors and production and manufacturing.

Liu and Yan (2019) discussed about the single-valued neutrosophic set (SVNS) which presents the imperfect information in the real decision system however it also handled the undefined and probabilistic information effectively. They both presented the three way decisions as an effective techniques to deal with the uncertainty of the dataset. But he used a subjective conditional probability approach for decision analysis which were too subjective. Therefore, multi croterion decision making techniques were applied to

Settle this issue. For this purpose they used SVNDTRS for handlining the subjectivity based on baysian decision process. Then they adapted the analytic hierarchy process to compute the qualitative weightage for each attribute, this data randomness to get the attribute' weightages and the minimum total deviation to find out the composite weight of the attributes. Authors have discussed the advantages of the study in establishing the approach to extend the accuracy of the information evaluation. It is also useful to strengthen the rationality and efficiency of the decision.

Xinna Mao Et.al. (2020) used neutrosophic theories in Data Envelopment Analysis (DEA) which is one of the principal mathematical approaches to determine the general performance of organizations based on input and output relation. Original DEA is determinant method which incorporates a precise information about inputs and outputs which can be accessible from the real world. Although, in few cases, the information about the input output variables is not complete and correct. In their studies author added the fact about original DEA models which was solely for defined outputs. Nevertheless, disagreeable outputs may be added in the manufacturing system, which needs to be minimized. To deal with this kind of problems and to attain a reliable measurement which retains the key utility of DEA and assumes the effect of disagreeable factors under the unspecified environments. Furthermore, authors reports a neutrosophic DEA model to deal with disagreeable outputs which recommend a method on the basis of accumulation operator and got constructed on simple methodology. At last, authors have presented an example to demonstrate the new model and ranking approach in comprehensive way.

Desmond Jun Yi Tey et. al (2019) had proposed a multi-criteria decision making method popularly known as the neutrosophic data analytic hierarchy process (NDAHP) for the single-valued neutrosophic set (SVNS). In this method they explained an extension of the neutrosophic analytic hierarchy process (NAHP) intended to deal with the real datasets which contain the predefined values. The proposed NDAHP techniques were used as an objective weighting mechanism while other existing versions of the AHPs used as a subjective weighting mechanism to draw an inferences and get the decision. Authors claims this NDAHP method effective as the weightage of the attributes (criteria) which creates the input of the evaluation matrix that was determined in an objective manner on the basis of real data observed for the problem, therefore, it will not be changed according to the various decision makers and their opinions that are supposed to be subjective. They suggested that this method can be applied for multi criterion decision making models to make a ordinal scaling of the attributes of the various financial sectors and stock market. In 2017, the data of 15 financial indices were taken for the 5 petrochemical companies collected from yahoo search engine. With the help of various other financial techniques and parameters, a small comparative study was

conducted to examine the performance of NDAHP algorithm against the output obtained from the existing SVNS decision making methods used by various researchers. Further, results got compared with the actual results attained from KLSE. Moreover, to test the ranking attained by each method, the spearman & Pearson rank correlation method was applied on each of the decision-making methods. Furthermore, authors proved that NDAHP give the better and accurate results. This accuracy was also tested by Spearman and Pearson ranking test.

Basset (2017) initiated a study to emphasize the demonstration of the integration of Analytic Hierarchy Process (AHP) into Delphi framework in neutrosophic environment and proposed a novel technique for examining the consistency and computing the agreement degree of expert's opinions. There are cases where the experts might be not able to define the certain evaluation values to the comparison judgments because of their limited knowledge or the differences of individual judgments in group decision making. Basset decided to apply neutrosophic theory to tackle these issues, the integration of AHP into Delphi framework, in which every coupling comparison judgment is represented as a trapezoidal neutrosophic number. The degree of AHP is increased by including Delphi technique, as it can be mitigate the white noise which can occur from focusing on group and/or single person's interests rather than focusing on the issues dispersion. Additionally, it expands the agreement degree about ideas of the expert.

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