TRAPEZOIDAL AND TRIANGULAR SHAPES OF FUZZY SET AND ITS APPLICATION

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Abstract

The purpose of this paper is to present Trapezoidal Fuzzy set and Triangular Fuzzy set on basis of Definition of fuzzy set and we give its application in different fields.

Key words- Fuzzy set, Crisp set, Membership function.

INTRODUCTION:

Fuzzy set theory was developed specifically to deal with uncertainties that are not statistical in nature [1].The concept of fuzzy sets theory differs from that of the conventional crisp sets mainly in the degree by which an element belongs to a set. In the crisp set theory, the members of a crisp set would not be members unless their membership was full in that set (i.e. their membership is assigned a value of one).While, in the fuzzy set theory, set elements are described in a way to permit a gradual transition from being a member of a set to a non-member. Each element has degree of membership ranging from zero to one, where zero signifies non-membership and one indicates full membership. On the basis this facts, we shall give here two shapes of fuzzy sets, namely Trapezoidal Fuzzy set and Triangular Fuzzy set.

SHAPES OF FUZZY SET:

A fuzzy set, A, is defined as a set of pairs$[x, y_A(x)]$, where x is an element in the universe of discourse X and $y_A(x)$ is the degree of membership associated with element x, when the (variable) universe of discourse (X) is discrete and finite, a fuzzy set A in this universe is denoted by

$$A = \left\{ \frac{y_A(x_1)}{x_1} + \frac{y_A(x_2)}{x_2} + \cdots + \frac{y_A(x_n)}{x_n} \right\}$$

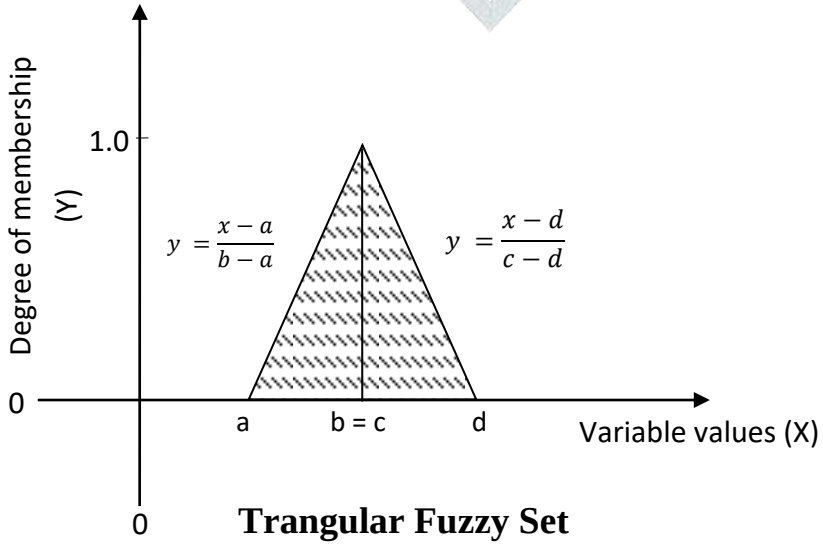
In the case where X is a continuous and infinite variable, the degree of membership can be represented by function commonly known as membership function, membership functions can take various shapes and forms, A is denoted by

$$A\left\{\int \frac{y_A(x)}{(x)}\right\}$$

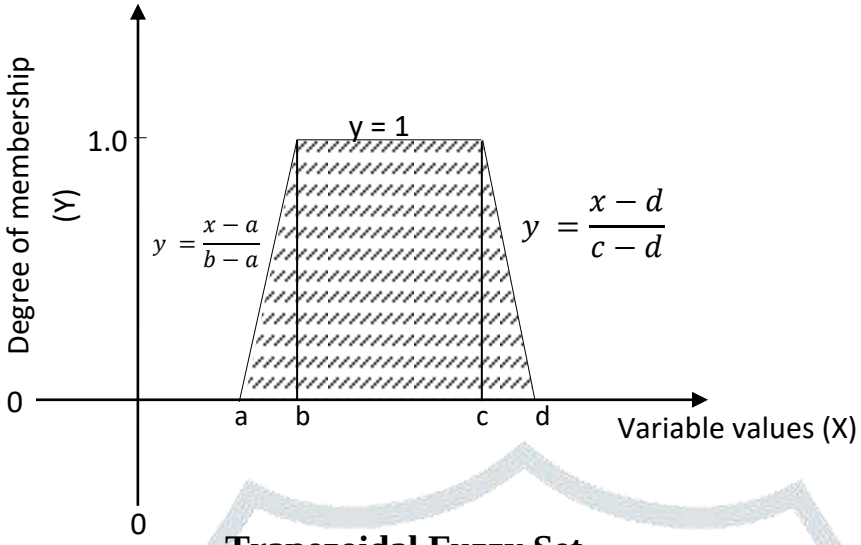
The numerator is the membership value in set A associated with the element of the universe indicated in the denominator. The plus signs in the first notation are not the algebraic "add" but are a function theoretic union. Similarly, the integral sign in the second notation is not an algebraic integral but a continuous function – theoretic union for continuous variables.

A continuous Fuzzy set contains two properties (1) convexity and (2) normality. The convexity means that the membership function has only one distinct peak, while the normality ensures that at least one element in the set has a degree of membership equal to 1.0.Fuzzy sets can take various shapes , however , linear approximations such as the trapezoidal and triangular shapes are frequently used [2,3].A trapezoidal fuzzy set can be represented by a four points (a,b,c,d).Where a & d are the lower and upper bonds, b & c are the lower and upper middle values respectively. Also, a triangular Fuzzy set considered as a special case of the trapezoidal Fuzzy set with b = c .The membership function can be formulated as :

$$y_A(x) = \begin{cases} \frac{x-a}{b-a} & , a < x < b \\ 1 & , a \le x \le b \\ \frac{x-d}{c-d} & , c < x < d \\ o & , \text{otherwise} \end{cases}$$



Trangular Fuzzy Set



Trapezoidal Fuzzy Set

Graphically, a membership function can be represented by a variety of shapes, such as bells, triangles, or trapezoidal, but it is usually convex. For a given value $y_A(x) = 0$ means that x has bull member ship in fuzzy set A and $y_A(x) = 1$ means that x has full membership. These membership functions can be determined subjectively, the closer an element to satisfy the requirements of a set, the closer its grade of membership is to 1 and vice-versa [4].

Application of fuzzy set theory

Prof. L. A. Zadeh[5] laid the foundation of fuzzy set theory, which is the generalization of classical set theory. Due to this generalization, theory of fuzzy sets has wider scope of applicability than that of an abstract set theory in solving problems, which involves subjective evaluation to some intent. In about four decades of its existence, it has been used in many areas. Fuzzy logic works by turning the hard-edged world of binary logic into more natural human like reasoning. Medicine was one of the first fields in which it was applied. After its formal introduction, the use of fuzzy concepts was entended from the Philosophy of medicine to technology of medicine. This medical application of Fuzzy sets, systems and relations appeared shortly after development medical expert systems [6, 7].The theory was used to deal with vagueness in perceptions of reality phenomena. Many companies are using Fuzzy logic to enhance things like automobile parts, air conditioners, computers, elevators, rice cooker, microwave ovens, cameras, televisions, antilock brake systems and washing machines etc. In medical field, expert systems using fuzzy concepts help doctors to diagnosis the many diseases. During last two decades, it has been developed in the direction of a powerful fuzzy mathematics.

Some areas of Fuzzy set theory

(1) Mathematics

Graph theory, Group Theory, Linear Algebra, Cryptography, Topology, Logic, Measure Theory, Automata Theory, Systems Theory, Information Theory, Stability Theory etc.

(2) Operations Research

Linear programming, Integer programming, Transportation, Mixed Integer programming, Non-Linear programming, Quadratic programming, Geometric programming, Fractional programming, Goal programming, Parametric programming, Dynamic programming, Network programming, Stochastic programming, Inventory control, Project evaluation etc.

(3) Statistics and Probability

Curve Fitting, Regression Quality control, possibility Theory, Probability Theory etc.

(4) Computer Science

Expert systems, Database Design, Artificial Intelligent, Pattern Recognition, Speech Recognition, Image Processing etc.

(5) Engineering

Architecture, Building damage Assessment, Design Experts, Switching Circuits, Earth Quake, Traffic Control, Aircraft Control, Automatic Control, Robotics, Heat Exchange Process, Steam Engine, Automatic Translation, Preservation and Safety systems, Automatic Design, Picture Recognition, Fault Analysis, Intelligent Sensors, Blast Furnace Control, Cold Rolling Control, Automatic Train operation, Dam Reservoir, Water Temperature Predication, Surface Mining Planning, Wireless Sensor Network etc.

(6) Decision Making

Management Decision making, Multistage or dynamic decision making, collective decision making, Possibility decision making, Administrative decision making, Multiple criteria decision making etc.

(7) Management

Business management, Personal management, Safety management, Marketing, Investment advising, Management. Planning, System operation, Contract supports, Office automation,

Environmental evaluation, Product evaluation, Training system, new product development etc.

(8)Medical Science

Coronary Disease, Medical Diagnostic, Electro Cardio logical Diagnosis Process, Treatment with oriental Medicines, Artificial organ control, Nursing Robots, Port Treatment care, Health systems, Artificial Limbs for Medical fields, Semiology, Lung disease etc.

(9) Natural Life and Social Science

Psychology, Cognitive science (Concept Formulation and Manipulation, Memory and Learning), Sociology, Economics, Ecology, Meteorology weather. For elasting, weather prediction, Biology etc.

(10) Agricultural Engineering

Agricultural production and Processing, Disciplines of Animal Biology, Plant Biology, Mechanical, Civil, Electrical and Chemical Engineering principles with Knowledge of Agricultural principles.

Conclusion:

The study of Fuzzy set theory has become increasingly important in the wake of fast technological development and increasing complexities in real world decision making problems. The Fuzzy set theory technique is now considered as an effective and powerful aid towards solving problems of management decision making, Computer Science, Medical Science, Artificial Intelligence etc. and it is of wider interest in areas where the dichotomical States use of “yes” and “no” cannot define or describe the actual situation. In the last few years a phenomenal increase in the use of Fuzzy set theory has been witnessed and it is believed to grow at ever faster rate.

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